THURSDAY, JULY 13, 1871

THE NEXT TOTAL SOLAR ECLIPSE

IT is infinitely to the credit of English men of science that they are at the present moment busily engaged in making arrangements for observations of the Total Solar Eclipse in December next, and it is extremely fortunate for the advance of Science that this rare phenomenon—rare, that is, so far as the chance of observing it with moderate facility goes—occurs again just as the knowledge gleaned by the recent expeditions is being garnered to serve as a starting point for future inquiry.

When we state that the eclipse will be visible as a total one in India, Ceylon, and Australia, it may at first be imagined that in this case the facilities are not so very great. This would be quite true if it were necessary to garrison all these stations with observers from England; but, as it happens, the Governments both of India and Victoria have under their orders government astronomers—Mr. Pogson at Madras, and Mr. Ellery at Melbourne; and all that is necessary is to forward to those stations instructions, so that the observers there may glean all the experience gained in the last eclipse, and instruments such as are required to advance our present knowledge. And here we may remark that our knowledge in solar matters has recently advanced so rapidly, that astronomers have, as it were, to use new weapons in each attack, as artillery gives place to small arms, and small arms to the bayonet, in less scientific warfare.

That India and Australia will thus be provided with everything that may be necessary will be evident when we state that the Astronomer Royal is superintending the adaptation of instruments already in his possession for use in the former country, while the President of the Royal Society has already communicated with the authorities in Australia, offering to aid in every way in the proposed observations—an offer which we doubt not will be accepted, and in both cases we may hope for results of the highest importance, if the local observers set to work with a will. As to the entire sympathy of both governments there can be no question, India was magnificently helpful to Janssen in 1868, and Australia has her spurs to win; and there are good men in plenty, in both places, in whom the Governments may place their fullest confidence.

There remains, then, Ceylon. Both the Royal and Royal Astronomical Societies have determined, if the Government will help, to send out a small party of observers from England to garrison this mid-station, which modern helps to travel have placed at our doors, and who knows that at one station or other Americans and Frenchmen may not be found to join in the good work? The new railway has made an American Expedition extremely easy.

And now let us enter a little more into particulars.

The central line of the eclipse will first meet the earth's surface in the Arabian Sea, and entering on the western coast of India, will pass right across one of the most important parts of Hindustan, in a S.E. by E. direction. In this part of the peninsula the sun will be about 20° above the horizon when totally obscured. The duration of totality will be two minutes and a quarter, and the breadth of the shadow about seventy miles. On leaving the eastern coast of the Madras Presidency, the central line will cross Palk's Straits, passing about ten miles S.W. of the island Jaffnapatam, and over the northern part of Ceylon, where the small towns of Moeletivoe and Kokelay will lie near the central line; and also the well-known naval station of Trincomalee, which will be about fifteen miles S.W. of the line. Continuing its course over the Bay of Bengal, the shadow will cross the S.E. point of Sumatra, and will touch the south-western coast of Java, where Batavia, the capital, will lie nearly sixty miles N.E. of the central line; and two other smaller towns, Chidamar and Nagara, will also be very near the middle of the shadow path. In the Admiralty Gulf, on the N.W. coast of Australia, the eclipsed sun will be only ten degrees past the meridian, and not far from the zenith; in consequence of which the totality will last $4^m\ 18^s$, or only four seconds less than the time of greatest duration. Lastly, passing through the most barren and uninhabited portion of Australia, crossing the Gulf of Carpentaria and the York Peninsula, the shadow will ultimately leave the earth's surface in the Pacific Ocean.

At present not too much is known about the chances of weather at any place; but what is known seems to point to a fair chance of success in both India and Ceylon, as the eclipse occurs during the N.E. monsoon; but, in any case, the experiences of the last Expedition show that for such a momentary phenomenon these chances need scarcely be taken too seriously into consideration, seeing that where the finest weather was predicted a terrible pall of cloud covered the sky.

Next as to the work which the present state of our knowledge shows to be most desirable. This has been pointed out by Mr. Lockyer, in a communication to the Royal Society, and here we may in the main quote from his paper. Mr. Lockyer states:—

"In my opinion the fundamental points of attack are:

"α. Spectroscopic observations made with such an instrument as the one I took out to Sicily, *equatorially mounted*, and with reference spectra.

"β. Photographic observations made with such an instrument as the one I took out to Sicily, namely, a camera with large aperture and small focal length *equatorially mounted*. . . . .

"Perhaps I may clear the ground by stating what, in my opinion is comparatively UNIMPORTANT, so far as the crucial points are concerned, though to be tolerated if the crucial points are strongly taken up.

"α. Photographing prominences.

"β. Sketching anything but the *changes* in the corona.

"γ. Polariscopic observations.

"δ Observing Baily's Beads.

There should be one instrument, and Mr. Pogson could probably provide this in India, to determine the position of prominences before and after totality. *During totality they should not be observed at all except incidentally.*

"At each place (*i.e.*, India, Ceylon, Australia) the spectroscopes should be employed for half an hour (to be on the safe side) before totality, in scrutinising the crescent at its narrowest place and the chromosphere outside the following limb of the moon.

"At each place, as before defined, there should be a spectroscope with a finder, and equatorial motion

(or some equivalent arrangement) directed to the sun's centre, to record any changes which take place in the spectrum from, say, half an hour before to half an hour after totality, and during totality, *bien entendu*. The relative darkness or brightness of the lines should be recorded every ten seconds.

"This spectroscope should have moderate dispersion, large object-glasses for collimator and telescope, and with focal length such that two or three degrees round the sun should be taken in (*i.e.*, 1° or 1½° from the sun's centre), and a large field. . . .

"To come to the details of the expedition to Ceylon; I am of opinion that it need not exceed the following numbers, as my Sicilian experience has taught me that we may depend upon much valuable help from the officers at the place of observation :—

"1 Telescope-Spectroscopic observer; 2 assistants.

"1 Photographer; 2 assistants. This duty perhaps may be entrusted to skilled Sappers.

"1 Spectroscopic observer; 1 assistant, or 8 in all.

"Among general observations, I would point out as being of extreme importance :

"α. Rays before, during, and after totality—their length, direction, and colour.

"β. Colours of the various layers of chromosphere, and of clouds and landscape. The *order* of these colours is of great importance.

"γ. Dark rays or *rifts*; whether they change, and whether they extend to the dark moon, or stop short above the denser layers of the chromosphere.

"δ. The colours of the corona between bright or dark rays.

"ε. All changes in corona.

"ζ. Comparative brightness of rays and chromosphere and outer corona. . . . . .

"In the above letter the nomenclature employed is the one I suggested in a recent lecture at the Royal Institution, namely :

"*Corona*, embracing the whole compound phenomenon outside the prominences (including rays and streamers), part of which is undoubtedly non-solar.

"*Chromosphere*, embracing the whole of the solar portion of corona, and all bright line regions outside the photosphere."

It is scarcely necessary to point out that the above deals with possibilities, rather than with desirabilities. We are convinced that a much larger party would do good work in Ceylon, but our scientific leaders are right in asking what our Government cannot refuse; and, moreover, we may hope that the magnificent stations in India on the Neilgherries, at considerable elevations, will be strongly garrisoned, as they can well be by the eminent observers now in India.

We trust that these efforts to procure fresh observations will meet with the largest measure of success, for certainly the question of the Sun's Corona is the scientific question of the day. Once settle what is the real nature of the sun's surroundings, and the path of work is open for the more distant stars. So long as our knowledge of the sun is clouded by contending hypotheses, we cannot hope for real progress.

For our part we do not doubt that the Government will act as admirably as they did last year in the same branch of research when the requirements of Science are properly laid before them; and if the elements are equally kind, we may hope for a large increase of our knowledge.

TYNDALL'S "HOURS OF EXERCISE IN THE ALPS"

Hours of Exercise in the Alps. By John Tyndall, LL.D., F.R.S. (London: Longmans.)

THIS volume is a collection of short articles which have already seen the light in various publications, and are here thrown together, as the author says, "partly to preserve to myself the memory of strong and joyous hours, and partly for the pleasure of those who find exhilaration in descriptions associated with mountain life." Accordingly we find in it accounts of exciting scrambles, such as the Lawinenthor and the Old Weissthor, the first ascent of the Weisshorn, and the various assaults upon the Matterhorn, crowned at last with success. Of sadder interest are the story of the death of Benner, the professor's faithful guide, upon the Haut de Cry, contributed by one of the survivors; notices of the accidents on the Col de Géant and on the Matterhorn; and, hardly less in interest though with happier ending, the rescue of a porter from the jaws of a crevasse on the great Aletsch Glacier, and the author's own hairbreadth escape on the Piz Morteratsch. All these are described with his usual graphic power and intense appreciation of natural scenery; sometimes in the philosophic vein, when a glass of whisky gives "a flash of energy," and even a ham sandwich can only be regarded as a conditioned form of potential muscular force; or sometimes in the more jubilant mood, when we are shown the grave professor "delighting to roll himself in a bubbling pool in some mountain stream, and afterwards dance himself dry in the sunshine."

Together with these sunny memories of alps and cascades, snow-fields and glaciers, there are some chapters of a more distinct scientific import, to which, as most germane to the pages of NATURE, we shall confine our notice. The first of these—the twentieth in the volume—is on Alpine Sculpture. The professor, we need hardly say, is a strong "Erosionist," attributing the valleys to the sculpturing influences of water, frost, and ice, as opposed to those who regard them as the result of fissures in the earth's crust produced by strains during its upheaval. His summary of the evidence for "sculpture *v.* fracture" strikes us as particularly good, and, as it happens, we can bear testimony from personal experience to the accuracy of the facts cited. He shows that by a simple geometric calculation, the width of the fissures produced by the upheaval of a hundred miles of the earth's crust to a maximum height of four miles would bear a very small ratio to the width of the existing valleys; therefore that the most which can be claimed for fissures is that they have guided the action of meteoric forces, have, as it were, drawn the rough sketch on the stone which has directed the picks of Nature's quarrymen, and guided the chisels of her sculptors. He points out that in the most fissure-like of gorges, such as those of the Via Mala or Pfäffers, characteristic water-marks are visible from top to bottom. His description of the latter may be taken as a summary of the evidence in these and many other cases which he has quoted. "Here the traveller passes along the side of the chasm, midway between top and bottom. Whichever way he looks, backwards or forwards, upwards or downwards, towards the sky or towards the river, he meets everywhere the irresistible and impressive evidence that this wonderful fissure has been sawn through the mountain by the

waters of the Tamina." The only points in Prof. Tyndall's description to which we a little demur are when he speaks of the traveller "passing along the chasm midway between top and bottom," the fact being that the well-known gallery is only a few yards above the Tamina; and where he quotes the gorge as an illustration of water-action upon *limestone* rock. It is true that the strata here are not crystalline, and they may be occasionally calcareous, but we should hardly venture to apply the name of limestone to the hard black shales or slates out of which the gorge itself is cut. Professor Tyndall also omits to call attention to the close connection between the direction of the principal joints and the form of the gorge. This is especially noteworthy at Pfäffers, where the chasm is not vertical, but inclined to the horizon at an angle of some 70°, the water having followed, as is its wont, the direction of least resistance, viz., one of the sets of joint planes. The gorges of the Pantenbrücke, the Aar above Im-Hof, with many others, might be quoted as instances of the same. We think, indeed, that in arguing against those who ascribe alpine sculpture mainly to fracture, the professor does not quite do justice to the influence which fissures, faults, and joints (which last may, in many cases, be connected with the others) exercise in directing the meteoric agents. These have not, indeed, fashioned the mountains, but they have obliged the sculpturing forces to work in certain directions, have been like the rails or the points which cause a locomotive to follow a particular course instead of wasting its power in wandering over the fields.

Further on in the chapter, Prof. Tyndall refers to his own favourite theory of glacier sculpture, with regard to which he expresses himself more guardedly than in the paper originally published in the *Philosophical Magazine* (vol. xxiv. p. 169). Still we cannot say that we are convinced by his arguments even in their modified form. No one, of course, would deny that a glacier can deepen its bed; the question is simply one of degree. With regard to this our space will allow us to do little more than express dissent, and indicate one or two points where, while not disputing Prof. Tyndall's facts, we cannot accept his inferences.

The silt which is brought down by a glacier stream cannot, we think, be taken as a measure of the abrasion exercised by the glacier; surely the greater part is derived from the stones crushed between the ice and rock; it is the grist from the glacier mill, rather than the detritus of the nether stone. We fail also to see how, unless under exceptional circumstances, a glacier can "do more than abrade." Granted that "rocks are not homogeneous, they are intersected by joints and places of weakness which divide them into virtually detached masses," we doubt if it follows that "a glacier is undoubtedly competent to root such masses bodily away." A heavy body sliding over such masses and in close contact with them, would, we think, be more likely to keep them in their place, and certainly rocks from which glaciers have retreated do not exhibit evidence of this kind of erosive action. We confess, therefore, to still regarding the effects of glaciers as comparatively superficial, and classing the ice ploughs of past ages as among the efforts of scientific imagination.

A considerable portion of the latter part of the volume is devoted to a *résumé* of the "viscous" and "regelation" theories of glacier motion; a controversy which can hardly yet be regarded as concluded, seeing that the experiments of Mr. Mathews and Mr. Froude, to which Prof. Tyndall briefly alludes, appear likely to have a very important bearing upon the question of whether or not ice under any circumstances is a flexible or plastic substance to an appreciable extent.

Among the very miscellaneous scraps with which the volume terminates, is an account of the voyage to Algeria to observe the Eclipse. This, so far as its main purpose went, was a dismal failure, but remarks are introduced on the colour of the sea and sky, a subject already treated by the author in his "Glaciers of the Alps." During the voyage home a number of bottles of sea-water were secured from various stations, which were afterwards examined in London by passing through them a beam of electric light—the purity or impurity of the water is then shown by the less or greater amount of light which it scatters. Briefly, the result was that the dark blue water was very pure, the cobalt-blue rather less so, while the green tints denoted the presence of much suspended matter, and the yellowish green was very thick. A remarkable instance of this variety of colour which, if our memory serve us, he has not quoted, is in the Lakes of Thun and Brienz; the waters of the latter, which receives the silty streams of the Aar and the Lutschine, are distinctly green, while those of the former, into which no important glacier torrent directly enters, are of a beautiful blue.

In fine, though there is little new about the book, many of Prof. Tyndall's admirers will be glad to possess in a convenient form so many thoroughly characteristic papers, displaying at once his thoughtful mind and intense love of nature, as well as his great command over nervous and picturesque English.

T. G. BONNEY

OUR BOOK SHELF

The Natural History of Plants. By H. Baillon. Translated by Marcus M. Hartog. Vol. I. (London: L. Reeve and Co. 1871.)

HAVING noticed, on its publication, the first volume of Prof. Baillon's "Histoire des Plantes" (see NATURE, vol. i., p. 52) we need scarcely do more than call attention to the English edition which now lies before us. The translation, we may say at the outset, appears to us to be well done; the meaning of the original is, as far as we have observed, carefully preserved; and a better knowledge of his subject is shown by the translator than is always the case in English renderings of foreign scientific works. The co-ordination of the natural orders followed in the work is, as was mentioned in our notice of the original, novel; whether it will stand is a question on which we ought not, perhaps, to express an opinion until the plan is more fully developed. We could have wished that the author had given in this first volume some general sketch of his new system, with a defence of its peculiarities. So competent an authority as Prof. Baillon cannot have departed from the ordinary arrangement without cogent reasons, which we should have liked to have known. It is always a great advantage to English systematists to know the views of their fellow-workers on the Continent. We miss also the great assistance that is afforded to the systematist by a tabulated clavis of the genera belonging to each natural order. The amount of information con-

tained in the volume as to the various relationships of the natural orders described in it, the morphology of their genera, the distribution of the different types, and the economic products obtained from the species, is immense. It possesses, however, the defect so common in foreign scientific works, of the absence of any table of contents or index to the subjects treated of. Had the publishers of the English edition supplemented the index of genera and subgenera with one referring to the various topics discussed, they would have rendered the English edition a practically more useful contribution to botanical literature

CALYCANTHUS FLORIDUS: Floriferous shoot.

than the French original. The illustrations are profuse, and of that excellence which we look for in vain in works originally published in this country. We append one of the well-known "Allspice Tree," the *Calycanthus floridus*. The small order Calycanthaceæ, including only the American *Calycanthus* and the Japanese *Chimonanthus*, is one the true position of which has been much disputed by systematists. Baillon makes it a "series" of Monimiaceæ, with which he also unites the Australian Atherospermeæ, bringing this order forward from its usual position among the Incompletæ to close alliance with Magnoliaceæ and Anonaceæ. A. W. B.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his Correspondents. No notice is taken of anonymous communications.*]

A New View of Darwinism

I HAVE only just seen the two letters in answer to one from me on Darwinism which you were good enough to insert in NATURE, and to which I ask the favour of being allowed to reply. I have to thank Mr. Darwin for his references and for the tone of his letter, which is in such marked contrast to the angry dogmatism of Mr. Wallace.

Mr. Wallace commences by ridiculing the phrase the Persistence of the Stronger. The phrase was not mine, it has been used by a better man than I, namely, by Prof. Jowett, and it has the advantage of not involving an identical expression, which the Survival of the Fittest does. "That those forms of life survive which are best adapted or best fitted to survive," is not a very profound discovery; it might have suggested itself even to a child, and if Mr. Wallace means nothing more than this when he speaks of the theory of Natural Selection, he cannot claim to have added much to the world's philosophical opinions.

He then complains that I have only touched one of the many facts relied upon by Darwinians; I refer him to my letter, in which I distinctly say that it contained only one of my objections, and that I have many more which will follow if the Editor have patience with the discussion. The reply to Mr. Wallace will confine me, however, in this letter to the ground covered by the former one. Having disposed of the formal and personal matters, I now approach the matters of fact about which we are at issue.

Here, I am sorry to say, I am met in a very different spirit by Mr. Wallace to that in which Mr. Darwin meets objections. Dogmatism, bold and unwavering, was the privilege of the philosophy of the Schools, but in the 19th century it is puerile. Mr. Wallace states boldly, without any authorities, merely as an imperial *ipse dixit*, that the most vigorous plants and animals are the most fertile. I had, at least, the decency to quote the book of Mr. Doubleday, containing a magazine of facts and examples in support of my view, and which tells exactly the other way.

This view has not been correctly stated by Mr. Wallace. The position I maintain is this, that, as a general law, those individuals which are underfed and lead precarious lives, are more fertile than those whose advantages make them vigorous and healthy. The ringing of the bark and the pruning of the roots of barren fruit trees and the starving of domestic animals to make them fruitful were examples to this end.

Mr. Wallace quotes only one example in his own support, and I will accept it as a crucial test of my position, which he will acknowledge to be fair; the case of the Red Indian and the Backwoodsman. The Red Indian lives entirely on flesh, the Backwoodsman almost entirely on vegetable food. Like meat livers in every part of the world, in Mexico, on the River Plate, in Siberia, in Turkestan, and in some parts of Russia, the Red Indian is not a fertile creature. The Backwoodsman, like vegetable feeders everywhere who are not luxurious, in India, China, Poland, and the Russian provinces bordering on it, Ireland, &c., is comparatively fertile, but only comparatively. It is a mistake to suppose that the Backwoodsman is specially fertile, and in a few years he becomes, as the inhabitants of Kentucky and Tennessee have been long known to be, diminishing in numbers, the population of the States being kept up by immigration.

Mr. Chadwick, in his "Sanitary State of the Labouring Classes," observes that where mortality is the greatest there is much the greatest fecundity; thus, in Manchester, where the deaths are one to twenty-eight, the births are one to twenty-six, while in Rutlandshire, where deaths are but one to fifty-two, births are one to thirty-three, showing that a state of debility of the population induces fertility. This only supports the common dicta of doctors that consumptive patients are generally very fertile. The pastoral tribes of Eastern Russia which have recently taken to agriculture, such as the Tchuvashes, &c., have begun to increase most rapidly. The Hottentots at the Cape, who were formerly a numerous race living very hard lives, are almost extinct now that they are carefully tended and well fed. The Yeniseians, the Yukahiri, and other Siberian tribes, have disappeared like smoke before the advance of Russian culture; they have suffered little if at all from the Russian arms.

Let me quote a curious example in answer to Mr. Wallace from the very race to which he has referred. Captain Musters, in describing his recent journey through Patagonia at the Anthropological Institute, told us that it was the custom for the Patagonian women to be bled at certain times referred to, as they believed *it made them fertile*. Among the Patagonians, therefore, we meet with empirical witnesses, unsophisticated by our philosophy, to the truth of the position I maintain. But those who live in large cities need not travel to Patagonia. The classes among us who teem with children are not the well-to-do and the comfortable, but the poor and half-fed Irish that crowd the lowest parts of our towns. I am not contrasting now the fat with the lean, but the comfortable classes with those who lead precarious lives—the vigorous in health with the sickly, the half-fed, and the weak. It will be asked, why rely so much upon man? The answer is that I quite agree with Mr. Darwin that man is subject to the same natural laws as the animals, and further I believe that since we have studied man more closely and under a greater variety of conditions, facts derived from our experience of man are of greater value than those deduced from our examination of the other animals.

But let us turn to these latter for a space; and here I tread with much greater diffidence, for I am aware of the vast ex-

perience and fund of illustration possessed by Mr. Darwin, and I have to say that I am unconvinced by the arguments he has adduced. With the transparent frankness of all his writings, Mr. Darwin, in one of the references to which he has commended me, has collected a very large number of examples that tell very strongly against him, and which I again commend to Mr. Wallace. I refer to the 18th chapter of Mr. Darwin's book on the "Variation of Plants and Animals under Domestication," and especially to that portion beginning on page 149. In speaking of animals, he says:—"The most remarkable cases, however, are afforded by animals kept in their native country, which, though perfectly tamed, quite healthy, and allowed some freedom, are absolutely incapable of breeding Rengger, who in Paraguay particularly attended to this subject, specifies six quadrupeds in this condition, and he mentions two or three others which most rarely breed. Mr. Bates, in his admirable work on the Amazons, strongly insists on similar cases, and he remarks that the fact of thoroughly tamed wild animals and birds not breeding when kept by the Indians, cannot be wholly accounted for by their negligence or indifference, for the turkey is valued by them, and the fowl has been adopted by the remotest tribes. In almost every part of the world, for instance, in the interior of Africa, and in several of the Polynesian islands, the natives are extremely fond of taming the indigenous quadrupeds and birds, but they rarely or never succeed in getting them to breed," and so on, through sixty pages of closely-packed examples. And what is Mr. Darwin's commentary on these facts? I again quote page 158:—"We feel at first naturally inclined to attribute the result to loss of health, or at least to loss of vigour, but this view can hardly be admitted when we reflect how healthy, long-lived, and vigorous many animals are under captivity, such as parrots and hawks when used for hawking, chetahs when used for hunting, and elephants. The reproductive organs themselves are not diseased, and the diseases from which animals in menageries usually perish are not those which in any way affect their fertility. No domestic animal is more subject to disease than the sheep, yet it is remarkably fertile." Mr. Darwin, with equal clearness and conclusiveness, decides that this sterility cannot be due to a failure of sexual instincts, change of climate or of food, or want of food or exercise; and he concludes that certain changes of habits and of life affect in an *inexplicable manner* the powers of reproduction. But what is true of man it is reasonable to suppose is true of all these instances—namely, that it is a more luxurious habit, a more vigorous health, a less precarious existence, induced by the care and attention of domesticators, that have caused the sterility; that these animals are too well off, and not that they are ill off in any way; and this theory explains the whole most conclusively. On the other hand, and in opposition to this vast and uniform collection of examples, Mr. Darwin adduces a few instances which tell the other way, but they are very few in number, and seem to me explicable on other grounds. Ferrets, it is notorious, are always kept in a state of extreme depletion and as thin as possible. Domestic poultry are fed almost entirely on poor vegetable food, while their wild and semi-wild relatives feed much more on worms, insects, and on animal diet generally. In regard to sheep, it is notorious that very weak ewes generally bear twins, that Somersets and Dorsets are more fertile than Southdowns and Leicesters. We have, I may add, no facts to guide us in regard to wild dogs, and few in regard to wild cats; but we do know that in tame ones the half-fed lantern-ribbed curs are more prolific than their sleek relations. In regard to domestic fowls, and especially pigeons, we must remember that their condition is materially altered by the disuse or only very partial and irregular use of their powers of flight, this must reduce their circulation and vigour very considerably, and make them *pro tanto* so much weaker. But these instances, upon which Mr. Darwin relies to answer Doubleday and others, are very partial indeed. In his own pages, as I have already said, they form a very small element compared with the overwhelming cases he quotes on the other side. So much so, indeed, that these cases may be taken as exceptions which prove the rule that domestication and improved conditions of life induce sterility in animals.

It savours of scholastic philosophy to speak of Nature as exercising any influence on the regeneration of races, and yet there may be sound philosophy in the old notion that when an individual or a class is in danger of being extinguished from want, Nature puts forward a special effort to preserve it. The sickly mother, the half-starved plant, is more likely to breed than the healthy and the vigorous. If we remove the peasant's family to the drawing room, it will cease to be composed of ten and twelve children. If we remove our daisies and cowslips to the greenhouse, their flowers grow double, and they ripen no seeds. The vine that has felt the frost is the one to pay the rent. Wherever we turn, in fact, we meet with examples of the universal law; and this law seems to be at issue with an important portion of Mr. Darwin's theory, namely, that in the struggle for existence, the vigorous, the hearty, and the well-to-do, elbow the weak and decrepid until they elbow them out of existence, and supplant them. If I have said anything above which can be construed into an impertinence, I unconditionally withdraw it. The only excuse for soreness, is an impatience at what seems to the writer to be indefensible dogmatism. The days will not be ripe for scientific dogmatism until the Infallibility of Positive Philosophers has been generally accepted, and it does not do to forestal that millennium.

H. HOWORTH

MR. WALLACE has effectually set aside Mr. Howorth's new views on Darwinism, and it now only remains to point out that the latter gentleman, in his instances, puts the cart before the horse. Hens that are fat and don't lay are fat because they don't lay. When the sexual powers, either in plants or animals, are defective from accident or design, the overgrowth always takes place, and this among animals is chiefly by the increase of adipose tissue.

Birmingham LAWSON TAIT

Recent Neologisms

I HAVE been long accustomed to register the first appearance of new words and phrases. Of course the vast majority of these take no root, perishing where they fall. Here is a sample of the latest issue: *Survival*, introduced, I think, by Darwin; *indiscipline* and *impolicy*, which were brought in by the Franco-Prussian War, and also the vulgarism *to telegram*. The greatest atrocities in this line are committed by "physicists," if the shade of Faraday will pardon me the use of that word; and far away the worst coinage I ever encountered is due to Mr. Alfred R. Wallace. As it is "meet and right and our bounden duty" to stigmatise such intruders, and if possible prevent their adoption, I take the liberty of making my feeble protest against Mr. Wallace's "prolificness," which he introduces to our notice in his letter on Mr. Howorth (NATURE, July 6, 1871, p. 181). In this case the hideousness of the coinage is some guarantee against its reception.

Malvern Wells, July 8 C. M. INGLEBY

Affinities of the Sponges

I HAVE just read with much interest the paper in NATURE by Mr. W. Saville Kent, criticising my friend Carter's article in the "Annals of Natural History" for this month, in which I fully concur. How Mr. Carter can have fallen into such an error, for such I must call it, I cannot imagine, as comparing a group of animals in Botryllus to those sponge cells, even in so highly a developed form as Grantia. For, taking this as the highest known form of sponge animal, it is at most only a monociliated sac, as shown both by Prof. Clark and by Mr. Carter. Now, it is well known to all investigators, and Mr. Carter has shown it himself, that the animals of Botryllus have distinct oral and fæcal apertures, whereas the sponge cell, so far as has yet been seen, has only an oral aperture. Again, the Ascidian Botryllus is shown to be far higher in the scale when we come to compare its internal organisation, and not merely to confine ourselves to the sac-like tunic. The discharge of the fæcal matter into a common cloacal canal is to me not a sufficient reason for comparing these groups of animals to the sponge animals in *Grantia*.

But what I wish to draw attention to more particularly is this, that in the hurry and bustle of our investigators of the present day, all old associations are mostly, if not entirely, forgotten. I can scarcely think that they are ignored, but are forgotten. Thus, Prof. Grant was, I believe, the first to determine the character and the full importance of the seed-like body in *Halichondria* by placing watch-glasses in the vessel in which living specimens of the above sponge was placed; the bodies were thus discharged from the fæcal canal of the parent sponge, and attached themselves to the watch-glasses, and he then carefully watched their development. Mr. Carter, being a pupil of Dr. Grant, no doubt followed his teacher's plan of investigation, which has led to the brilliant results of this gentleman's in-

vestigations of the fresh-water species in the tanks at Bombay. The clear and lucid manner of investigation detailed by Prof. Grant in the *Edinburgh New Philosophical Journal* (1826-27) might be held as a pattern for investigators, but he appears to be almost entirely lost sight of.

Again, as regards the animals of *Grantia compressa*, Prof. Reay Greene certainly preceded both Prof. Clark and Mr. Carter in his investigations, and has figured these monociliated animals in his handbook, published in 1859, p. 31, fig. 6. The figures are on the same scale as those given by Mr. Carter, and indeed some of the groups figured are so much like those given by Mr. Carter in the "Annals," pl. 1, sqr. 13, *a*, *g*, *h*, that it would be difficult to separate them, and the same may be said of Fig. 41 of Prof. Clark's in "Ann. Nat. Hist" pl. 6, 1868. The only difference being the want of the funnel-shaped mouth, which seems to have escaped the observation of Prof. Greene, probably owing to want of definition in the instrument used in the investigation. Now there is an amount of credit due to the first demonstrator of these animals, which, so far as I have seen, does not appear to have been accorded to him; and I therefore take the liberty of directing attention to this fact. I do not know Prof. Greene, and therefore do not take up this matter on personal grounds, but only in fairness due from one scientific man to another, and I hope my friend Carter will take this in the spirit it is intended. EDWARD PARFITT

Exeter, July 8

Cramming for Examinations

I ENCLOSE one or two *bonâ fide* extracts from "Middle Class" examination papers which have during the past few weeks come under my notice officially.

I do not wish thereby to reflect so much on the candidates as upon the mode of teaching in Middle Class schools, which produces such results.

As might be expected, where evidence of "cramming" from a text-book and want of practical knowledge are equally manifest, some of the answers in the papers from which these are selected are pretty good—but what can be the real value of knowledge of this sort?

The questions are sufficiently indicated by the answers.

CANDIDATE A.

Chlorine may be taken from decayed vegetable matter and animal matter, also manure. . . . It is used for killing insects, it is compounded with lime, and is very good when compounded with lime for the manuring of fields. Lime is chiefly formed from Chlorine.

CANDIDATE B.

Chlorine is prepared by mixing $Ca\,Cl_2$ with H_2O

$$Ca\,Cl_2 + H_2O = CaO + H_2 + Cl_2$$

Chlorine is a colourless invisible gas. Has no odour nor taste. . . . Hydrochloric acid is prepared as follows—

$$Ca\,Cl_2 + H_2O = CaO + 2\,H\,Cl$$

CANDIDATE C.

Carbon is an elementary substance, it is one of the constituents of the atmosphere, it is found in lime and pits among the coal. When the lime is soaked with water the carbon escapes out and the lime moulds away.

AN EXAMINER

Great Heat in Iceland during the present Summer

MR. R. M. SMITH has received a note from Dr. Hjaltelin, Corresponding Member of the Scottish Meteorological Society at Reykjavik, dated June 30, of which the following is an extract:—

"We have now the most excellent season you can imagine in these latitudes, the average temperature for this month (June) being as high as 59°, which is 12° higher than the mean temperature of the past four Junes. I was yesterday near the Hengil Mountain, just at that place where we pitched our tent last time you were here, and the heat was quite unsupportable in the valleys. The wind has been continually blowing from the south-west. Some Englishmen setting out for the Geyser will have something to tell of the extraordinary heat we have at present."

ALEXANDER BUCHAN

The Late Thunderstorm

AN ash tree in the garden attached to the farmhouse of Wester Cringate, near Fintry, struck by lightning on the 20th of June, presents a singular appearance.

About 20ft. from the ground a large branch has been torn from the trunk. The bark has been neatly peeled off for a few feet above and below the place from which the branch shot out. The wood has been first struck a little above the branch, and shows a clean cut, such as might have been made by a sharp-edged tool, as if a chisel three inches broad had been driven into the wood for about four inches. The branch itself has been torn, not cut, and a stripe of the trunk about two feet long below the branch has also been torn out.

For the next four or five feet the tree has suffered no damage of any kind, but after that space the trunk bears six parallel downward scars, varying in length from two to five feet. The scars do not all begin or end at the same height, although each might be cut in some point by a horizontal plane passing through the tree. They spread over about half the circumference of the trunk, and can all, or nearly all, be seen from one standpoint. The most striking circumstance, however, is the almost perfect parallelism of the scars, which are not vertical, but a little twisted round the trunk like the rifling of an Armstrong gun, the rifling in this case being on the outside of the barrel. Six chisels of about half an inch in breadth seem to have ploughed into the wood, tearing off at the same time rather broader stripes of the bark. Towards their lower ends the three right-hand scars cease to be quite parallel, and tend to converge; but all three die out before the convergence takes place, and the tree for the next two feet or so is unscathed. Five feet from the ground (at about the point at which the three scars would converge, if produced) a single rut cutting deeply into the wood commences, which continues down to the soil.

The garden wall (which is a "dry-stone dyke," *i.e.* of loose uncemented stones) passes some three feet behind the tree, on the side directly opposite to that on which the markings above described occur. Outside of this garden the lightning has ploughed two pretty deep parallel ruts through the grassy soil some four feet apart, and stretching from the foot of the wall to the edge of a ditch, a distance of three feet. These ruts are the last observable traces of the passage of the lightning, and were probably made by the currents which engraved the three left-hand scars on the tree. Of course it is impossible to decide whether the currents passed through the open wall, or down the outside of it.

Three sheep on the neighbouring farm of Spittalhill were killed in the same thunderstorm. Their carcases were found lying in a line and were very much swollen, but bore no external marks of injury. A small patch of wool had been stripped from the flank of one of them, but probably this had no connection with the cause of death. R. L. JACK

Geological Survey, Fintry by Glasgow, July 5

Saturn's Rings

AS you have favoured my work on "Saturn's Rings and the Sun" with criticism, I feel sure that as that criticism is adverse to my views, you will in fairness allow me to reply to it.

I will do so in detail. Your reviewer commences very much under the impression that Prof. Clerk Maxwell having investigated the "Stability of Saturn's Rings," no one else is to venture into any discussion touching on their nature or origin. In fact he issues a *caveat*—Prof. Clerk Maxwell has concluded the subject! Next he asserts that I have not seen the Professor's work, because I ascribe to the perusal of Mr. Proctor's "Saturn and its System," the enlistment of my "interest in favour of the Satellite Theory." This is surely beyond his province, as I am free to choose my own point of starting. Mr. Proctor's work interested me, and so did Mr. Clerk Maxwell's, but the former elicited my work, the latter did not.

He next accuses me of placing too great faith in figures, and shows surprise at my giving the hourly rate of the solar motion to a mile, and the solar parallax to four places of decimals. The solar motion is that given by the Herschels, and the solar parallax by several observers. He is hard to please. But my reviewer has unfortunately missed the point of my arguments. The actual velocity of this solar motion is perfectly immaterial; indeed, had he followed the reasoning, he would have seen how pointless are his objections.

As regards my arguments in favour of the meteoric theory of the sun, the reviewer is equally inaccurate. As to my being

blindly enraptured with that theory, as he is pleased to state, I only reply that very clever men have held it, as he is perhaps aware; and certainly none of the modern theories, cumbrous vagaries of the brain, can compare with it. I have never said that the meteoric theory is the real explanation, but I doubt if we shall ever arrive at a more truthful representation of the solar phenomena.

Lastly, he culminates by saying I am "either innocently or wilfully ignorant of the palpably cyclonic appearance which spots frequently present." All I can say in answer to this is that, having observed sun-spots myself for many years, probably as often as the reviewer, I have *never* observed one single appearance of a cyclonic nature. As I possess Mr. Carrington's valuable work, I have again referred to it, and find it in agreement with the assertion in my book and my own observation. I must apologise for my lengthy letter. A. M. DAVIES

2, Gloucester Terrace, Sandgate, July 4

On an Error in Regnault's Calculation of the Heat Converted into Work in the Steam Engine

IN Watts's "Dictionary of Chemistry" (vol. iii. p. 125), in the article on Heat by Prof. G. C. Foster, it appears to me that an important error has crept into the discussion of the above calculation.

The nature of the calculation is as follows :—A unit weight of saturated steam at the temperature of 152°C. contains 653 units of heat. Suppose we allow the steam to expand and to do work until the temperature falls to 503°C. the steam then contains 621 units or 32 units less than before, hence starting with water at 0°C., we give it 653 units of heat, and of this 32 only are converted into work, giving us the fraction $\frac{32}{653}$ as the amount of heat converted into work; but the real work produced by an engine is more than twice this. This difference in theory and practice is accounted for by the fact that saturated steam, in expanding and doing work, is partly condensed, hence the body with which we have to deal at the lower temperature is not all steam, but partly condensed water, therefore, does not contain so much heat as was allowed it.

This explanation is so intelligible as to be at first sight sufficient to account for the whole difference; there is, however, another cause, quite as important, and which is this; every time steam passes from the boiler to the cylinder it does work before it is cut off, and allowed to expand; this work is not done at the expense of the steam that passes into the cylinder, but of the whole mass of steam in the cylinder and boiler, which expands and is thereby cooled. The mass of water and steam in the boiler is, however, so large compared to that which passes into the cylinder, that a thermometer could scarcely detect the cooling effect upon it, and before the next stroke this loss of temperature is made up by the fire. Though thus inappreciable, it is nevertheless very important, and in most engines would amount to one-third the work done; in fact all the work done by the steam before it is cut off and allowed to expand is entirely neglected in this calculation, and a source of error introduced.

To correct it there should be added to the heat in the steam at the initial temperature, as many units of heat as the work done before the steam is cut off, would, if converted into heat, raise the amount of water which passes at every stroke in the form of steam into the cylinder. A. W. BICKERTON

Hartley Institution, Southampton, June 26

THE CAUSES OF THE COLOURS OF THE SEA *

PROF. TYNDALL, in his article in the *Fortnightly Review* for the 1st of March, attributes the greenness of the sea to the matter which it holds in solution. Perhaps the following may corroborate his theory. About the Andaman Islands, where the sea is of the deepest blue, there are most startling and sharply-defined changes of colour, from bright blue to green, where a bed of coral exists. This coral is white out of the water, what its colour when growing may be I know not, but the change I mention appears to corroborate the remarks in the article in question, which are appended below, about the green hues observed upon the plate, the screw blades, and the white bellies of the porpoises. One looks down from a hill into a bay of the brightest blue; you see it broken up here and there like a child's puzzle map by irregular patches of as bright green, often crossing several acres as sharply defined as it is possible to imagine, and indicating the existence of coral beds or reefs just below.

Bellary, Madras Presidency W. M'MASTER

[We give the passages referred to from Prof. Tyndall's lecture.—ED.]

"Let us clear our way by a few experiments towards an explanation of the dark hue of the deep ocean.* Colour, you know, resides in white light, appearing generally when any constituent of the white light is withdrawn. Here is a liquid which colours a beam sent through it purple, and this colour is immediately accounted for by the action of the solution on a spectrum. It cuts out the yellow and green, and allows red and blue to pass through. The blending of these two colours produces the purple. Does the liquid allow absolutely free passage to the red and blue? No. It enfeebles the whole spectrum, but attacks with special energy the yellow and green colours. By increasing the thickness of the stratum traversed by the beam, we cut off the whole of the spectrum. Through the deeper layer, which I now place in the path of the beam, no colour can pass. Here, again, is a blue liquid. Why is it blue? Its action on the spectrum answers the question. It first extinguishes the red; then as the thickness augments it attacks the orange, yellow, and green in succession; the blue alone finally remains, but everything might be extinguished by a sufficient depth of the liquid.

"And now we are prepared for a concentrated but tolerably complete statement of the action of sea water upon light, to which it owes its blackness. Here is our spectrum. This embraces three classes of rays—the thermal, the visual, and the chemical. These divisions overlap each other; the thermal rays are in part visual, the visual rays in part chemical, and *vice versâ*. The vast body of thermal rays is here beyond the red and invisible. They are attacked with exceeding energy by water. They are absorbed close to the surface of the sea, and are the great agents in evaporation. At the same time the whole spectrum suffers enfeeblement; water attacks all its rays, but with different degrees of energy. Of the visual rays the red are attacked first, and first extinguished. While the red is extinguished, the remaining colours are enfeebled. As the solar beam plunges deeper into the sea, orange follows red, yellow follows orange, green follows yellow, and the various shades of blue, where the water is deep enough, follow green. Absolute extinction of the solar beam would be the consequence if the water were deep and uniform, and contained no suspended matter. Such water would be as black as ink. A reflected glimmer of ordinary light would reach us from its surface, as it would from the surface of actual ink; but no light, hence no colour, would reach us from the body of the water. In very clear and very deep sea water this condition is approximately fulfilled, and hence the extraordinary darkness of such water. The indigo, to which I have already referred, is, I believe, to be ascribed in part to the suspended matter, which is never absent, even in the purest natural water, and in part to the slight reflection of the light from the limiting surfaces of strata of different densities. A modicum of light is thus thrown back to the eye, before the depth necessary to absolute extinction has been attained. An effect precisely similar occurs under the moraines of the Swiss glaciers. The ice here is exceptionally compact, and owing to the absence of the internal scattering common in bubbled ice, the light plunges into the mass, is extinguished, and the perfectly clear ice presents an appearance of pitchy blackness.

"The green colour of the sea when it contains matter in a state of mechanical suspension has now to be accounted for; and here, again, let us fall back upon the sure basis of experiment. This white plate was once a complete dinner-plate, very thick and strong. It is, you see, surrounded securely by cord, and to it a lead weight is fastened. Forty or fifty yards of strong hempen line were attached to the plate. With it in his hand, my assistant, Thorogood, occupied a boat fastened as usual to the davits of

* Communicated by Prof. Tyndall.

* A note written to me the 22nd of October, by my friend Canon Kingsley, contains the following reference to this point:—"I have never seen the Lake of Geneva, but I thought of the brilliant, dazzling dark blue of the mid Atlantic under the sunlight, and its black blue under-cloud, both so solid that one might leap off the sponson on to it without fear; this was to me the most wonderful thing which I saw on my voyage to and from the West Indies."—J. T.

the *Urgent*, while I occupied a second boat nearer to the stern of the ship. He cast the plate as a mariner heaves the lead, and by the time it had reached me, it had sunk a considerable depth in the water. In all cases the hue of this plate was green, not, of course, a pure green, but a mixture of green and blue; and when the sea was of the darkest indigo, the green was the most vivid and pronounced. I could notice the gradual deepening of the colour as the plate sank, but at its greatest depth in indigo water the colour was still a blue green.

"Other observations confirmed this one. The *Urgent* is a screw steamer, and right over the blades of the screw there was an orifice called the screw-well, through which you could look from the poop down upon the screw. The surface glimmer which so pesters the eye was here in a great measure removed. Midway down a plank crossed the screw-well from side to side, and on this I used to place myself to observe the action of the screw underneath. The eye was rendered sensitive by the moderation of the light; and still further to remove all disturbing causes, Lieutenant Walton had the great kindness to have a sail and tarpaulin thrown over the mouth of the well. Underneath this I perched myself, and watched the screw. In an indigo sea the play of colours was indescribably beautiful, and the contrast between the water which had the screw-blades for a background, and that which had the bottom of the ocean as a background, was extraordinary. The one was of the most brilliant green, the other of the most lustrous ultramarine. The surface of the water above the screw-blade was always ruffled. Liquid lenses were thus formed, by which the coloured light was withdrawn from some places and concentrated upon others. The screw-blades in this case replaced the plate in the former case, and there were other instances of a similar kind. The hue from an indigo sea was always green at a certain depth below the surface. The white bellies of the porpoises showed the same hue, varying in intensity as the creatures swung to and fro between the surface and the deeper water. In a rough sea the light which had penetrated the summit of a wave sometimes reached the eye. A beautiful green cap was thus placed upon the wave when the ship was in indigo water.

"But how is this colour to be connected with the suspended particles? Take the dinner-plate which showed so brilliant a green when thrown into indigo water. Suppose it to diminish in size until it reached an almost microscopic magnitude. It would still behave substantially as the larger plate, sending to the eye its modicum of green light. If the plate, instead of being a large coherent mass, were ground to a powder sufficiently fine, and in this condition diffused through the clear sea water, it would send green to the eye. In fact, the suspended particles which the home examination revealed in green sea water act in all essential particulars like the plate, or like the screw-blades, or like the foam, or like the bellies of the porpoises. When too gross, or in too great quantity, the suspended particles thicken the sea itself visibly. But when sufficiently small, but not too small, and when sufficiently diffused, they do not sensibly interfere with the limpid greenness of the sea itself. They then require the stronger and more delicate test of the concentrated luminous beam to reveal their presence."

THE TEMPERATURE OF THE SUN

PROF. NEWCOMB, in reviewing P. A. Secchi's work on the Sun, shows that if the temperature reached 10,000,000° Cent., as asserted by the author of "Le Soleil," the earth would speedily be reduced to vapour. In answer to this objection Père Secchi urges, "that a body may have a very high temperature and yet radiate but very little;" contending that "a thermometer dipped inside the solar envelope in contact with the photosphere," would indicate the temperature mentioned. He adds, "This high temperature, besides, is really a virtual temperature, as it is the amount of radiation received from all the transparent strata of the solar envelope, and this body at the outer shell must certainly be at a lower temperature." What information is intended to be conveyed by the statement that 10,000,000° Cent. "is really a virtual temperature," on the ground that it is the "amount of radiation received from all the transparent strata" outside of the photosphere, I will not attempt to explain; but I propose to show that a thermometer dipped inside the solar envelope in contact with the photosphere, cannot possibly indicate the enormous temperature of 10,000,000° Cent. assumed by Père Secchi. The assertion that "a body may have a very high temperature and yet radiate but very little," were it correct with reference to the photosphere, does not affect the question. It is of no consequence whether the sun's photosphere belongs to the class of active or sluggish incandescent radiators imagined by the distinguished savan; the temperature of the radiant surface, not its capacity to radiate more or less copiously, is the problem to be solved. Accordingly the following statement is intended to show that the temperature of the sun's photosphere at the point where the author of "Le Soleil" supposes his thermometer to be applied, cannot much exceed 4,000,000° Fahr. Observations conducted in lat. 40° 42′, with an actinometer (a drawing of which has been published in *Engineering*) have enabled me to ascertain, with desirable accuracy, the intensity of solar radiation for each degree of the sun's zenith distance from 17° to 75°. The atmospheric depth at the first mentioned zenith distance being only 0·046 greater than the vertical atmospheric depth, I have demonstrated, by prolonging the curve constructed agreeable to the observations referred to, that the intensity of solar radiation on the ecliptic is 67·20° Fahr. at the time when the earth passes the aphelion. The accompanying table, the result of two years of observations, shows the atmospheric depth and the intensity of solar radiation for each degree from the vertical to 75° zenith distance. The ratio of diminution of intensity of the radiant heat during the passage of the rays through the atmosphere being accurately defined by this table, it has been easy to calculate that the amount of retardation of the radiant heat on the ecliptic is 0·207 or 17·64° Fahr. Adding this loss of energy to the amount of observed radiant heat, it will be found that the intensity of solar radiation at the boundary of our atmosphere when the earth passes the aphelion corresponds with a thermometric interval of 17·64 + 67·20 = 84·84° on the Fahrenheit scale. Now, the aphelion distance of the earth is 218·1 times greater than the radius of the sun's photosphere; hence, basing our calculations on the established truth that the intensities are inversely as the areas over which the rays are dispersed, we prove that the temperature of the photosphere is $218{\cdot}1^2 \times 84{\cdot}84° = 4{,}035{,}584°$ Fahr. And if we then add the amount of loss of intensity attending the passage of the rays through the solar envelope, we establish, with absolute certainty, the temperature to which a thermometer will be subjected if "dipped inside the solar envelope in contact with the photosphere."

With reference to the retardation of the rays in passing through the solar envelope, we possess practical data of such a nature that the solution of the problem is by no means mere hypothesis. We know that the density of atmospheric air would be reduced to $\frac{1}{8000}$ of the ordinary density if subjected to a temperature of 4,000,000° Fahr.; hence, if we assume that the solar envelope consists chiefly of hydrogen, it may be shown, due-allowance being made for the superior attraction of the sun's mass, that the density of the terrestrial atmosphere at equal depth from the boundary is fully 2,000 times greater than that of the solar envelope. Accordingly, as the sun's rays lose only 17·6° in passing vertically through our cold atmosphere, it may be demonstrated that the loss of energy during the passage of the rays through a transparent solar envelope 80,000 miles in depth from the photosphere, cannot exceed 0·01 or 40,000° Fahr. Let us be careful not to confound this diminution of energy with the reduction of temperature consequent on the dispersion of the rays as they recede from the photosphere during their course through the solar envelope. The reduction of temperature attending dispersion, obviously does not involve any diminution of mechanical

energy. It would be waste of time to enter on any further demonstration in refutation of the extravagant assumption that a thermometer in contact with the photosphere would indicate some 12,000,000° Fahr. higher temperature than that which we have established on the basis of the known distance and radius of the sun's photosphere, and the ascertained radiant intensity at the boundary of the earth's atmosphere. Nor need we point out the inconsistency of the doctrine that the sun's photosphere possesses less radiant power than incandescent terrestrial substances, such, for instance, as iron and carburetted hydrogen. But the advocates of high solar temperature may urge, that the law, agreeable to which the temperature of 4,000,000° Fahr. has been determined, is mere *theory*, which, although true for distances of a few feet, may be wholly erroneous when the radiator is millions of miles away.

It has been one of the principal objects of my researches connected with solar heat, during the last three years, to endeavour to determine this question. Accordingly, the difference of intensity of solar radiation at midsummer and midwinter has been particularly observed. Fortunately, the eccentricity of the earth's orbit is sufficient to produce a marked difference of intensity at different seasons; but, on the other hand, the varying depths of the atmosphere resulting from the varying inclination of the earth's axis, apart from the varying distance between the sun and the earth, present serious obstacles. My observations as before mentioned have been conducted in lat. 40° 42′, hence 17° 12′ from the ecliptic at the summer solstice, and 64° 12′ at the winter solstice. Accordingly, the depth of atmosphere has varied during the investigations in the ratio of 1·04 to 2·25; thus rendering comparisons between the actual intensities very difficult. A series of observations made at different hours and seasons has ultimately enabled me to construct the curve before referred to, defining the maximum intensity of the sun's radiant heat for all latitudes at the time when the earth passes the aphelion; likewise defining the retardation of solar intensity for all zenith distances not exceeding 75°. Evidently an accurate knowledge of the solar intensity corresponding with given zenith distances removes the obstacles attending the varrying inclination of the axis of the earth. The variation of intensity consequent on the eccentricity of the earth's orbit has also been accurately determined for each day in the year. The detail not being immediately connected with the subject under consideration, it will suffice to state that actinometer observations conducted under very favourable circumstances, January 7, 1871, proved the sun's radiant heat to be 57·25° Fahr., the zenith distance being 63° 15′. Referring to the table, it will be seen that for equal zenith distance—63° 15′—the temperature produced by solar radiation is only 51·77° when the earth passes the aphelion. An *increase* of solar intensity of 57·25 − 51·77 = 5·48°, when the earth is in perihelion, has therefore been established. This important fact enables us to test on a grand scale the correctness of our assumption that the intensity of solar radiation diminishes in the inverse ratio of the area over which the rays are dispersed.

The aphelion distance of the earth being 218·1 times greater than the radius of the sun's photosphere, while the perihelion distance is 210·9 times that radius, the temperatures produced by solar radiation at the boundary of the earth's atmosphere at midsummer and at midwinter, will be inversely as $218{\cdot}1^2 : 210{\cdot}9^2$. Consequently, as the ascertained maximum temperature at the former period is 84·84° Fahr., the temperature produced by solar radiation at the latter period will be $\frac{218{\cdot}1^2 \times 84{\cdot}84°}{210{\cdot}9^2} =$ 90·72° Fahr. Let us ascertain if this theoretical temperature correspond with actual fact. Our table shows that the diminution of solar intensity attending the passage of the rays through the atmosphere, when the zenith distance is 63°15′, amounts to 15·43° in addition to the diminution of 17·64° on the ecliptic, together 33·07°. Adding this to the temperature 57·25°, observed January 7, 1871, we establish the fact that the temperature at the boundary of the atmosphere is 90·32° Fahr. Agreeable to the foregoing theoretical determination, the temperature ought to be 90·72°, difference = 0·4° Fahr. This discrepancy is accounted for by the fact that the sky, although unusually clear, was not quite free from cirrus haze on the day of observation, as proved by the indication of the solar calorimeter, an instrument by which the presence of any obstruction in the atmosphere is ascertained with absolute certainty. In addition to the proof thus furnished in support of the theory on which our calculations are based, that the temperature at the surface of the sun's photosphere does not much exceed 4,000,000° Fahr., other tests have been adopted with nearly identical results, an account of which, together with necessary delineations, has been published in *Engineering*. These tests prove that, unless the photosphere of the sun possesses relatively less radiating power than incandescent cast iron, or metallic substances coated with lampblack, and maintained at ordinary boiling heat, the temperature indicated by a thermometer "dipped inside the solar envelope in contact with the photosphere" will not exceed 4,100,000 deg. Fahrenheit.

Table showing the depth of atmosphere, and intensity of solar radiation, for each degree of zenith distance, when the earth passes the aphelion.

Zenith Distance	Depth of Atmosphere.	Maximum Intensity	Zenith Distance	Depth of Atmosphere	Maximum Intensity
Deg.		Fah.	Deg.		Fah.
0	1·000	67·20	38	1·265	62·11
1	1·000	67·20	39	1·283	61·81
2	1·000	67·19	40	1·302	61·50
3	1·001	67·18	41	1·322	61·19
4	1·002	67·16	42	1·342	60·88
5	1·003	67·12	43	1·363	60·57
6	1·005	67·08	44	1·384	60·25
7	1·007	67·02	45	1·406	59·93
8	1·010	66·96	46	1·431	59·60
9	1·013	66·90	47	1·457	59·25
10	1·016	66·84	48	1·485	58·88
11	1·019	66·77	49	1·514	58·51
12	1·023	66·70	50	1·545	58·12
13	1·027	66·62	51	1·577	57·72
14	1·031	66·54	52	1·612	57·31
15	1·036	66·44	53	1·648	56·89
16	1·041	66·33	54	1·686	56·46
17	1·046	66·21	55	1·726	56·02
18	1·051	66·08	56	1·769	55·56
19	1·057	65·95	57	1·815	55·09
20	1·063	65·82	58	1·864	54·60
21	1·070	65·68	59	1·916	54·10
22	1·077	65·53	60	1·970	53·58
23	1·085	65·38	61	2·037	53·05
24	1·093	65·22	62	2·098	52·50
25	1·102	65·04	63	2·164	51·90
26	1·111	64·86	64	2·235	51·40
27	1·121	64·67	65	2·312	50·81
28	1·132	64·48	66	2·398	59·20
29	1·141	64·28	67	2·490	49·57
30	1·152	64·07	68	2·591	48·91
31	1·164	63·85	69	2·701	48·25
32	1·176	63·63	70	2·821	47·55
33	1·189	63·40	71	2·952	46·84
34	1·203	63·16	72	3·097	46·12
35	1·217	62·92	73	3·255	45·37
36	1·232	62·67	74	3·428	44·60
37	1·248	62·40	75	3·624	43·78

J. ERICSSON

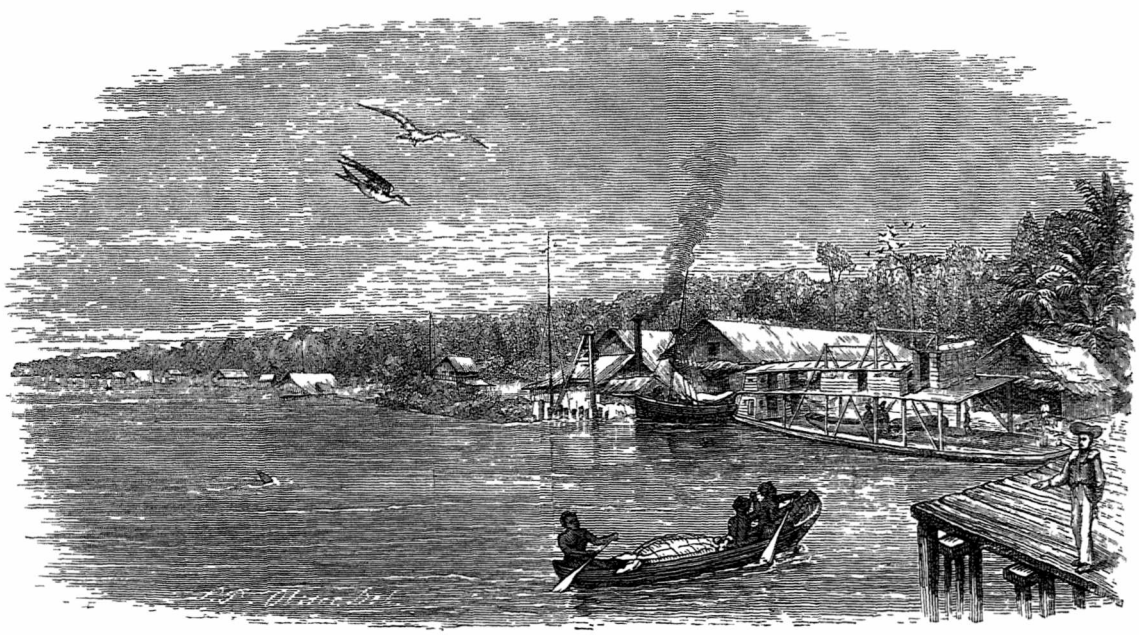
GREYTOWN AND ADJACENT COUNTRY

GREYTOWN is important as the only port possessed by Nicaragua on its Atlantic coast, and is situated in 11° N. lat. and 84° W. long. The place itself is insignificant enough, as a glance at the accompanying view of the interior of the harbour will show; at the same time it is of strategical importance in many ways, and its history is not uninteresting. The climate is humid, and along the low coast-lands a tropical heat prevails. The heat is never oppressive while the trade winds blow, but during calms it is sultry and overpowering. The prevailing type of disease appears to be a low form of intermittent fever, which is not to be wondered at, considering that Greytown is built upon a swamp. June, July, and August are considered the unhealthy months, and January, February, and March the healthiest, the thermometer seldom exceeds 82° Fahr., or falls below 71° Fahr. in the shade.

SEASONS*

RAINY	DRY
June	January
July	February
⅜ August	March
½ October	April
November	May
December	⅝ August
The rain descends in a perfect deluge, accompanied by thunder and lightning.	½ October
	Sometimes not a drop of rain falls, but generally it is showery, even in the so-called dry season at Greytown.

In the interior, where the forest vegetation has been cleared away in the neighbourhood of the islands and lakes, the seasons are more marked, and the dry season is really dry, not a drop falling. At times Greytown is visited by terrible gales or hurricanes styled "Northers," at such times the trade wind is gradually killed, and a



GREYTOWN HARBOUR

calm precedes the coming storm, the barometer falls rapidly, and the clouds bank up in the horizon. After these warnings the norther commences without further prelude, and in an incredibly short time the sea is churned up into great and violent waves, whilst the surf on the bar is terrific. A norther will sometimes last for three whole days.

The whole civilised population of the Nicaraguan and neighbouring republics is collected on the Pacific side of Central America; the Caribbean coasts being almost entirely uninhabited, with the exception of a few independent tribes of Indians along the banks of the large rivers like the Indian and Rama. The principal tribes are the Valiente, Rama Cookwra, Woolwa Tonga, and Poya tribes, all interesting from an ethnological point of view, especially as they are fast disappearing. There is generally a small camp of some of these tribes on the sandy spit (Punta d'Arenas) at the entrance to Greytown harbour, who catch and sell turtle, &c. Accounts of these Mosquito tribes will be found in the Journal of the Royal Geographical Society, 1862, p. 242, &c., by Mr. Bell, and in the last volume of Memoirs of the Anthropological Society, by Mr. Collinson. This region, *i.e.* the valley and lowlands of the San Juan and the lakes of Nicaragua and Managua, is more particularly interesting to naturalists and geologists, as forming the border land between two of the great primary distributional provinces for the terrestrial vertebrata in the present world recognised by Prof. Huxley, viz., the boundary line betwixt *Austro-Columbia* and *Arctogæa*. For it was in this direction apparently, that, during the Miocene epoch, these two great land divisions were separated by that great equinoctial ocean whose currents rolled from eastward beyond and over the present sites of the Sahara deserts and the plains of Hindostan.

As the line of the American Cordilleras was upheaved, the continents more nearly approached each other, an archipelago of detached volcanic summits probably first indicating the future isthmus; whilst the bounds of the ocean were narrowed, and previous to the actual junction but a narrow channel or strait was left. It is supposed that the last indication of this strait is yet observable in the line of the San Juan and the waters drained by it. This theory has received substantial support from the ob-

* See Capt. Pim's "Gate of the Pacific," p. 71.

servations of Mr. Osbert Salvin, the well-known ornithologist, who, from long studying the peculiarities of the Central American bird-fauna, has come to the conclusion that an oceanic separation is plainly indicated as having formerly existed between Costa Rica and the country north of the Nicaraguan lakes. This upheaval has by no means ceased, and the lakes of Managua and Nicaragua, up to which the Spanish galleons proceeded, *viâ* the San Juan, are now 156 and 128 feet respectively above the mean level of the two oceans. So that now with difficulty stern-wheel light-draught steamers, drawing but eighteen inches of water, make their way between the rapids, their cargo having to be shifted across these impediments. A rise of six feet in the waters of the lakes enables bongos to pass the rapids in the wet season.

Every year apparently adds to the difficulties of the navigation, which Mr. Collinson attributes to the continual rise of the Pacific coast. Indeed, it is not improbable, if a careful series of observations were established, that after a lapse of years the rate of rise might be ascertained, which, if compared with seismological observations in the same district, would prove of the utmost value and interest.

It has been before noticed that Greytown is the only settlement of any size on the Caribbean coast, owing to its position at the mouth of the San Juan river, which is the only one which offers facilities for transit across the isthmus; and consequently a portion of the Californian traffic has for some years passed in this channel, an enterprising American company having monopolised the "transit-route." Owing, however, to the rapid silting-up of the embouchure of the San Juan at Greytown, this town would infallibly have lost all its importance, had it not been that the rapid development of marine telegraphy has given rise to a great demand for india-rubber, a valuable kind of which is collected from trees which are numerous in the dense forests of the Central American isthmus, especially on the Atlantic coast.

Greytown is the principal port for the export of india-rubber on the coast. It is collected by parties of Indians, Caribs, or half-caste Creoles, seldom by Europeans, to whom the dealers, who are also storekeepers, advance the necessary outfit of food, clothing, and apparatus for collecting rubber, on condition of receiving the whole of the rubber collected at a certain rate. The rubber hunters are termed *Uleros* (*Ule* being the Creole term for rubber). A party of Uleros, after a final debauch at Greytown, having expended all their remaining cash, generally make a start in a canoe for one of the rivers or streams which abound on the coast, and having fixed on a convenient spot for a camp, commence operations. The experienced rubber hunter marks out all the trees in the neighbourhood. The rubber tree is the *Castilloa elastica*, which grows to a great size, being on an average about four feet in diameter, and from twenty to thirty feet to the first spring of the branches. From all the trees in the almost impenetrable jungle hang numerous trailing parasites, lianes, &c., from these, and especially the tough vines, are made rude ladders, which are suspended close to the trunks of the trees selected, which are now slashed by machetes in diagonal cuts from right to left, so as to meet in the middle in central channels, which lead into iron gutters driven in below, and these again into the wooden pails. The pails are soon full of the white milk, and are emptied into larger tin pans. The milk is next pressed through a sieve, and subsequently coagulated by a judicious application of the juice of a Bejuca (an *Apocyna* ?) vine. The coagulated mass is then pressed by hand, and finally rolled out on a board with a wooden roller. The rubber has now assumed the form of a large pancake, nearly two feet in diameter and about a quarter of an inch thick, on account of which they are termed *tortillas* by the Uleros; these cakes are hung over the side poles and framework which supports the *rancho*, which is erected in the woods, and allowed to dry for about a fortnight, when they are ready to be packed for delivery to the dealer.

In the meantime others of the party go in pursuit of game, such as tapirs or *dantes*, or mountain cows, as they are termed, of which there are several species; or they harpoon the manatee,* which they dexterously follow in their canoes, as it cannot remain under water long. The point of the harpoon used by the Indians is moveable, and, attached to a line and floating reel, it becomes detached from the shaft when the siren is struck. The wild boar or javali (domestic pig run wild?) and the *waree*, or peccary, which are shot in June and July, and the deer, which are shot in December, afford good pork and venison. The waters of all the numerous rivers and lakes are characterised by an astounding number of distinct ichthyological faunæ. The Indians are good fishermen, and will shoot fish in the water by bow and arrow, or cut them down with a machete; the best fish are perhaps the *guapote*, *mojarra*, and *savallo*. By way of feathered game the curassows and guans (*Crax alector*, *C. fasciolata* and several Penelopes) of different species are of good size and flavour, whilst iguanas and land turtle eggs serve to vary the bill of fare of the Ulero gourmet.

The picnic life of the Ulero is not all *couleur de rose*. At night the jaguars and pumas (*Felis onca*, *F. melas* and *F. concolor*) will prowl in the neighbourhood of the *rancho*. These beasts are sometimes brought to bay with dogs by the Carib mahogany cutters in the fork of a low tree, and then speared; the spear in this instance is always provided with a stout cross bar, to prevent the transfixed animal from reaching his assailant.

Besides this the alligators abound in the water, which renders bathing slightly precarious; but as a general rule these brutes are cowardly enough when not hungry. On one occasion one of the party (with whom the author was in these woods) having shot a dante, which sank to the bottom of the River Rama, an Indian dived after it to attach a rope to the carcass; while the alligators, attracted by the smell of blood, surrounded the canoe in a circle of some score yards in diameter, but none of them ventured an attack on the bold diver. Both Caribs and Indians have a profound contempt for the alligator in these rivers. On shore, again, the snakes are numerous, such as the *taboba*, *vipora de sangre*, a long black snake, *Coryphodon constrictor*, the lovely coral, and barber pole snakes, and, worst of all, the small tamagusa or "tommy goff." The Caribs assert the valuable propereies of a vine—a species of Aristolochia—which they declare will allay the effects of a snake bite.

The greatest drawbacks, however, to the enjoyment of Ulero life in Mosquitia and Costa Rica are the swarms of garrapatas or ticks (*Ixodes*), which persecute remorselessly the hunter or woodsman. The *chigoe* or jigger is also another annoyance. By-the-bye, it is said, I do not know on what grounds, that this last-mentioned pest is only to be found where domestic swine are kept. I only know that I have suffered from one in the woods many miles from any domesticated swine. Do they appear therefore where there are wild hog or peccary? There is also a digusting bot fly and swarms of mosquitoes near the water.

The Formicidæ are likewise numerous and formidable; a gigantic black ant which especially pervaded the ebœ (*Dipterix oleifera*) trees is justly dreaded, and we always avoided slinging our hammocks from these trees if pos-

* The genus Manatus appears to be the most ubiquitous of the sub order Sirenia, and various species are to be found not only on the rivers, inland lakes, and coasts of Tropical America, but along the entire opposite coast of Africa, where the habitat of the *Manatus senegalensis* extends round the Cape, and as far north on the Mozambique coast as the river Zambesi; besides which its presence is recorded in the Lake Shirwa by Dr. Kirk. A species, *M. Vogelii*, also occurs in the upper Niger, and, according to Barth, in Lake Tsad, whilst Heuglin notices one species in the Tana Sea in Abysinnia. So it is not improbable that the Manatus may occasionally meet its East Indian congener the *Halicore Dugong*.

sible. Stout Indians will howl and writhe with agony from the effect of their bites. A minute red fire ant also infests the acacia trees, and is barely more endurable. The howling of the black monkeys also is not conducive to sleep when they choose some neighbouring branches for their "serenade." The above slight sketch may serve to give some insight into the pleasures of a country life in the vicinity of Greytown, pleasures, however, of which the Nicaraguan citizens seldom avail themselves.

There have already appeared in NATURE some accounts of peculiar nocturnal vibrations observable in iron vessels off Greytown, which I will not allude to further.

The drawing which accompanies this notice was taken from the pier of the Transit Company's wharf; the town itself is barely visible from this point, and lies beyond the few buildings shown. The remains of one of the flat-bottomed streamers which ascend the river is shown lying by the shore. Canon Kingsley appears to have been disappointed at only twice catching a glimpse of the black fin of a shark during his recent visit to the West Indies; let me recommend the bar of Greytown Harbour and its vicinity as an exceptionally favourable locality for studying these monsters in their native element.

S. P. OLIVER

THE DATE OF THE INTERMENT IN THE AURIGNAC CAVE

IT is a remarkable fact in the history of Archæology that the palæolithic age of the human interments in the cave of Aurignac has been universally accepted without any criticism of the evidence. It has passed into the condition of an article of scientific faith, partly through the eminence of M. Lartet, the describer of the cave, and partly through the high authority of Sir Charles Lyell, who followed his views in the "Antiquity of Man." The ready faith with which it has been received stands in marked contrast to the scepticism which refused to allow the value of the discovery of flint implements in the caves of England and Belgium for more than a quarter of a century, and up to within some three years of M. Lartet's investigations in Aurignac. The importance of examining the data on which M. Lartet's theory is based can hardly be over-estimated in the present state of the science of man. If the human interments really be of the same relative date as the extinct Mammalia found in the cave, and M. Lartet's interpretation of the circumstances be true, then, to quote Sir Charles Lyell, "we have at last succeeded in tracing back the sacred rites of burial, and, more interesting still, a belief in the future state," to the palæolithic age, and we have a powerful argument against the progressive development of religious ideas. This point did not escape Mr. Wallace in his speech at the Exeter meeting of the British Association. If, on the other hand, the interments be not proved to be palæolithic, the sooner an element of error is eliminated from a most difficult problem, the nearer shall we be to its solution. I shall first of all take the facts as they are now universally interpreted; and then I shall check them by the independent evidence of the late Rev. S. W. King, who finally explored the cave.

M. Lartet's account falls naturally into two parts: first that which the original discoverer of the case told him, and secondly that in which he describes the results of his own discoveries. I shall begin with the first. In the year 1852 a labourer named Bonnemaison, employed in mending the roads, put his hand into a rabbit-hole and drew out a human bone, and, having his curiosity excited, he dug down, until, as his story goes, he came to a great slab of rock. Having removed this, he discovered on the other side of it a cavity 7 or 8 feet in height, 10 in width, and 7 in depth, almost full of human bones, which Dr. Amiel, the Mayor of Aurignac, believed to represent at least 17 individuals of all ages. All these human remains were collected, and finally committed to the parish cemetery, where they rest at the present time undisturbed by the sacrilegious hands of archæologists, the discoverer and the sexton being alike ignorant of their last resting-place. Fortunately, however, Bonnemaison, in digging his way into the grotto, had met with the remains of extinct animals and works of art, and these were preserved until, in 1860, M. Lartet heard of the discovery, and resolved to examine the cave for himself. It must be remarked that before his advent the interior had been ransacked, and the original stratification to a great extent disturbed, a circumstance which obviously does away with any argument based on the association of remains in the cave.

M. Lartet's exploration resulted in the discovery that a stratum containing the bones of cave-bear, lion, rhinoceros, and hyæna, along with undisputable works of art of the palæolithic type—like those of the Dordogne—passed from a plateau on the outside into the cave. On the outside he met with ashes and burnt and split bones, which implied that it had been used by the palæolithic hunters as a feasting place; within he detected no traces of charcoal, and no traces of hyænas, which were abundant outside. Inside he met with a few human bones, which were in the same mineral state as those of the extinct Mammalia. That, however, identity of mineral state is any clue to age is disproved by the varying condition of bones of the same geological age in every bone cave with which I am acquainted. As an example I might quote the remains of cave-lion in the Taunton Museum. Such is the summary of the facts which M. Lartet discovered. He has, of his personal knowledge, only proved that Aurignac was occupied by a hunter tribe during the palæolithic age.

Is he further justified in assuming that it was used as a sepulchre at that remote period? Bonnemaison's recollections may be estimated at the proper value by the significant fact that, in the short space of eight years intervening between the discovery and the exploration, he had forgotten where the skeletons had been buried. And even if his account be true in the minutest detail, it does not afford a shred of evidence in favour of the cave having been a place of sepulture in palæolothic times, but merely that it had been so used at some time or other. If we turn to the diagram constructed by M. Lartet to illustrate his views (An. des Sc. Nat. Zool. iv. ser. t. xv., pl. 10), and made for the most part from Bonnemaison's recollection, or to the amended diagram given by Sir C. Lyell (Antiquity, fig. 25), we shall see that the skeletons are depicted above the strata containing the palæolithic implements and the quaternary mammals, and therefore, according to the laws of geological evidence, they must have been buried after the subjacent deposit was accumulated. The previous disturbance of the cave earth altogether does away with the value of the conclusion that the few human bones found by M. Lartet are of the same age as the extinct mammalia in the same deposit. The absence of charcoal inside was quite as likely to be due to the obvious fact that a fire kindled inside would fill the grotto with smoke, while outside the palæolithic savages could feast in comparative comfort, as to the view that the ashes are those of funereal feasts in honour of the dead within, held after the slab had been placed at the entrance. The absence of the remains of hyænas from the interior is also negative evidence disproved by subsequent examination.

The researches of the Rev. S. W. King in 1865, hitherto unpublished, complete the case against the current view of the palæolithic character of the interments, insomuch as they show that M. Lartet did not complete the examination which he began; and that he consequently wrote without being in posesssion of all the facts. The entrance was blocked up, according to Bonnemaison, by a slab of stone

which, if the measurements of the entrance be correct, must have been at least 9 feet long and 7 feet high, placed, according to M. Lartet, to keep the hyænas from the corpses of the dead. It need hardly be remarked that the access of these bone-eating animals to the cave would be altogether incompatible with the preservation of the human skeletons, had they been buried at the time. The enormous slab was never seen by M. Lartet, and it is very hard to understand how it could have been removed by one workman cutting a trench after a few hours' work. And it certainly did not keep out the hyænas. In the collection made by the Rev. S. W. King from the interior, there are two hyæna's teeth, and nearly all the antlers and bones bear the traces of the gnawing of those animals. The cave, moreover, has *two* entrances instead of one, as M. Lartet supposed, when his paper in the Annales was published. There are also in the collection above quoted —now presented by Mrs. King to the Christy Museum— two metacarpals of sheep or goat—animals which, as yet, have not been proved to have been living in Europe during the quaternary period, and which, probably, were introduced by neolithic races of men, as well as a fragment of pottery of precisely the same kind as that in the superficial deposit in Kent's Hole.

In a word, the evidence in favour of the interment in Aurignac being of a later date than the occupation seems to me to be overwhelming, and it does not afford the slightest ground for any hypothesis as to the belief of palæolithic men in the supernatural. On that point, up to the present time, modern discovery is silent, and negative testimony is valueless. W. BOYD DAWKINS

DAYLIGHT AURORAS

WE have published several letters lately on this subject, in some of which doubts are suggested as to the reality of the phenomenon. The following extracts from a paper which we have received from Mr. Glaisher, will put the matter to rest :—

The Aurora of Feburary 12, appearing in Daylight.

"The accounts of auroræ appearing by daylight are very few indeed, yet the following reports made by two of the observers in the magnetic department of the Royal Observatory, Greenwich, who called my attention to the appearance of the sky and to the fixity of the arch, as well as to the apparent avoidance by the clouds of the clear space, together with the disturbed state of the magnetic elements at the time, seem to decide that the appearances were really due to an aurora appearing by daylight.

"Mr. Wright says that at about noon the clouds in the north began to break, and soon after an almost perfect arch of clear sky, with its apex in the magnetic meridian, was visible. This space of clear sky kept its shape more or less perfect for more than an hour—a remarkable fact, as the clouds in the remaining portion of the sky were being driven rapidly across by a strong N.E. wind. The clouds immediately above the top of the arch seemed to be charged with electricity, the edges assuming the ragged appearance common to thunder-clouds. At times these clouds were slightly tinged with a reddish colour. About $0^h\ 45^m$ P.M., a very remarkable cloud of a reddish-brown colour passed slowly across the clear space from E. to W., being apparently much nearer to the observer than the ordinary clouds. Apart from the ordinary motion of the clouds from N.E. to S.W., caused by the wind, there seemed to be an apparent vibratory motion from E. to W.

"Mr. Marriott says :—'About noon the clouds in the north began to break, and shortly after, there was a perfectly clear space of blue sky in the form of an arch, the apex of the arch being in the magnetic meridian. At the circumference of the arch were very fine cumulus clouds, the edges of which were tinged with a reddish colour; and along the whole of the north horizon there stretched a bank of cumulus clouds to the altitude of 10° or 15°. At about $0^h\ 20^m$, just below the apex of the arch, I observed something like steam shooting up and moving from east to west; this, I imagine, is what streamers would be like in the daytime. At $0^h\ 45^m$ a small cloud of a brick-red colour traversed the clear space; a few other clouds which passed over at the same time were not tinged. The arch was very well defined for about an hour or an hour and a half; and although the wind was blowing a gale from the north-east, and the clouds passing rapidly over the other portions of the sky, this space was not encroached upon by clouds. The altitude of the arch was about 50°, and the point at which the supposed streamers first appeared was about 7° below the apex. I also observed auroral light at night.

"On the 11th day and till $6^h\ 35^m$ P.M. the movements of the several magnets were those of the ordinary diurnal changes, and at this time the western declination was 19° 55′. At $6^h\ 40^m$ a sudden disturbance began; the declination decreased 19′ by $7^h\ 19^m$, then increased to 19° 56′ by 8^h; at $8^h\ 12^m$ it was 19° 47′, increased to 20° 4′ by $8^h\ 29^m$, was 19° 45′ at $9^h\ 11^m$, was 20° 6′ by $9^h\ 58^m$ P.M., then there were several small movements of 3′ or 4′ both to the east and to the west; at $11^h\ 30^m$ the declination was 19° 58′, and by midnight had increased to 20° 12′.

"The magnet still continued to move through small arcs, but gradually decreasing to $4^h\ 10^m$ A.M. on the 12th. to 19° 47′; then there were frequent changes of position, but such that the declination generally increased, and was 20° 3′ at $8^h\ 45^m$ A.M.; by $10^h\ 40^m$ it decreased to 19° 55′.

"There were frequent movements of the magnets between this time and till after noon. On the 12th day, at $0^h\ 30^m$ P.M., the declination was 20° 12′, at $0^h\ 45^m$ it was 20° 3′; this movement of the magnet towards the east is remarkable as having taken place immediately before the passage of the reddish-coloured cloud from east to west across the clear space of sky, and attained its maximum at about the time of the passage of the cloud. The movement of this cloud was not that of all other clouds, viz. from N.E. to S.W., and it would seem to be of auroral origin. . . . .

"Authentic instances of auroral displays by daylight are very few.

"The first instance I can find is recorded at p. 189, vol. ii. of the 'Transactions of the Royal Irish Academy,' from which the following extract is made :—

"'An account of an Aurora Borealis seen in full Sunshine. By the Rev. Henry Ussher, D.D., F.R.S., and M.R.I.A.

"'On Saturday night, May 24, 1788, there was a very bright aurora borealis, the coruscating rays of which united, as usual, in the pole of the dipping-needle. The next morning, about 11, finding the stars flutter much, I examined the state of the sky, and saw whitish rays ascending from every part of the horizon, all tending to the pole of the dipping-needle, where at their union they formed a small thin and white canopy, similar to the luminous one exhibited by an aurora in the night. These rays coruscated or shivered from the horizon to their point of union.'

"The only other account is extracted from the 5th vol. of the 'Transactions of the Royal Society of Edinburgh,' and is as follows :—

"'An account of an Aurora Borealis observed in daylight at Aberfoyle, in Perthshire, on the 10th of February, 1799. By Patrick Graham, D.D., minister of Aberfoyle.

"'On the 10th of February, 1799, about half an hour past 3 o'clock P.M., the sun being then a full hour above the horizon, and shining with an obscure lustre through a leaden-coloured atmosphere, I observed,' says Dr. Graham, 'the rare phenomenon of an aurora borealis by daylight. The weather for several days before had been intensely cold, and during the two preceding days much snow had fallen. On this day a thaw had come on, and the temperature of the air was mild. The general aspect of the

sky was serene. Some dark clouds hung on the horizon between S.W. and W. I was intensely observing a large halo about the sun, of about 20° in semi-diameter. It exhibited the prismatic colours, though obscurely, except in one quarter, where it coincided with the skirt of a dark cloud on the horizon, almost directly west. In that portion of the halo the colours of the iris were very distinctly exhibited.

"'Whilst I was attending to this appearance, the whole visible hemisphere of the heavens became covered with a light palish vapour, as I at first imagined it to be. It was disposed in longitudinal streaks, extending from the west, by the zenith, and all along the sky towards the east. On examining this appearance more narrowly, I found it to be a true aurora borealis, with all the characters which distinguish that meteor when seen by night, excepting that it was now entirely pale and colourless. The stream of electric matter issued very peceptibly from the cloud in the west, on the skirts of which the halo exhibited the prismatic colours; thence diffusing themselves, the rays converged towards the zenith, and diverged again towards every quarter of the horizon; and the coruscations were equally instantaneous, and as distinctly perceptible as they are by night.

"'This appearance continued for more than twenty minutes, when it gradually vanished, giving place to thin scattered vapours, which, towards sunset, began to overspread the sky. Through the ensuing night, I could not discern the smallest trace of these meteors in the sky.'"

NOTES

OUR readers will learn from another column that an appeal is about to be made to Government to aid another Eclipse Expedition, this time a very small one. Seeing that another so favourable opportunity will not occur for some time, it is to be hoped that the Government will respond to the call, and deserve as hearty thanks from all lovers of scientific progress as it earned for its efforts last year.

THE American Association for the Advancement of Science will be opened at Indianopolis, Indiana, on August 17. The president for this meeting is Prof. Asa Gray.

IT is with great regret that we have to record the death of Mr. Alexander Keith Johnston, LL.D., to whose eminent services in the promotion of meteorological and physico-geographical science we had occasion to refer but a few weeks since on the occasion of the medal awarded him by the Royal Geographical Society. Dr. Johnston was president-elect of the geographical section of the British Association at its approaching meeting at Edinburgh. He died on Sunday last, at Ben Rhydding, in Yorkshire.

THE Natural History Society of Montreal, with the aid of the Government of Canada, is sending an expedition to dredge in the deeper parts of the Gulf of St. Lawrence. The Hon. Mr. Mitchell, Minister of Marine and Fisheries, has taken much interest in the matter, and has placed the government schooner *La Canadienne* at the disposal of the party. The gentlemen selected are Mr. Whiteaves, F.G.S., secretary of the Society, and Mr. G. F. Kennedy, B.A. Principal Dawson, the president of the Society, sends the latter gentleman on behalf of the museum of M'Gill University. It is hoped that the deepest parts of the gulf will be searched, and that much interesting information will be obtained, bearing both on zoological and geological questions, and also on the prosecution of the fisheries.

MR. W. S. ALDIS, of Trinity College, Cambridge, Senior Wrangler in 1861, has been appointed Professor of Mathematics at the College of Physical Science at Newcastle-on-Tyne.

WE are enabled to state that the scheme proposed for the institution of the Sharpey Scholarship at University College, London, has been adopted by the Council. Its principal features are that the scholarship may be held for three or a greater number of years, and that the holder of it shall act as an assistant to the Professor of Practical Physiology, having opportunities afforded to him of pursuing original investigations, and having the right to use the laboratory and its apparatus for that purpose.

THE Brown Institution which has just been founded by the University of London, will comprise, in addition to a hospital for the treatment of animals, a laboratory for the study of pathology on the model of the Pathological Institutes of Germany, which have been already described in these columns. In this laboratory those who desire to learn the methods of exact research, or, after having learnt them, to carry out pathological or therapeutical investigations of their own, will have the opportunity of doing so under the guidance of the new Brown Professor, Dr. Burdon Sanderson. As we before announced, Dr. E. Klein, of Vienna, is expected to have the direction of the microscopical work of the laboratory, for which his numerous researches show him to be so pre-eminently fitted.

WE have to record the death of Mr. George Tate, of Alnwick, Hon. Secretary of the Berwickshire Naturalists' Club, which took place on June 7, at the age of 66. His treatises on the archæology of his native borough and county entitle him to take rank among the best of local historians; and his articles on Archæology and Geology, published in the "Transactions of the Berwickshire Naturalists' Club," show powers of observation and clear habits of thought of no ordinary kind.

A REPORT on the progress and condition of the Royal Gardens at Kew during the year 1870 has just been issued by the director, Dr. J. D. Hooker. The number of visitors was not quite so large in 1870 as in 1869. The improvements in the laying out of the grounds of the Botanic Gardens, which have been in progress for the last five years, are now nearly brought to a close. The pleasure grounds have suffered severely from the long and severe drought of last summer, acting on the excessively poor natural soil; very large numbers of trees have perished, especially the older elms, ashes, beeches, and sycamores. These are being replaced, and preparations have been made for the formation of the new Pinetum, which will be immediately commenced. Notwithstanding the rage for planting Conifers which has prevailed in England for many years, and which has almost supplanted the growth of hardy deciduous trees, no complete public, arranged, and named collection of hardy conifers exists in this country. The interchange of living plants and seeds with foreign and colonial botanic gardens has been vigorously prosecuted, especial attention having been paid to the promotion of the growth of the cinchona, and the introduction of the ipecacuanha into our Indian possessions. The museums, herbarium, and library have been enriched by numerous purchases and donations.

AT a recent meeting of the Scientific Committee of the Horticultural Society, Mr. Andrew Murray read a paper on the blight of plants, in which he combated the ordinary theory that the lower forms of vegetable organisms, which constitute ordinary blight, are developed from germs existing in the plant or floating in the air. The extraordinary rapidity of their propagation, frequently after a few hours' east wind, when no trace of them has been visible for many months, the prodigious numbers in which they appear, and the great variety of species developed sometimes on the same plant, and other considerations, have led him to the conclusion that these lowly organised fungi are evolved out of previously-existing organic materials, without the intervention of a germ, by the process erroneously called spontaneous generation.

A VERY interesting collection of paintings is now on view at the Langham Hotel, Portland Place, being delineations of Arctic scenery, by Mr. William Bradford, of New York. In company with Dr. J. D. Hayes, Mr. Bradford spent four months of the

summer of 1869 in an expedition to the coasts of Labrador, Greenland, Melville Bay, &c., for the express purpose of studying the pictorial effects of Arctic scenery. A very large number of photographs were taken, as well as many sketches, from which the finished paintings were afterwards completed. The collection is, therefore, unique of its kind. Among the most striking of the paintings is one representing sunset among the icebergs.

THE Geologists' Association organised excursions of its members to Ilford on the 17th of June, and to Riddlesdown on the 1st of July. In the former the chief objects of attraction were the famous mammaliferous brick-pits of Ilford, to which Mr. Henry Woodward acted as cicerone. Mr. Woodward and Mr. Searles V. Wood consider the Ilford beds to be older than those at Grays. The distribution of the fossils is remarkably different; *Elephas primigenius*, for instance, being the common species at Ilford, and *E. antiquus* at Grays. The party were afterwards kindly invited by Sir Antonio Brady to inspect his magnificent collection of mammalian remains. The excursion to Riddlesdown gave a good opportunity for examining the sections of the Upper Chalk, and the sequence of the formations of the Cretaceous system. This was the last excursion of the season.

THE "Working Men's Club and Institute Union" has just issued a paper recommending the establishment of classes at each institution for the study of one or more of such branches of Natural History as Botany, Geology, and Entomology, according to the circumstances of the several localities. It is proposed that these classes shall on Saturday afternoons sally forth into the fields and woods for the collection of specimens illustrating the particular subjects of their studies. With the view of encouraging such pursuits, a member of the Council of the Union offers two prizes of three and two guineas respectively to the best collection made during the present season by members of workmen's clubs. It is hoped that this suggestion may lead to the formation of museums of natural history at the clubs—the contents being collected and arranged by the members. The adoption of such pursuits in leisure hours will not only be productive of much mutual enjoyment to the working people of this country, but afford a powerful argument for the more general adoption of the Saturday half-holiday by employers.

THE Leicester Literary and Philosophical Society has recently revived its old custom of instituting geological excursions to some of the many objects of interest in the county. One of these took place last month under the guidance of the veteran geologist, Mr. J. Plant, and was an eminently successful one.

THE Liverpool Naturalists' Field Club has issued its Report of Proceedings for the Session 1870-71. The address of the president, the Rev. H. H. Higgins, refers chiefly to the interesting palæontological discoveries made during the last two years in the neighbourhood of Liverpool, and is illustrated by a plate of fossils from the Ravenhead Collection in the Free Public Museum. An epitome is given of the results of each of the summer excursions and of the papers read at the evening meetings, including one on the microscopic structure of the plants of the Coal Measures, by Prof. Williamson. A unique feature of this Society is that at each Field Meeting five prizes are competed for, for the best flowers gathered or collected during the excursion. We are glad to see the Report published at so low a price as one shilling, or to members, sixpence, and commend this laudable practice to the notice of other similar societies.

THE following schools have been invited by the Royal Geographical Society to take part in the competition for prize medals for the ensuing year:—English Schools: St. Peter's College, Radley, Abingdon; King Edward's School, Birmingham; Brighton College; Cathedral Grammar School, Chester; Cheltenham College; Clifton College; Dulwich College; Eton College; Haileybury College; Harrow; Hurstpierpoint; Liverpool College; Liverpool Institute. London: Charter House; Christ's Hospital; City of London School; King's College School; St. Paul's; University College School; Westminster School; Royal Naval School, New Cross. Manchester School; Marlborough College; University School, Nottingham; Repton; Rossall; Rugby; King's School, Sherborne; Shoreham; Shrewsbury; Stonyhurst College, Blackburn; Uppingham School; Wellington College; Winchester School. Scotch Schools: Aberdeen Grammar School; Edinburgh Academy; Edinburgh High School; Glasgow High School. Irish Schools: Royal Academical Institute, Belfast; Dungannon Royal School; Ennis College; Portora Royal School, Enniskillen; Foyle College, Londonderry; Rathfarnham, St. Columba's College.

THE part of the "Proceedings of the Geologists' Association" just published contains an interesting article by Mr. H. Woodward "On Volcanoes," and reports of the excursions made during 1870.

THE last number of Petermann's "Mittheilungen" contains an admirable physical map of the region covered by Hayward's journey from Leh to Kaschgar in 1868-69.

UNDER the title "The Geographical Distribution of Seagrasses," Dr. P. Ascherson gives an account in Petermann's "Mittheilungen," of the distribution of the phænogamous plants native to sea-water. Of these he enumerates twenty-two, belonging to eight genera, and two natural orders. The area of each species is generally very limited, its distribution being dependent on the present condition of the sea in which it is found. Those which grow in temperate regions are frequently represented by closely allied species in tropical seas. Although the Isthmus of Suez is of comparatively modern geological date, the nine species of the Red Sea are entirely distinct from the four species of the Mediterranean, and, with one exception, belong to different genera. A map accompanies the paper.

WE have on our table the *Astronomical Register* for June, and have much pleasure in calling the attention of astronomers to this magazine, which is rapidly improving in usefulness.

THE December number of the *Canadian Entomologist* concludes the second volume. It is intended to be increased on the commencement of the third volume, without any corresponding increase of subscription, to twenty pages each number, and will remain under the editorship of the Rev. C. J. S. Bethune.

THE volume of lectures delivered at the Industrial and Technological Museum, Melbourne, during the spring session of 1870, shows great activity in scientific matters in Victoria. Among the subjects discussed are the Circulation of the Blood, the Conservation of Energy, the Application of Phytology to the Industrial Purposes of Life, Chemistry applied to Manufactures and Agriculture, the Preservation of Food, the common Uses of Astronomy, and On Methods of Diffusing Technological Knowledge.

WE have before us the number for May of the "Journal of the Franklin Institute," containing several valuable articles. We may notice in particular the continuation of a series on "Iron Manufactures in Great Britain," by Mr. R. H. Thurston, and "A Method of Fixing, Photographing, and Exhibiting the Magnetic Spectra," by Dr. A. M. Mayer.

WE have received the first volume of an important continental flora, "Flora der preussischen Rheinlande," by Dr. P. H. Wirtgen, including as far as the end of Thalamifloræ. Descriptions of each species are given, with physiological and morphological annotations, and a copious list of localities of the less abundant species. Independently of its scientific value, the book will be very useful to the numerous summer visitors to that district.

A NEW port has been opened in Southern Chile in the Depart-

ment of Constitucion. It is called Curanipe, and it appears that already the population is 1,186, and the tonnage in and out 7,867 in 1870.

ON May 11 two distinct shocks of earthquake were felt at Peshawur, in India.

ON May 22 an earthquake was felt at Landour, Meerut, Agra, and Nynee Tal. At the latter place it was severe.

AN earthquake was felt at Hayti on May 30.

ON June 16 a severe storm assailed Constantinople. During its height three waterspouts swept across different parts of the Bosphorus in great volume and with unusual fury. By one of them a caique was destroyed. The lightning struck the lightning-conductor on the great Gulata Tower in Pera, and also the wire at the Observatory connecting it with the arsenal at Tophaneh. On the other side of the Bosphorus, at Scutari, a house was struck.

A REPORT has been published in the Hong Kong press of March 25 by Captain Frost, of the Noord Brabant. He says he sighted Tinakoro, or Volcano Island, one of the Santa Cruz group, in lat. 10, 23 S., 155 long. E., and lay becalmed there five days. The island is a cone of perfect symmetry, resting on a base of three miles in circumference, and, except about the base, destitute of vegetation. The volcano, estimated to be about 2,500 feet high, was in constant activity, presenting the appearance of a great flame vent. Captain Frost denies the description of Captain Wilson, of the *Duff*, that there are several low islands there, at least on its south and west quarters, about seventeen miles off.

A REPORT has been sent in by the Governor of the Province of Leon in Ecuador as to the condition of the volcanic region of Cotopaxi in his province. He states that the principal mountains which stand forth in the great circle formed by the two branches of the Andes are Cotopaxi, Quillindana, Puchalagua, and the Calpon. Of these Cotopaxi alone is known as a volcano, which after many years of inaction became active in June 1851. These eruptions continued and became gradually weaker until 1867, when they ceased. In 1868 subterranean noises were again heard, and a slender column of smoke appeared. In May 1868 there were some earthquakes, which ruined Palate and Pelileo. In July 1869 noises were again heard and an awful flood took place, but without earthquakes and subterranean noises. Abundant fountains of water burst forth, hundreds of immense rocks were rent and thrown down, and the rivers were flooded. The Governor, who was at the time in the Cordillera, considers that the landslides were not owing to the action of water, but rather to a pressure upward from below, as if from accumulated gases seeking an exit. The most curious effect reported by him is a variation in the climate. Many plants, such as the sura, flowered, which had not done so before. After this premature ripening the surales all closed up again, and have not revived. After this event it was noticed the sugar cane could be cut in twenty-four months instead of thirty. At present Cotopaxi is inactive, but its condition is looked upon with dread.

FROM the *Australasian* of April 22, we learn that Mr. Russell, the Government astronomer at Sydney, has visited Deniliquin and picked up there something which astonished him, in the shape of the greater portion of a meteoric stone which fell some years ago at Barratta, thirty-five miles below Deniliquin. The stone (Mr. Russell secured about one-half of it, weighing about 150lb.) was originally about 300lb. in weight, but has been broken, and parts of it given away as curio ities. Mr. Russell made provision for despatching the stone to the Sydney Museum.

SCIENTIFIC INTELLIGENCE FROM AMERICA *

AT a recent meeting of the New York Lyceum of Natural History, Professor D. S. Martin described the remarkable deposit of magnetic iron at Cornwall, Pennsylvania, and exhibited the group of minerals found in connection with the iron. The ore is a soft, often pulverulent magnetite, associated with copper, and often pyrites. It is found in three hills which owe their relief to the erosion of their surroundings, and are composed mainly of iron ore embraced between walls of trap, the whole mass lying at the junction of the Triassic red sandstone and older metamorphic series. The yield of the Cornwall mines is 160,000 tons per annum. Prof. Martin exhibited beautiful specimens of allophane, brochantite, and other minerals collected at Cornwall. —Prof. Newberry, at the same meeting, exhibited a series of lignites from the Far West, with ultimate analyses of each. He said these modern coals were the only mineral fuels found west of Omaha. The Los Brances (Sonora) coal is Triassic anthracite. Most of the New Mexico and Arizona coals are Cretaceous, the beds sometimes thirty feet in thickness. The Placer Mountain coal is a Cretaceous anthracite. The coal of Colorado is both Cretaceous and Tertiary; the coal of Mount Diabolo, California, is Cretaceous; and that of Vancouver Island, Coose Bay coal, is Tertiary. Alaska furnishes some of the best Western coal—a Tertiary lignite. A Cretaceous anthracite found in Queen Charlotte's Island is nearly as good as that of Pennsylvania. All these anthracites are caused by volcanic action baking lignites. The calorific power of the Western coals is generally greatly impaired by the large percentage (ten to twenty per cent. each) of oxygen and water they contain. The average Western lignite has about half the heating power of our best coals. The gas and coke made of some of them, however, are excellent furnace fuels, though they are generally worthless.—Prof. Davidson, of the United States Coast Survey, has lately devised an apparatus for recording the temperature at different depths by means of an electro thermal pile. He proposes to register the depth by breaking the circuit of an electric current passing through two insulated wires in the sounding line at about every one hundred fathoms by means of the wheel-work of the Massey or similar apparatus. In the changes of temperature an electro-thermal pile eighteen inches long, insulated, surrounded by a non-conductor except at one end, is used in combination with a Thompson's reflecting galvanometer, not liable to derangement on shipboard. At every one hundred fathoms, when the chronograph registers the depth, the observer notices the readings of the galvanometer, which readings are reduced to Fahrenheit degrees. —One of the most original and important contributions to the zoology of the day is that constituting the third number of the Bulletin of the Museum of Comparative Zoology at Cambridge, treating upon the mammals and winter birds of East Florida. The author, Mr. J. A. Allen, an assistant of Prof. Agassiz, is well known for the thoroughness of his research into the vertebrata of America, and the critical attention paid by him to the proper limitation of species, both in their relationships to each other, and in their geographical distribution. In the present work he gives a summary of the views to which he has been led within a few years past by his studies of the immense collection in the Cambridge Museum, and makes numerous important generalisations. Among these he corroborates the conclusion previously announced by others, of the diminution in size of the American birds in proportion as their birthplace is more southern, and also that there is a similar difference existing between the animals of the higher and lower altitudes. He also finds that with the more southern locality of summer abode there are corresponding differences in colour and proportion, as well as in habits, notes, and song, the vivacity of the bird decreasing as its size increases. The principal difference in colour with the more southern localities consists in the darker tints and the reduced extent of any white markings, with other features that our space will not permit us to give at the present time. The entire work is one eminently worthy of careful study, and is destined to exercise a very important influence upon the methods of zoological research. — Late advices from Prof. Hayden's expedition announced that he was to leave Ogden, Utah, on June 9 for Virginia City and Fort Ellis, in Montana, a distance of about 430 miles, with the special object of proceeding from the last-mentioned place to the exploration of the Yellow Stone Lake and its immediate vicinity. It

* Contributed by the Scientific Editor of *Harper's Weekly*.

is an interesting fact that the head waters of tributaries of the Columbia, the Colorado, the Missouri, and the Yellow Stone rivers rise within a short distance of each other in this mysterious region; which, in addition, is characterised by the extraordinary development of hot springs, spouting geysers, mud volcanoes, extensive beds of sulphur, gypsum, the silicates, &c. The party, as at present organised, embraces thirty-two persons, including specialists in all branches of science, and accompanied by several artists, who take advantage of Dr. Hayden's protection to visit the interesting region referred to. The party carries materials for a boat, which is to be launched on the Yellow Stone Lake, and used in a thorough hydrographical and topographical survey of it. As the expedition will probably remain in that vicinity during the summer, we may hope for a complete solution of all the remaining questions in regard to its physical features and natural history. A competent photographer with the expedition expects to make instantaneous views of the spouting geysers, so as to enable those who cannot visit the locality to have a correct idea of their character. A company of cavalry will escort the expedition into the Yellow Stone Lake region, although no trouble from the Indians is anticipated. In the course of the journey from Ogden to Fort Ellis it is proposed to make an accurate map of a belt fifty miles wide, so as to furnish a basis for reference in subsequent explorations.—In the monthly report of the Department of Agriculture for March and April of the present year, we find a valuable paper upon the cultivation of the Cinchona in Jamaica, by Dr. C. C. Parry, the botanist of the Department, who accompanied the San Domingo Investigating Committee, and in returning spent some time in Jamaica. As the general result of his inquiries in regard to the cultivation of this plant, and the possibility of introducing it into any portion of the United States, he states, first, that the peculiar conditions of soil and climate suitable for the growth of the best varieties of cinchona plants cannot be found within the present limits of the United States, where no suitable elevations possessing an equable, moist, cool climate, free from frost, can be met with; second, that the island of San Domingo, located within the tropics, and traversed by extensive mountain ranges attaining elevations of over 6000 feet above the sea, presents a larger scope of country especially adapted to the growth of cinchonas than any other insular region in the western hemisphere; third, that the existence of successful cinchona plantations in Jamaica within two days' sail from San Domingo, would afford the material for stocking new plantations in the latter island at the least possible expense of time and labour.—In a recent communication to the Academy of Natural Sciences of Philadelphia, by Prof. Leidy, attention was invited to certain teeth of fossil mammals, forwarded to him for examination by Prof. Whitney. One of these was a fragment belonging to the *Mastodon americanus*, obtained from a depth of eighty feet beneath the basaltic lava of Table Mountain, Tuolumne County, California, where it was found associated with the remains of human art. There was also a molar of a large fossil horse, found sixteen feet below the surface on Gordon Gulch. Two other teeth, somewhat similar in character, were determined as belonging to the species of *Protohippus*. In other specimens Dr. Leidy found evidences of the existence of a gigantic animal of the camel tribe, allied to the llama.

CORRESPONDENCE OF NORTHERN AND SOUTHERN AURORÆ

I TAKE the liberty of sending you a paper containing corresponding observations of Aurora Borealis and Australis, with the request to insert them in your valuable journal.

Corresponding Observations of Aurora Polaris, made in the Northern and Southern Hemispheres.

In the years 1859-65 I kept up a correspondence with the active director of the Flagstaff Observatory at Melbourne, (Australia), Mr. George Neumayer, in order to make observations concerning the contemporaneous appearance of aurora polaris in the northern and southern hemispheres.*

* See Results of the magnetical, nautical, and meteorological observations made at the Flagstaff Observatory, Melbourne, and at various stations in the colony of Victoria, Melbourne, 1860. Heis, "Wochenschrift für Astronomie und Meteorologie," 1859, 1860, 1861, 1863, 1865.

Some years since, when Dr. Neumayer returned to his native country, this correspondence was interrupted. But the numerous appearances of aurora borealis which occurred last year, induced me to recommence this correspondence with the present director of the same establishment, Mr. C. Moerlin. Sending him a list of all the appearances of aurora borealis and magnetical disturbances in the year 1870 known to me, I begged him to favour me with the corresponding observations viewed by him. I subjoin the answer of Mr. Moerlin.

I received your letter of December 2, 1870, and in reply shall be most happy to comply with your request, of informing you periodically of the occurrence of the aurora australis, and of magnetic disturbances observed here.

To this end I have made out a list, which is enclosed, of auroræ observed since January 1, 1870, containing the dates and times (Melbourne mean time) of their occurrence, from which it appears that at most of the dates you mention in your letter, as having observed the aurora borealis, the aurora australis has been observed here. The greatest magnetic disturbances occurred on April 5 and October 25; on the latter day the disturbances continued during two days; the minimum of easterly declination occurred about 5 A.M. on the 26th, and the maximum about 6 A.M. on the same day, the range being 51′ of arc, with corresponding disturbances in the other two elements. Unfortunately the sky was completely overcast during the night, with a slight break only at midnight, when the display was very beautiful, but visible only for a few minutes; but during the evening of the 25th an intense, but ever varying, luminosity only of the whole southern sky was the sole indication of aurora.

I would remark that at all the dates on which auroræ were observed, magnetic disturbances invariably took place of a greater or less extent; but disturbances occurred also at other times, of the very same nature as took place generally during aurora displays, on which, however, no auroræ were observed. These dates I give you enclosed also, separately, as these may be of interest to you in connection with the possible occurrences of the aurora borealis on one or the other of those dates.

I shall continue from this date to send you periodical notice of the occurrence of the aurora australis and magnetic disturbances at Melbourne, and shall be happy to furnish any information respecting physical phenomena, which you may desire, and I may be able to give. C. MOERLIN

Melbourne Observatory, Feb. 7

Date and time of occurrence of the Aurora Australis observed at Melbourne during the period from January 1, 1870, to February 21, 1871, during which, at the same time, great disturbances in the magnetic elements generally took place.

LAT. 37° 49′ 53·5″ S. LONG. 9^h 39^m 54·8^s E.

1870, January 8.—During the evening the aurora was seen at Adelaide, South Australia, as reported by Mr. Food, Superintendent of Electric Telegraph.

February 1.—A fine display between 8 and 10 P.M.; shortly after nine some magnificent streamers.

April 5.—Became visible shortly after 7^h P.M., and lasted all through the evening and night. The display at times was most brilliant, particularly at 10^h 30^m P.M., and again at 12^h 30^m. Slight disturbances in the magnetic elements occurred during the afternoon, which increased shortly before 7^h P.M. At 10^h 45^m P.M. a rapid decrease of easterly declination and increase of horizontal force took place, which lasted until a few minutes before 11^h P.M., when both elements as rapidly returned to their former state. Comparatively slight disturbances until 12^h 30^m, when a similar movement to the above mentioned took place, but to a smaller extent. The minimum of easterly declination took place a few minutes before 11^h P.M., and the maximum at 10 minutes before 6^h A.M. on the 6th, and the range of the disturbance amounted to about 54′ of arc, while the range in the horizontal force was 0·06273 of the absolute (English) unit, =0·02892 Continental unit.

May 20.—Faint display, most distinct at 10^h 30^m P.M.

August 22.—At 6^h 40^m P.M. some fine streamers visible, but not for long.

September 21.—Visible from about 6^h to 8^h P.M., but not

very brilliant; 24, visible from shortly before 9h P.M.; the finest display took place 11h P.M.; 25, traces visible during evening in S.S.E.; 30, traces visible during evening, S.E.

October 21.—Visible during the evening, at 10h 30m P.M., some fine streamers 30° and 40° high; 25, visible at times during the evening, though completely overcast, as a luminous sheet, extending from S.W. to S.E.; 26, shortly after midnight a beautiful display, though cloudy.

November 9.—Visible shortly after midnight until early morning, again during the whole evening; fine red streamers visible through bright moonlight; 15, auroral light visible during the evening, but no streamers; 17, visible at 9h 30m P.M., for a short time; 18, visible all through the evening; 19, visible all through the evening; at 9h 20m P.M. very fine streamers; 20, visible from 11h P.M.; at 10 minutes past midnight, a fine display, with streamers extending from S.E. to S.W. At 4h A.M. on the 21st the whole extent of the southern sky, from the horizon upwards, was illuminated by a reddish light, terminating in something resembling a corona, but no streamers at all were visible; a thunderstorm occurred towards daylight, and the whole appearance vanished instantaneously at 4h 40m A.M, when a terrific thunderclap occurred; 23, visible between 11h P.M. and midnight; 24, traces visible all through the evening; 25, traces visible all through the evening; 29, visible from 8h 30m to 10h P.M., but not brilliant.

December 10—Faint streamers visible all through the evening; 16, visible all through the evening, at 10h P.M. very fine streamers, and at intervals, up to 2h A.M. on the 17th, a very fine display; 17, visible during the evening, some fine streamers at 9h P.M.

1871, January 3.—Visible during the evening; 13, visible after 11h P.M, no streamers, but strong reddish light in S.S.W.; 15, at midnight, faintly visible; 20, visible during evening, but only faint; 21, visible during evening, but only faint.

February 12, visible for a short time at 9h P.M.

List of dates when great disturbances in the magnetic elements took place, of the same nature as during auroral displays, but when no auroras were visible, or at least observed:

1870: January 3, 4; February 10, 11; March 20, 21; April 22, 23, 28; May 16; June 13, 14, 16, 17; July 5, 28; August 3, 7, 19, 20, 21, 23; September 4, 5, 6, 7, 8, 16, 18, 26, 27; October 1, 15, 24; November 10, 22, 27; December 5, 6, 7, 9, 11, 15, 22, 23, 25, 27. 1871: January 5, 6, 10, 27, 28, 30; February 4, 5, 9, 13, 14, 15.

We add to the above-mentioned auroræ australes and magnetical disturbances observed in Melbourne the following ones observed in our own hemisphere:

1870, January.—To the aurora on January 8, at Melbourne, corresponds the aurora borealis on 8th at Oxford, Liverpool, Cockermouth, and North Shields. To the magnetic disturbances on January 3 and 4 correspond the disturbances observed on the same days at Rome; on January 3 auroræ boreales were observed in Piedmont and in France; also in England at Guernsey, Worthing, Royston, Norwich, Boston, Eccles, and Culloden. Aurora borealis visible on the 4th in England at Wisbech.

February.—To the aurora australis visible on February 1, from 8 to 10h, at Melbourne, correspond the aurora borealis seen at many places of the Europe on the same day, at Münster, Munich, Ruhrort, Nevtomysl, Peckeloh, Lennep, at Upsala (5h 50m to 13h), also at Cœslin, Petersburg, Königsberg, Paris, London, Calais, Cracow, Stockholm, and in England at Eastbourne, Royston, Little Wratting, Norwich, Wisbech, Boston, North Shields, and Culloden. To the magnetic disturbances on 11th at Melbourne correspond the aurora borealis observed on the same day at Upsala, and in England at Taunton, Wilton, Streatley, Cardington, York, Hawsker, North Shields.

March.—To the magnetic disturbances at Melbourne on the 21st correspond the magnetic disturbances at Rome on the 22nd and the aurora borealis in England at Little Wratting, Stonyhurst, and York.

April.—To the aurora australis on April 5, at Melbourne, correspond the aurora australis observed at many places of Europe on the same day, at Münster, Peckeloh, Lennep, Bonn, Linzig, Dülken, Brunswick, Niederorschel, Stettin, Kurnik, Munich, Feldkirch, Wolgast, Berlin, France and Italy, Paris, Austria, Athens, at Upsala, Petersburg, Riga, Pulbus, and Stockholm. To the magnetic disturbance on April 23 correspond the magnetic disturbances at Rome, and the aurora borealis at Papenburg on the same day.

May.—To the aurora australis on the 20th at Melbourne corresponds the very fine aurora borealis at Münster, which also was seen on the same day at Mannheim, Paris, and London, and the great magnetic disturbances visible in Rome and Munich.

June.—To the magnetic disturbances in Melbourne on the 13, 14, 16, 17 correspond the magnetic disturbances at Rome on the same days. (Bulletino Meteorologico dell' Osservatorio del Collegio Romano, No. 7, vol x.)

July.—To the magnetic disturbances on July 8 and 28 at Melbourne correspond the disturbances at Rome on the same days.

August.—To the aurora australis on the 22nd at Melbourne corresponds the aurora borealis on the 21st at Volpeglino near Tortona in Italy. To the magnetic disturbances in Melbourne on the 3, 7, 19, 20, 21, 23 correspond the contemporary disturbances of the magnetic instruments at Rome. With the magnetic disturbances on the 7th the aurora borealis at Upsala coincides. With the disturbance on the 19th the aurora borealis at Münster and at Carthaus near Dülmen. With the disturbances on the 20th the aurora borealis at Münster, Groeningen, Peckeloh, Oesel, Leipzig, and Upsala. To the magnetic disturbance on the 23rd corresponds the aurora borealis at Glasgow.

September.—To the aurora on the 25th in Melbourne corresponds the aurora borealis at Carthaus, Danzig, Peckeloh, Weisenheim, also at Arnsburg, Oesel in Schleswig, Lichtenberg, Hamburg, Upsala. To the aurora australis on the 26th at Melbourne corresponds the aurora borealis at Lichtenberg, Weisenheim, Upsala, Glasgow. To the aurora on the 30th at Melbourne corresponds the aurora borealis on the same day at Upsala and Lichtenberg. To the aurora australis on the 21st at Melbourne correspond the contemporary aurora borealis at Upsala, Schleswig, Arnsburg, Lichtenberg, Hamburg, Norburg, Alsen, and the magnetic disturbance at Rome. To the aurora on the 24th at Melbourne corresponds the contemporary aurora borealis at Carthaus near Dülmen, Niederorschel, Groeningen, Danzig, Wolgast, Peckeloh, Weisenheim, Norburg, Alsen, Eger, Prague, Oderberg by the Inn, Kremsmünster, Moncalieri, Vienna, Stockholm, Hawkhurst, London. On the same day great disturbances of the magnetic instruments were observed at Rome and at Kremsmünster.

October.—To the aurora australis on the 21st at Melbourne corresponds the aurora borealis on the same day in England, and on the former day in Westphalia and England. To the aurora australis on the 25th at Melbourne corresponds the brilliant aurora borealis which was seen at many places in Germany, England, Russia, Sweden, Italy,* Greece, and Turkey on the same day. To the aurora on the 26th at Melbourne corresponds the aurora borealis on the same day in Hamburg, Lichtenberg, Keitum, Athens, and in England. To the magnetic disturbances on the 1st at Melbourne corresponds the aurora borealis at Peckeloh, Upsala, and in England, and the magnetic disturbances on the same day. To the magnetic disturbances on the 15th at Melbourne correspond the contemporary mag-

* Bulletino Meteorologico dell' Osservatorio del Collegio Carlo Alberto in Moncalieri.

netic disturbances in Rome, and the aurora borealis at Upsala. To the magnetic disturbance on the 24th at Melbourne correspond the great magnetic disturbances at Rome, and the very fine auroræ boreales on the same day in Germany, Russia, England, Turkey, Greece, and Sicily.

November.—The aurora australis of November 9 at Melbourne, lasting from midnight till the morning twilight, corresponds to an hour to the aurora borealis which was seen at clear full moon on the evening of the 8th in Schleswig, and to the magnetic disturbances at Rome on the 8th and 9th. To the auroræ australes on the 15th, 17th, and 18th at Melbourne correspond the auroræ boreales on the 14th, 17th, and 18th in England. To the great aurora australis on the 19th at Melbourne corresponds the contemporary aurora borealis at Münster, Niederorschel, Peckeloh, Schleswig, also at Upsala and in England. To the aurora on the 23rd in Melbourne corresponds the aurora borealis in England of the 22nd and 23rd. To the aurora australis of the 24th corresponds the aurora borealis at Upsala of the 24th and in England. The magnetic disturbances at Rome on the 19th, 20th, 23rd 24th, 25th, and 29th coincide with the aurora australis, on the same days, and the magnetic disturbances at Rome on the 10th, 22nd, and 27th, with the disturbances at Melbourne on the same days.* Besides the aurora borealis on the 22nd in England, and on the 27th in Brünn coincide with the contemporary magnetic disturbances at Melbourne.

December.—To the aurora australis on the 6th and 17th at Melbourne corresponds the aurora borealis at Peckeloh, Keitum, and in England. To the aurora on the 17th at Melbourne corresponds the contemporary aurora borealis at Münster, Schleswig, Breslau, Keitum, and in England. The magnetic disturbance on the 22nd at Melbourne coincides with the aurora borealis on the 22nd in Schleswig.

January 1871.—To the aurora australis on the 3rd and 13th at Melbourne correspond the magnetic disturbances at Rome on the same day, and to the aurora australis of the 13th corresponds the aurora borealis on the same day at Münster, Breslau, Cologne, Schleswig. To the aurora on the 15th at Melbourne corresponds the aurora borealis at Breslau and Schleswig on the 15th. To the aurora on the 20th at Melbourne corresponds the aurora borealis on the 19th at Thurso.

February.—To the aurora australis on the 12th at Melbourne corresponds the aurora borealis on the 12th at Münster and Niederorschel, Peckeloh, Wolgart, Moncalieri, Coeslin, Breslau, the pharos of the Weser, on the west coast of England, Eger, Datschitz, Florence, Rome, Volpeglino, and the aurora borealis on the 13th at 3 A.M. at Rome. The magnetic disturbances on the 4th at Melbourne correspond to the magnetic disturbances at Rome on the same day. To the magnetic disturbances on the 5th at Melbourne corresponds the aurora borealis at Breslau. To the magnetic disturbances on the 9th at Melbourne corresponds the aurora borealis at Cleve and Thurso.

EDWARD HEIS

Münster, Westphalia, June 30

* Bulletino Meteorologico del Collegia Romano, dell' Osservatorio di Palermo edel Collegio Carlo Alberto a Moncalieri.

SOCIETIES AND ACADEMIES

LONDON

Entomological Society, July 3.—A. R. Wallace, president, in the chair. Prof. Westwood exhibited the minute-book of proceedings of an Entomological Society existing in London in 1780, but which appeared to have been dissolved after about a year. The members seemed to have consisted of Messrs. Drury, Honey, Swift, Francillon, Jones, and Bentley; the meetings being held weekly.—Mr. S. Stevens exhibited a collection of Coleoptera recently made in Ireland, the most interesting species being *Chlæmius holosericeus* from near Killaloe. Mr. Champion exhibited an example of *Emus hirtus* recently captured by him in the New Forest; also rare British Hemiptera. Mr. Blackmore exhibited a collection of insects of all orders from Tangiers; locusts were extremely destructive there, and on the shore the pedestrian is often up to his ankles in the dead and dying accumulations of these insects.—Mr. Dunning read a letter from the Rev. Mr. Wayne, of Much Wenlock, calling attention to the damage done to his strawberries in consequence of a Myriopod effecting an entrance into the interior of the ripe fruit; also complaining that his young carrots were destroyed by a dipterous larva, probably that of *Psila rosæ*, which bored into the root.—Mr. Druce exhibited a collection of rare Diurnal Lepidoptera, including species of *Papilio*, *Euryades*, *Heliconia*, *Eresia*, *Catagramma*, *Agrias*. *Paphia*, &c.—Mr. Stainton exhibited an example of *Botys fuscalis* captured by the Rev. R. P. Murray in the Isle of Man, to the head of which a portion of the puparium still adhered; the insect was flying briskly when taken, notwithstanding that it must have been nearly blind. Mr. Albert Müller exhibited a leaf from a vine growing at Basle showing the damage done by *Phytoptus vitis*.—Mr. Riley, State Entomologist for Missouri, exhibited a collection of American insects with their transformations.—Prof. Westwood read a paper on new species of exotic *Papilionidæ*. Mr. S. S. Saunders read a monograph of the Strepsiptera, describing twenty-one species; he considered the group as undoubtedly pertaining to the Coleoptera, in the vicinity of *Rhipiphorus*. Mr. C. O. Waterhouse read a memoir on some species of *Cantharis*. The Baron de Selys Longchamps communicated a statistical sketch of the *Odonata;* the number of species of dragon flies now known he estimated at 1,344.

Society of Biblical Archæology, July 4.—Samuel Birch, LL.D., F.S.A., in the chair. The Rev. F. K. Cheyne, M.A., was duly elected a member of the society. The Rev. B. T. Lowne, M.R.C.S., read a paper "On the Flora of Palestine." He considered that it comprised eight distinct elements, four of the dominant existing floras of Southern Europe, Russian Asia, North Africa, and that of Arabia and North Western India. Each of these floras was stated to occupy a distinct region of the country. Interspersed with these are found numerous examples of plants belonging to palæarctic Europe, constituting its fifth element. The Arctic flora of Hermon and Lebanon constitutes the sixth. Mr. Lowne thought further that the cedars of the Lebanon, and the papyrus of the Jordan lakes were the remnants of two ancient and almost extinct floras belonging to two distinct geological periods.—James Collins read a paper "On the Gums, Perfumes, and Resins mentioned in the Bible," particularly pointing out the fact that few of them were indigenous to Palestine, and that many have been wrongly named by the Greek and later botanists. In the course of his observations Mr. Collins detailed the characteristic differences between the true and false Balm of Gilead, ladanum, sandal wood, &c., and the greater or less efficacy of their medicinal properties. Mr. Lowne and Mr. Collins brought for exhibition a large number of mounted specimens, and a complete collection of gums, perfumes, &c., to illustrate their respective papers.

PARIS

Académie des Sciences, June 28.—M. Claude Bernard in the chair. M. Robin presented a new edition of his great work on the Microscope.—M. Elie de Beaumont presented a most valuable book by M. Rivat, who died recently, and who was one of the chief engineers in the mining service, containing a new method of extracting silver from sulphuric ores, with the assistance of super-heated steam. The quantity of steam required was originally very great, and is now reduced to $\frac{1}{50}$th of what it was when the first experiments were tried. This process of quantitative analysis is largely used in the Laboratory of the Ecole des Mines, at Paris.—Father Secchi sent a memoir on a supposed relation between protuberances, sun-spots, and "faculæ," as discovered by him.—M. Struve and others sent a letter on behalf of the German astronomers, who will meet at Vienna, and asking for the presence of French astronomers. Some instruments destroyed by the Communists were intended for that meeting.—M. Delaunay has circulated amongst the members a small notice relating to an intended meteorological atlas of France, and presented the volume of meteorological observations made at the National Observatory, which he calls the "Observatory of Paris." M. Charles Sainte-Claire Deville rose immediately in order to present the French Academy with the

observations made at the observatory of Montsouris. The two observatories are at a distance of something less than a mile, and a deadly feud appears to exist between them.—M. Ch. Sainte-Claire Deville then read a paper relating to the part taken by him in the projecting of the meteorological atlas of France in 1847.—M. de Falen and Fisher described bathymetrical observations and researches executed on the coasts of France, in 1847, in depths varying up to 250 fathoms. The submarine fauna has no peculiarity worth mentioning. M. Gustave Tissandier, one of the postal aeronauts, presented a *résumé* of the results obtained by the sixty-four postal aeronautical expeditions during the siege of Paris. He merely gives however the number of letters and pigeons sent, but not the number of pigeons returned to Paris, and of letters duly posted in the post-offices of the French postal service delegated in the provinces.

July 3.—M. Claude Bernard in the chair.—M. Delaunay read a letter from M. Marie Davy, in answer to M. Ch. Sainte-Claire Deville's communication on the Physical Atlas of France. The learned astronomer, supporting M. Marie Davy, admits that the idea of constructing a physical atlas belongs to M. Ch. Sainte Claire Deville, who originated it in 1847; but he contends that in 1868 he tried to start it, since nothing had been done during twenty-one years. M. Delaunay contends moreover that it is a duty for the National Observatory to undertake such a publication. It is to be hoped that M. Delaunay's exertions will not interfere with M. Sainte-Claire Deville's own publications, and at all events, that we shall have at least an atlas worthy of the French reputation in meteorological matters. But the safer way for both contending parties should be to agree in a common work. Such a resolution would diminish the expenses to the Republic, and enlarge the chances of common success. M. Sainte-Claire Deville's brother, the chemist, was not returned a member for Paris, although he received more than 50,000 votes.—M. Delaunay presented for M. Latterade a most extraordinary memoir on "The Theory of two Suns." M. Latterade contends that the warm period which is demonstrated by the presence of tropical fossils in Sweden and Norway was produced by the proximity of a very powerful star which had given to the earth an immense quantity of heat, and which from that time has receded into the abysses of celestial space. M. Latterade contends that the *supplementary sun* has not disturbed the elements of the planets, because its attractive power was smaller than its warming power. He states, moreover, that the warming power does not vary according to the mass, like the attractive power. This communication was referred gravely to a committee composed of three members.—M. Champion sent a new memoir on nitro-glycerine, which he has studied with so much care during the investment of Paris. It is not only a very dangerous study, but also a very painful labour, as violent headaches are experienced by persons engaged in such operations. The whole of the memoir is worthy of being read attentively by working chemists. We will not try to analyse it, but merely mention two facts. Electricity is without action on glycerine as proved by Ruhmkorff, and explosion does not take place at 360° Fah. as supposed, but at 540° only.—M. Quatrefages presented an interesting memoir from M. Dareste, who is pursuing with constant success his studies on artificial monstrosities, produced by different operations on eggs during incubation. The learned physiologist examines the alterations produced in the blood, and finds the number of corpuscles is very small indeed under special circumstances.—Father Denza sent from Italy an account of the aurora borealis observed in Italy on the evenings of April 9, 10, 18, and 23. Father Denza mentions other auroræ boreales on the 7th, 12th, and 18th of June. This last display was very brilliant, and was accompanied with very great magnetical disturbances. It coincided, moreover, with great storms observed in England and other countries.—Baron Larey announced that Dr. Castano is just leaving France for a climatological and medical inspection of Denmark, Sweden, Norway, and perhaps Iceland, as well as the Faroe Islands.—In its secret sitting the Academy is discussing the titles of several candidates to fill the room of M. Lamé, who was mostly engaged in abstruse researches on the application of high mathematics to molecular physics during his whole lifetime. M. Puiteux was chosen as candidate in the first line. He will be certainly returned on the 10th. M. Lamé cannot have any fitter or more qualified successor.—M. Delaunay has published the result of observations for the month of June. The greatest excess of black bulb thermometer *in vacuo* exposed to the sun over the ordinary thermometer in the shade was 35½° Fah. on June 1, and the smallest on the 5th, when it was only 4°.

VIENNA

Imperial Academy of Sciences, May 11.—Dr. Neilreich communicated a critical revision of the species, forms, and hybrid forms of the genus *Hieracium* hitherto observed in Austria and Hungary. The author remarked upon the peculiar difficulty of deciding what constitutes a species among the Hawkweeds, and pointed that by one course, the number of species is inordinately increased, whilst the other diminishes it to an unnatural minimum. In his treatment of the Hawkweeds of Austria and Hungary he has adopted a middle course, namely, the establishment of what he calls "artificial species." — Prof. E. Linnemann transmitted a memoir on the simultaneous formation of propylic aldehyde, acetone, and allylic alcohol with acroleine, by the desiccating action of chloride of calcium upon glycerine.—Prof. F. Simony presented the conclusion of his memoir upon the glaciers of the Dachsteingebirge.—Prof. V. von Lang communicated a paper on the dioptrics of a system of centred spherical surfaces.—Prof. C. Jelinek communicated a note by Prof. Handl containing corections of errors in Kunzek's meteorological observations made at Lemberg.—Dr. von Monckhoven exhibited a blowpipe constructed by him for the production of the Drummond light, which permits the use of hydrogen, common gas, or alcohol as the combustible material. He also discussed some of the incandescent materials which may be employed, of which he seems to prefer white marble. Prof. Brühl transmitted three plates of the anatomy of the lice, intended for early publication, for the purpose of claiming priority in case of his results being hit upon by Dr. v. Graber, in his memoir on the same subject lately communicated to the Academy of Sciences.

May 16.—The following memoirs were communicated:—"Graphical determination of the stereographic and allied projections of the lines of the geographical sphere," by Prof. J. O. Streissler; "The pressure of water as a motor," by M. F. Schindler.—Director C. von Littrow presented a report upou the determination of the latitude and azimuth effected by Prof. E. Weiss at Dablitz.—M. F. Unferdinger communicated two mathematical papers, one upon four integrals, the other upon the theory of that spherical triangle in which one angle is equal to the sum of the other two.

BOOKS RECEIVED

ENGLISH.—Mycological Illustrations: W. W. Saunders, W. G Smith, A.W. Bennett, part 1 (Van Voorst).—Darwinism Refuted: S. H. Laing (E. Stock).—A Treatise on Asiatic Cholera: C. Macnamara (Churchill).—A History of British Birds: W. Yarrell, edited by A. Newton, part 1 (Van Voorst).—The Census of England and Wales for 1871, Preliminary Report.

AMERICAN.—A Treatise on Diseases of the Nervous System: W. A. Hammond (New York, Appleton).

FOREIGN.—Das Leben der Erde: N. Humnel (Leipzig, Fleischer).—Die Grundsätze graphischen Rechnens, part 1: K. Von Ott (Prag, Calve).

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