THURSDAY, SEPTEMBER 10, 1896.

RECENT ORNITHOLOGY.

A Vertebrate Fauna of the Moray Basin. By J. A. Harvie-Brown, F.R.S.E., and T. E. Buckley, B.A., F.Z.S. 2 vols. Pp. xx + 262 and 309. (Edinburgh: David Douglas, 1895.)

British Birds' Nests: How, where, and when to find and identify them. By R. Kearton, author of "Birds' Nests, Eggs, and Egg Collecting." Introduction by R. Bowdler Sharpe, LL.D. Illustrated from Photographs, by C. Kearton, of Nests, Eggs, Young, &c., in their Natural Situations and Surroundings. Pp. xx + 368. (London, Paris, and Melbourne: Cassell and Co., Ltd., 1895.)

British Sea Birds. By Charles Dixon. With eight illustrations by Charles Whymper. Pp. ix + 295. (London: Bliss, Sands, and Foster, 1896.)

A Hand-book to the Birds of Great Britain. By R. Bowdler Sharpe, LL.D., Assistant Keeper, Zoological Department, British Museum. Vol. iii. Allen's Naturalist's Library. Pp. xii + 338. (London: W. H. Allen and Co., Ltd., 1896.)

"THE Vertebrate Fauna of the Moray Basin," by Messrs. Harvie-Brown and Buckley, is the latest addition to the series being issued by them on the Vertebrate fauna of Scotland. They have already given us the Vertebrate fauna of Sutherland, Caithness, and West Cromarty; of the Outer Hebrides; of the Orkney Islands; and of Argyll and the Inner Hebrides. When we get, as we are promised before long, that of West Ross and Skye, and of Shetland and Dee, the northern parts of Scotland, so far as the section of its fauna with which our authors concern themselves, will be complete.

The area dealt with in the present volume is extensive, embracing "all the country drained by the rivers flowing into the Moray Firth . . . including the greater part of Sutherland, Ross, Inverness . . . Banff, Moray and Nairn." "We have endeavoured," say the authors, "from within our own narrow horizons in this, as in previous volumes of the series, to indicate the importance of natural areas and boundaries as determining to a large extent the faunal values." The greater part of the first volume, therefore, describes the water system, topography and physical features of the Moray Basin—"whose landward portion [is] hemmed in by some of the highest mountains of Scotland, and its seaward area similarly enclosed by the funnel-shaped contours of the shores"—and discusses the relation of these to the resident and migrant species inhabiting it. Forty-two species of mammals, 255 of birds, and nine of reptilia and amphibia are enumerated from the Moray Basin, with lengthy and valuable notes on their distribution, dates of breeding, and habits. No account is given of the marine or fresh-water fishes, beyond incidental mention, but we have an important chapter by Dr. R. H. Traquair, F.R.S., on the extinct vertebrates found in the different geological formations in the region, illustrated by several plates of restorations of the fishes for which the rocks of the Moray Basin are remarkable.

Such small defects as a style somewhat discursive, and sentences often rather involved and occasionally less pellucid than could be desired, will be readily forgiven the two naturalists who have laid their brethren under great obligations by this addition, which can hardly be too highly praised, to their valuable series of local faunas of Scotland. In addition to the palæontological plates, and several of nests and nesting-places of birds, excellently reproduced by process, these volumes are embellished by a number of exquisite photogravures (by Annan, of Glasgow) of scenery in the Moray region interesting to the naturalist. No book deserves to be commended—even if good otherwise—which fails to provide a full index and, where topography is dealt with, a good map. Both are to be found in "The Moray Basin." The map, which includes Scotland north of latitude 56½°, by Bartholomew, whose cartographical fame is world-wide, is beautifully clear yet full of detail. For all that is excellent in the publisher's art and craft, the name of David Douglas, by whom these volumes are given out, is sufficient guarantee; and they are worthy companions to their predecessors in the well-known sport and natural history series, issued from Castle Street, Edinburgh.

The book second on our list, by the brothers Kearton, owes its existence to a series of photographs of British birds' nests and eggs taken "in their natural situations and surroundings." They claim theirs as "the first practical attempt to illustrate a manual on the subject from photographs taken *in situ*," and characterise their pictures as "unique." Surely we have before the appearance of this volume had bird-articles illustrated by process blocks of birds' nests and eggs in their natural situations; and has not Mr. Welch, of Belfast, published a charming series of photographs of birds' nests taken also *in situ?* The manual before us, whose letter-press is from the pen of Mr. R. Kearton, presents us with the species-breeding in this country arranged in alphabetical order, and gives a short description of the parent birds (whose scientific names are, we regret to see, omitted), of the locality, situations and materials of the nest, and of the colour and size of the eggs and their time of laying—all sufficiently accurate, and of much value where the authors speak from personal observation. The illustrations, of which there are over a hundred, most of them well printed, are from photographs by Mr. C. Kearton. They by no means illustrate the nests of all the birds described in the text; but, on the other hand, those of many species are given which few even of those who are bird-lovers are likely ever to see unless they make a special journey for that purpose. Mr. C. Kearton has spent an enormous amount of time, energy and perseverance, and overcome troubles and disappointments of no ordinary kind, and he has bravely—occasionally foolhardily—hazarded his life, poised on the slender tops of high trees, or dangling from the face of precipices, in obtaining illustrations for his book. We agree with Dr. Sharpe, who, in the commendatory preface by which he introduces our authors to the public, remarks that the way in which they have overcome the very serious difficulties presented by their task "proves that in addition to the native British pluck, the true love of natural history is necessary to accomplish such a result as they have achieved." Much as we admire the one, and feel in fellowship with the other, we cannot help saying that the results are ornithologically unsatisfactory, and expressing what we have long realised, that photographs direct from nature are not the best means of representing birds' nests and eggs. So little of the surroundings can, as a rule, be got into a half-plate, that it is difficult, if the nest and eggs are to be visible at all, to form any true idea of the situation or of the materials of the nest; nor, except under very favourable circumstances, can a standard of size be introduced to correct, as is so often needed, the retinal impression. Unless also the photograph be taken perpendicularly above the nest, which is unsatisfactory, the eggs cannot be seen in the nest unless they are elevated or, what is equally to be deprecated, the nest be tilted, as in the song-thrush's on page 299. If, again, we compare the nests of the gadwall and the pheasant, the character, form and uniform surface of the eggs are so similar, that both nest and eggs might belong to either bird; and a "Skylark's nest on the crown of a furrow," conveys the impression of being situated on the face of a rocky wall. There seems to be greater scope for the "photographic naturalist" in dealing with nestlings. The young "Grey-lag geese" and the "Golden eagle's eyrie, with young," are both delightful.

Notwithstanding these defects in some of the illustrations, inseparable from the process employed, or due to the awkward places whence the views were photographed, this volume, which is attractively produced, will doubtless have a wide circulation among young British ornithologists.

Mr. Charles Dixon, who appears under the auspices of a different publisher than heretofore, claims audience with a new book, "British Sea Birds," in which we are pleased to find fact more plentiful than fancy. It has been our far from pleasant duty oftener than once to criticise adversely the theories and speculations he has advanced. On the present occasion, however, we feel considerable gratification in being able to recommend his chatty articles on the birds to be found along our coasts. There is nothing new or striking in the volume; but it will prove an agreeable and instructive companion to many of those who, during their sea-side holidays, take an interest in the birds they meet with, and desire to know something about them. Besides describing our strictly marine birds, Mr. Dixon contributes a chapter on land birds that are constantly to be found frequenting the shore or the cliffs. The volume is very prettily got-up and illustrated by eight excellent full-page plates by C. Whymper.

The third and penultimate volume of Dr. Sharpe's "Handbook to the Birds of Great Britain," in Allen's Naturalist's Library, concludes his account of the ducks (*Anatidæ*), and describes the herons, storks and ibises (*Ardeiformes*), the cranes (*Gruiformes*), and the bustards and plovers (*Charadriiformes*), in all ninety-two species. The present volume maintains the high standard of excellence of its predecessors; but the illustrations, though perhaps as good as can be expected for the exceedingly low price at which each volume is published, are not above criticism.

BRITISH MOSSES.

The Student's Handbook of British Mosses. By H. N. Dixon, M.A., F.L.S.; with Illustrations and Keys to the Species by H. G. Jameson, M.A., Author of the "Illustrated Guide to British Mosses." Pp. xlvi + 520; 60 plates. (Eastbourne: Sumfield, 1896.)

THIS book appears to us a very useful one. The author observes that Wilson and Berkeley are out of date, that Hobkirk's synopsis is too compressed to be of great service to the less practised collector, and that Braithwaite's great work is expensive and at present incomplete. There is, therefore, room for a new work on the subject, and the present volume appears to be a very praiseworthy attempt to fill the vacant space.

The work consists of a brief introduction; a glossary; a key to the genera; a description of the orders, genera, and species; an index, including synonyms; and 60 pages of plates. The key to the genera is intended to help a student to discover the genus of his specimen, and is based on practical considerations and not on system. The student should, perhaps, be warned not to suppose that there is more than an accidental connection between the genera which get thrown together by this process. The first group to which the student is referred is headed "A. Leaves distichous, inserted in two rows on the stem," and under this we find the genera Schistostega belonging to the order Schistostegaceæ, Swartzia belonging to the Dicranaceæ, and Fissidens belonging to the Fissidentaceæ. For the purpose of aiding the student in his hunt, this method of dealing with prominent features of the plant is very convenient. In the body of the book the name of the genus under consideration is printed at the top of the right-hand page, and in the text the genera are numbered throughout; if the number were also printed at the top of the page—thus, "12 Swartzia," or "xii. Swartzia"—it would make the process of turning to the genera from the key to the genera much easier and quicker.

Another suggestion which we venture to make to the authors for the second edition relates to the index. If one wants to see the plate illustrating, for instance, *Hypnum aduncun*, one must either look through the plates till it is found, or one must go to the index; from that to p. 458 of the treatise, from which there is a reference to Tab. lvi. O. If the index gave the following entry, "*Hypnum aduncun*, Hedw., 458, lvi. O," the reader would be saved this trouble, and the index would serve both for plates and text.

In dealing with the genera, our author gives us not only a description of the genus, but a table dichotomously arranged as a guide to the several species; and in his descriptions, both of genera and species, he has adopted the very useful practice of printing in italics the salient and most distinctive characters.

Mr. Jameson, whose useful illustrated guide to British mosses we reviewed in March 1894, has aided Mr. Dixon in the preparation of this work. He has re-written the keys to the genera and to the species, and the plates to the present work are based on those of Mr. Jameson, but have been re-drawn, and in many cases improved and added to.

We have not, of course, made use of this new volume practically; but from what we see of it, we should, without hesitation, recommend it to any person beginning the delightful study of mosses as the most likely of all those within our knowledge to suit his needs. E. F.

OUR BOOK SHELF.

Catalogue of the Described Diptera from South Asia. By F. M. Van der Wulp. 8vo. Pp. 220. Published by the Dutch Entomological Society. (The Hague: M. Nijhoff, 1896.)

COMPARATIVELY few entomologists interest themselves in *Diptera*, and therefore the number of species of the order enumerated in the present catalogue is only 2889, and doubtless represents only a small percentage of those actually existing in the rich fauna which it samples; for the *Diptera* are probably the third most numerous order of insects, surpassed only, according to the indications of our present knowledge, by the *Hymenoptera* and *Coleoptera* in the total number of species which they may be expected to include. Prof. Van der Wulp is recognised as one of our first living authorities on *Diptera*, and his work will prove of great use to specialists, especially as M. Bigot's "Catalogue of the *Diptera* of the Oriental Region," published in the *Journal* of the Asiatic Society of Bengal for 1891 and 1892, is both imperfect and inaccurate. The introductory part of the work is written in English, and includes a "Review of the Literature of Oriental Dipterology" and a bibliographical list of books and papers consulted. There is also a table of contents at the beginning, and an index of families and genera at the end. We cannot have too many books of this description; for although the number of undescribed species of insects is enormous, it is perhaps even more important to attempt to keep pace with the rapidly-accumulating mass of descriptive matter by means of carefully compiled monographs and synonymic reference catalogues, than to confine our energies to piling up additional descriptions by the hundred or the thousand.
W. F. K.

History of Modern Mathematics. By David E. Smith. (London: Chapman and Hall, Ltd., 1896.)

"HIGHER Mathematics," edited by Mansfield Merriman and Robert S. Woodward, is a text-book for classical and engineering colleges, and is a work containing 600 pages. Each chapter is written by a different author, and is devoted to some special branch of mathematics; chapters i., ii., iii., &c., dealing with solutions of equations, determinants, and projective geometry respectively. The eleventh and last chapter, a reprint of which we have before us, is written by Mr. David E. Smith, of the Michigan State Normal School, and deals with the "history of modern mathematics." Of course it has not been intended here to give a complete history of modern work, but just a sufficient survey of the whole domain to give a student an intelligent idea of the way in which the more recent advances have been made, and the ends gained thereby. Each mathematician has, as a rule, his own speciality; but each of these is one link in the chain which, when put together, forms the whole. Such a history as Mr. Smith gives here fulfils this point, and its shortness and conciseness will be favourable to students of mathematics. The text is increased in value by the numerous footnotes, and a short bibliography is given at the end; this latter is, however, by no means complete, as the author remarks, but he gives references for those who wish to go further afield. For a biographical table of mathematicians he refers to Fink's "Geschichte der Mathematik," p. 240, and for the names and positions of living mathematicians to the "Jahrbuch der Gelehrten Welt," published at Strassburg.

Graphical Calculus. By Arthur H. Barker. (London: Longmans, Green, and Co., 1896.)

A VERY timely book; and useful to instructors in the elements of the subject in providing a number of apt and eloquent illustrations of fundamental ideas. It represents a series of lectures addressed to engineering students, liable to be repelled by pure abstractions, and preferring concrete representations in which their ideas can take root; a complete contrast to the ordinary mathematical text-book of the school of Todhunter. The author should point out that the gradient of 1 in 100 (p. 13) means an angle whose tangent is 0·01 only in the indoor mode of reckoning on a plane; but that in construction of the railway, the angle is made with a sine of 0·01; the two modes of measurement are indistinguishable practically.

Integration is introduced simultaneously with differentiation, as in many respects a simpler idea to grasp; we can realise the growth of a tree at the end of a year, although the rate of growth is imperceptible. Our ordinary mathematical text-books make the mistake of keeping integration in the background too long. G.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

The Utility of Specific Characters.

I MUST confess to still feeling some difficulty in understanding my friend Prof. Lankester's position, notwithstanding his explanations.

The correlation principle was arrived at by Mr. Darwin after a careful examination of a large body of facts. I quote the carefully considered words in which he sums up his conclusions:—

"Correlation is an important subject; for with species, and in a lesser degree with domestic races, we continually find that certain parts have been greatly modified to serve some useful purpose; but we almost invariably find that other parts have likewise been more or less modified, without our being able to discover any advantage in the change. No doubt great caution is necessary in coming to this conclusion, for it is difficult to overrate our ignorance on the use of various parts of the organisation; but, from what we have now seen, we may believe that many modifications are of no direct service, having arisen in correlation with other and useful changes." ("Animals and Plants under Domestication," vol. ii. pp. 354–5.)

It does not appear to me that there is anything in this which conflicts with the doctrine of the "utility of specific characters." The non-useful parts of the correlated chain (if any) are sustained by the useful, and the *whole* seems to me part of the "specific character." If Prof. Lankester had no other object but to call attention to Mr. Darwin's correlation principle, I think this was a little superfluous, for it is part of the mere grammar of Darwinism.

But the point of his speech at the Linnean Society, and of the subsequent account he gave of it in NATURE, appeared to me to go a good deal beyond this, and to be of considerable interest and importance.

In the cases cited by Mr. Darwin, the correlated structures are almost all, to use Prof. Lankester's words, "obvious and measurable." This we would expect in the correlated variation of homologous parts on which Mr. Darwin lays such stress, and which form the bulk of the instances which he gives.

Prof. Lankester's "suggestion" was that "obvious species marks may be only superficial and non-significant phenomena correlated . . . with other less obvious but really important life-saving peculiarities, which might well escape the observation of the describer of specific characters." He then adduces Wells's theory as "a case which seemed to [him] most striking and suggestive in connection with the utility of specific characters." And so I think it is. I ventured to express an opinion that if established it would prove very damaging to, at any rate, the universatility of that doctrine. I certainly supposed that that was Prof. Lankester's object in bringing it forward.

He now adds that he might as well "have used any of the other cases collected by Mr. Darwin." It is not a very material point, but I do not find that Mr. Darwin makes any reference to Wells's theory in his discussion of correlation, nor do I see any in the body of the sixth edition of the "Origin of Species," though a passage is quoted from Wells's paper at p. xi. of the "Historical Sketch" which is prefixed to it. It had, however, independently occurred to Mr. Darwin, and he discusses it in a somewhat different connection in the "Descent of Man" (i. pp. 242–245). He remarks:—"That the immunity of the negro is in any degree correlated with the colour of his skin is a mere conjecture; it may be correlated with some difference in his blood, nervous system, or other tissues." And he concludes:—"I endeavoured with but little success to ascertain how far it held good." Elsewhere he gives cases to show that "differences in colour are correlated with constitutional differences." But these, though interesting, seem to me too obscure to found any definite conclusion upon. And no attempt is made to show on what material basis, subject to variation, the constitutional difference depends.

The correlation principle as originally defined dealt then with obvious and measurable characters. It is extended by Prof. Lankester's "suggestion" to what is obscure, may be unknown, and perhaps unknowable. In considering the probable utility of any specific character we shall, if the extended principle be accepted, be always open to the objection that we cannot show that the character is not the outward and visible sign of some unobservable internal peculiarity. But that is a position which I do not think we are bound to accept till something more than a hypothetical case has been established.

To sum up: Mr. Darwin based the correlation principle on what is concrete and tangible; Prof. Lankester extends it to what is intangible and hypothetical. It is not a question of what is "apostolic and orthodox," but of what is susceptible of reasonable proof.

As I do not propose to continue this discussion any further, I will take the opportunity of saying that I think it is a matter for regret that, as Prof. Lankester was present at the meeting of the Royal Society when Prof. Weldon's paper was read, he did not deliver himself on that occasion of his somewhat belated criticism. Prof. Weldon's work is of extraordinary interest, and one cannot but admire the self-sacrifice with which such laborious investigations have been prosecuted. If they want a defence, I think the following passage from the "Origin of Species" supplies it.

"It may metaphorically be said that natural selection is daily and hourly scrutinising, throughout the world, the slightest variations; rejecting those that are bad, preserving and adding up all that are good; silently and insensibly working, *whenever and wherever opportunity offers*, at the improvement of each organic being in relation to its organic and inorganic conditions of life. We see nothing of these slow changes in progress, until the hand of time has marked the lapse of ages, and then so imperfect is our view into long-past geological ages, that we see only that the forms of life are now different from what they formerly were." (Sixth edition, pp. 65–66.)

I do not myself see how the slow and ordinarily imperceptible, but inevitable action of natural selection can be demonstrated except by the statistical method. But, firmly as I believe in the inevitableness of that action, I confess that the results attained by Prof. Weldon surpassed my expectations. I am unable to agree with Prof. Lankester, that the investigation does not satisfy the canons of scientific inquiry. The hypothesis on which it appears to me to be based is, that the mean configuration of any organism at any moment is an optimum. In order to test that by the statistical method, the choice of measurements is a mere matter of convenience. W. T. THISELTON-DYER.

Kew, August 29.

Thermometer Readings during the Eclipse.

I STARTED on July 30 in the *King Harold*, and arrived at Vadsö on August 6. On board this vessel, amongst others, were Prof. Rambaut and Dr. Hugh R. Mill, of the Geographical Society, who I see has sent a note which appears in NATURE of August 27, as to some observations of temperature he took during the eclipse. I was constantly with Prof. Rambaut on the island at Vadsö, and he particularly requested me to observe the temperatures of sun, and shade thermometers during the eclipse at the position he had taken for his observations, which were specially directed to the degree of polarisation of different parts of the corona. I enclose a diagram of my observations, which Prof. Rambaut has suggested I should send to NATURE, should you think they are worth recording. The fall of the sun thermometer (which unfortunately was fully shaded by cloud) was, from 4h. 10m. to just after totality, 2°, and its recovery

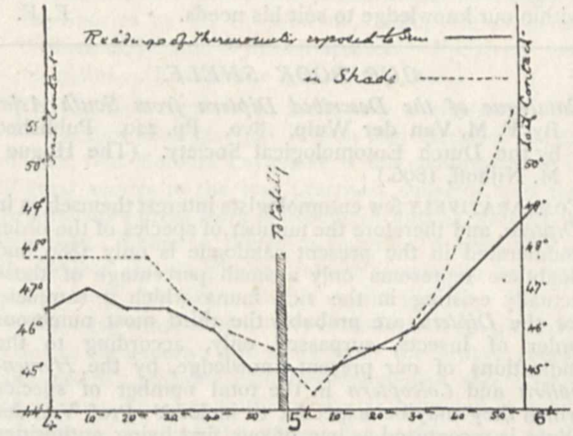

Diagram of observations of sun, and shade thermometers during the eclipse of the sun, August 9, taken at Vadsö.

from that point to 5h. 56m., last contact, was 3°·6. The shade thermometer showed greater variations, viz. a fall of 3°·35, and subsequent rise at 5h. 50m. of 5°·6.

H. WOLLASTON BLAKE.

8 Devonshire Place, W., September 3.

Sailing Flight.

MR. PEAL (NATURE, vol. liv. p. 317) having again brought up this matter for discussion in the columns of NATURE, I would like to make a new suggestion concerning it, which I have long had on my mind. It will be remembered that Lord Rayleigh (NATURE, vol. xxvii. p. 534) assumed an increase of wind-velocity with altitude to explain the facts of circular soaring, and that quite recently Langley (*Amer. Journ. Sci.*, vol. xlvii. p. 41) has tried to explain the same phenomenon by the assumption—supported in his case by direct observation—that the velocity and direction of the wind is subject to great and rapid changes. Concerning this latter statement, I must say that although in a thunderstorm great irregularities can be observed in the upper air-currents, the shape and relative constancy of small clouds in fine weather seem to show that under ordinary conditions the upper air-currents are much steadier than Langley assumes, and that, therefore, soaring birds can by no means always depend on the presence of wind-irregularities sufficiently great to sustain them. Although no doubt wind-velocities generally increase with altitude, I do not believe that such an increase will *always* be present, nor that it will, when present, be usually sufficiently great to produce the force necessary for raising a bird. We observe, however, that birds do soar nearly always, perhaps even more frequently in fine weather, when the currents are more steady, than in rough weather, when they are more irregular.

Under these circumstances it seems to me that neither Lord Rayleigh's nor Langley's assumptions concerning the source from whence these birds derive the power of overcoming gravity can be correct. It seems to me, doubtless, that a steady horizontal wind of equal velocity in different altitudes *does* enable them to soar and to rise. It is remarkable that this soaring without loss of elevation is always accompanied by *circling*. Elevation is not known to occur without circling, as it might if Langley's views were correct. Were the bird attached to the earth by a string like a kite, it could be and, if the wing-planes were placed in proper positions, would be sustained and raised by a purely horizontal and steady wind. Now it seems to me that the *circling replaces the string*. A circling top retains its position on account of the force in its rapidly circling parts. Could not the soaring bird produce—through circling—a similar stability which, acting like a kite-string, would enable it to oppose itself to the wind, and thus convert the horizontal wind-force partly into a vertical, lifting force? Mr. Peal, in his last letter (*l.c.*) very correctly remarks that the connectingline of the wing-tips does not lie horizontally, but obliquely, so as to describe in moving, a cone, apex downward. This slant gives, through the resistance of the air, a certain degree of rigidity to the system represented by the soaring and circling bird, which corresponds to the rigidity that holds the parts of the top together, and prevents them from flying off in tangents.

Being myself a zoologist, and not a mathematician, I cannot venture to state this hypothesis otherwise than in the shape of a question; perhaps one of the mathematical readers of NATURE will kindly take the trouble to answer it.

Czernowitz, August 23. R. VON LENDENFELD.

THE CONWAY EXPEDITION TO SPITZBERGEN.

THE expedition organised by Sir Martin Conway for the exploration of the interior of Spitzbergen left London on June 2, and first sighted the island on June 17, the exact tercentenary of its discovery by Barentz. The northern ice sheet having broken up exceptionally early this year, the floes off the western coast of Spitzbergen were unusually heavy, and somewhat delayed the arrival in Advent Bay. The expedition landed the stores there on June 20. In accordance with the plan of operations arranged, the members divided into two parties: one party, consisting of Sir Martin Conway, Mr. E. J. Garwood, a well-known geologist and Alpine photographer, and the writer, proceeded to cross Spitzbergen to the east coast. The other party, composed of Mr. Trevor Battye, the ornithologist with the expedition, and Mr. H. E. Conway, the artist, cruised about Ice Fjord and its two chief bays, in order to collect birds and make sketches.

Till the present year very little was known of the interior of the country. The coasts have been carefully surveyed by many expeditions, of which those of Parry and of various Swedish explorers, notably the series organised by Baron Nordenskiöld, are of the first importance. But hitherto the only contributions to our knowledge of the interior were those of the late Gustav Nordenskiöld and M. Rabot. The former marched for three days across the ice-sheet from Hornsund to Bel Sound, along a line parallel to the west coast and some miles inland. M. Rabot made a three days' excursion up a valley going inland from the head of Sarsen Bay. With these exceptions, exploration had been limited to the coast, and to within a day's march of it. Sir Martin Conway therefore took out two ponies and sledges, with which to provision some inland camps. The ponies answered well, but the sledges broke down repeatedly, and thus greatly delayed progress.

The principal geographical work of the expedition was the first crossing of Spitzbergen, from Advent Bay to Agardh Bay. The country traversed was mapped by Sir Martin Conway, while his two companions worked out the geology of the country and made collections of its flora and of its very limited fauna. Subsequently the whole expedition sailed northward to the Seven Islands, and through Kinlopen Strait and across Olga Strait to near King Charles' Islands. An effort to complete the circumnavigation of Spitzbergen was nearly successful, but failed owing to the passages into Sta Fjord being blocked by fast ice. Mr. Garwood and Mr. Battye ascended Hornsund Sind, the highest peak in Spitzbergen.

In regard to the biological results, it is too early to estimate their value, for novelties can only be expected among the invertebrates, which have not yet been examined. The only land mammals are the bear, arctic fox, and reindeer, of which the last are abundant. Birds are individually numerous, but the species are few; of the twenty-five authentically recorded species, we saw all but the snowy owl (*Nyctea nivea*). One addition to the list might have been made, had we been able to carry a gun across the island; for we saw an unrecorded species on the shore of Agardh Bay. Several dredge hauls were made in Advent Bay and Hornsund, yielding various species of worms, mollusca, crustacea, ophuiroids, &c.

Botanical collections were made during the traverse of the island in order to contrast the flora of the inland valley, of the high plateaus, and of the nunataks, with that of the coast. The flora is remarkably uniform, and the influence of height has less effect than those of situation and season. The species found on the mountain summits in the middle of the summer were the same as those found on the coast at the beginning of the spring. As the season advanced the species first found in flower on the lowlands and in sheltered valleys were succeeded by another set; but at any time it was only necessary to seek exposed and barren positions, or to climb above the snow line, to find the first flora still in flower.

Spitzbergen offered better opportunities for geological than for either zoological or botanical work. The rock sequence includes representatives of the Archæan, Lower Palæozoic, Devonian, Carboniferous, Trias, Jurassic, and Middle Tertiary. The coast series has been described by many workers, including Keilhau, Torell, Loven, Lamont, Nordenskiöld, Nathorst, de Geer, and others; but as the interior had not been visited, we had there a fresh field of work. In this I had the good fortune of the co-operation of Mr. E. J. Garwood; together we mapped the belt of country between Advent Bay and Stor Fjord, and made collections from each of all the geological systems that occur in Spitzbergen. Our work was greatly facilitated by the simplicity of the geology of the country; the sections are numerous and clear, and the structure is often shown with diagrammatic clearness.

Our best opportunity for the study of the Archæan rocks was given by the bare cliff sections at Walden Island, one of the Seven Islands situated in lat. 80° 38'. Here we found that this series was formed of a group of schists which have been invaded by two sets of intrusive gneisses; great blocks and seams of the schists are included in the gneisses, while veins from the latter cut upward into the schists.

The general stratigraphical sequence has many points of interest. Great stress is often laid on the absence from Spitzbergen of any indication of glacial action in times earlier than the Pleistocene; and also on the fact that the occurrence of fossil coral reefs, and beds containing warm, temperate, or even sub-tropical plants, shows that the climate before the Pleistocene epoch was quite different from that of the present time. Our evidence, however, greatly simplifies the task of explaining these difficulties; that remarkable changes of climate have happened, is unquestionable. One such is probably in progress still. But these changes of climate are reduced to much narrower limits than seems to be generally considered. We found signs of glacial action in the deposits of, at least, two different eras before those of the "great ice age." Moreover, the so-called coral reefs are not coral reefs, and might have been formed in the adjoining seas; and the fossil plants do not indicate so mild a climate as those of the Miocene beds of Southern Greenland. In fact, the whole of the fossil faunas and floras from the Devonian onward are comparatively poor in species, and appear to have lived under unfavourable conditions, and their existence in Spitzbergen may all be explained by the assumption of only a sub-arctic climate.

One of the main temptations Spitzbergen offers to the geologist is a magnificent opportunity for the study of glacial action; for we may see there marine and land ice working side by side. As our time on the coast was short, we naturally saw most of the inland glaciers. These are very different from those of Switzerland; for example, they have practically no *névé* fields. All the snow that falls on the collecting-ground at the head of the glacier turns to ice *in situ*. Time after time we ascended glaciers, expecting to be soon stopped by reaching snow-covered crevassed ice; but, to our surprise, we found that the apparent *névé* field was a slope of ice reaching to the col, or the mountain summit. We naturally devoted much attention to a comparison of the deposits accumulated by marine and land ice. Both lay down glacial beds of very varied characters. We had no difficulty in finding cases of the formation of typical boulder clay by land ice. We also kept in mind the questions of the possibility of the uplift of material through ice, and of the existence of a differential flow in glaciers. To take one case of the former: in the moraine lying on the eastern face of the "Ivory Gate Glacier" we found many fragments of shells which had been lifted above the level of the old sea beaches, whence they had been derived. This supplied us with one clear case of the uplift of material, and the sections round the snout of this glacier left no doubt as to the method by which this is effected. The proof of a differential flow in glaciers is even more conclusive; the evidence of the extent and importance of such movements strikes us as the most impressive fact in the glacial geology of Spitzbergen. Many of the glaciers terminate with precipitous faces; these show that the layers of ice have the false-bedded arrangement that is familiar from photographs of the Greenland glaciers. Study of the sections shows that beds of englacial drift are being uplifted or carried in a direction different from that of the main movement of the ice. As we climbed and sketched the face of the "Booming Glacier" at the head of Advent Vale, we could not but recall Mr. Goodchild's paper on the "Glacial Phenomena of the Eden Valley" (1872); for we could see deposits of the same characters as those he there describes being formed by ice, acting in the way which he there assumes it must have acted.

The raising of beach material is also effected by the stranding of bergs and floes upon the sea shore; but the range of this action is not very great. The Spitzbergen walrus and seal hunters and fishermen agree that ice is never forced on shore more than one hundred yards inland, or to a height of over fifty feet.

Marine glacial deposits occur in many parts of Spitzbergen; but moraines formed in the sea differ from those formed on land—by their shape, by the character of the material, and its arrangement.

It is, perhaps, unnecessary to add that the glaciation of Spitzbergen was solely due to a local glaciation. We found no evidence of any great polar ice cap. Had any such have existed and overridden Spitzbergen from the north, we ought to have seen its traces. On the contrary, along the north coast the ice movement was from south to north. J. W. GREGORY.

THE LAST DAY AND YEAR OF THE CENTURY: REMARKS ON TIME-RECKONING.

THE late Astronomer Royal, Sir George Airy, once received a letter requesting him to settle a dispute, which had arisen in some local debating society, as to which would be the first day of the next century. His reply was: "A very little consideration will suffice to show that the first day of the twentieth century will be January 1, 1901." Simple as the matter seems, the fact that it is occasionally brought into question, shows that there is some little difficulty connected with it. Probably, however, this is in a great measure due to the circumstance that the actual figures indicating the century are changed on January 1, 1900, the day preceding being December 31, 1899. A century is a very definite word for an interval, respecting which there is no possible room for mistake or difference of opinion. But the date of its ending depends upon that of its beginning. Our double system of backward and forward reckoning leads to a good deal of inconvenience. Only the other day I was reading in a high-class scientific periodical (the *Journal* of the Astronomical Society of Wales), that the Athenian expedition under Phocion to succour Byzantium (attacked by Philip of Macedon) took place in B.C. 339, and that that was now exactly 2235 years ago.[1] But it is evident that as there was no year 0, and B.C. 1 immediately preceded A.D. 1, the interval from any date in a B.C. year to the same in an A.D. year is found not by simply adding the respective years, but by afterwards subtracting 1 from this sum. Our reckoning supposes (what we know now was not the case, but as an era the date does equally well) that Christ was born at the end of B.C. 1. At the end of A.D. 1, therefore, one year had elapsed from that event, at the end of A.D. 100, one century, and at the end of 1900, nineteen centuries.

Believing that our Lord was born in the autumn or towards the end of B.C. 5, I once stated that our ordinary reckoning was five, not four, years in error, because the interval from a given date in B.C. 5 to the same in A.D. 1 is five years. But I was properly pulled up for saying so, because our reckoning supposes that Christ was born in B.C. 1, and B.C. 5 is the fourth year before that, so that if we could now revert to the correct year of the Nativity, the present year would be 1900, *i.e. the nineteen hundredth year after the birth of Christ.* At its close nineteen centuries from that event would be completed, and the twentieth century commence with January 1 next year, which would be called 1901. Here is where the apparent difficulty comes in. Some people fancy that the year 1900 means 1900 years after the birth of Christ; but the years are in fact ordinal, not cardinal, numbers, and the century is completed, not at the beginning, but at the end of that year. The mistake is of the same kind as if we should conclude from a man being, for instance, in his sixty-second year that he was sixty-two years old. A recent writer in the *Times* points out that though the same argument applies to the hours of the day, we do in fact use cardinal numbers in this respect; and when we say, for instance, 4 o'clock in the afternoon, we mean that four whole hours have passed since noon, whereas by analogy with the number indicating the year, we might mean the fourth hour. This of course is what the Germans do, in speaking of time between two consecutive hours, *halb vier*, for instance, with them meaning half-past 3, or the fourth hour, half gone. But it would be impossible to designate by half-*past* 4, for instance, half an hour or thirty minutes in the fifth hour or of hour five; and the French idiom equally necessitates counting the portions of an hour from the hour as a cardinal number.

It is clear then that the year, as we call it, is an ordinal number, and that 1900 years from the birth of Christ (reckoning it as we do from the end of B.C. 1) will not be completed until the end of December 31 in that year, the twentieth century beginning with January 1, 1901, that is (to be exact), at the previous midnight, when the day commences by civil reckoning. The writer referred to above, truly says that in speaking of months of the year and days of the week we also use ordinal numbers; but in these, when that method of designating them is used, we actually say so, and call them the first or second, &c., month or day. The year, on the other hand, is always spoken of as a cardinal number; but probably this is on account of its number being large. Had the reckoning from the true or supposed date of the birth of Christ been commenced in the first century, the years would doubtless have been called, like those of the reign of a king or queen, the first, second, &c., or fiftieth, sixtieth, year. In mentioning the hours of a day, the matter becomes somewhat different, because we see them

[1] The expedition really took place late in the summer of B.C. 340, and there may be a misprint here. The article is in reference to a medal struck at Byzantium, representing an occultation which occurred at the time, and is the origin of the present Turkish standard.

marked and hear them struck on a clock. We think therefore of an hour not as an interval of time, but as an instant, which is that of the completion of the hour, 4 o'clock or 4 by the clock, meaning that four complete hours have passed since the beginning of the clock-round. When this is noon, and the hours afternoon hours, all is logical enough. We are obliged to call the beginning of the round the completion of the preceding; because though a clock may mark 0, as clocks used in observatories do, we cannot indicate nothing by a strike. Our ordinary habit, however, becomes illogical when we speak of morning hours and call them a.m. or ante-meridiem; for eight hours, for instance, before noon should mean what we call 4 o'clock in the morning or 4 a.m. To be logical, the morning or a.m. hours should diminish instead of increasing; but the usage cannot well be altered, and it is not likely that ordinary people will ever adopt the astronomer's plan and count the whole day through twenty-four hours, even if astronomers try to conciliate them by dropping their practice of beginning the day at noon. For this there is now much less reason than there was in early days of the science, when it was thought desirable to keep a whole night's observations under one date; for modern astronomers make a considerable number of observations in daylight and during the day hours.

W. T. LYNN.

POPULAR GEOLOGY.[1]

SOME fifteen years ago, if a book had been published under the title of "The Scenery of Switzerland," the reading public might have expected glowing descriptions of the magnificent mountains, the wild waterfalls, the quaint châlets, the dangerous passes and precipices of that wonderful Alpine rampart of Switzerland

> "Which serves it in the office of a wall,
> Or as a moat defensive to a house,
> Against the envy of less happier lands."

And it would have been somewhat startled on opening the book to find the first chapter dealing with the "Geology of Switzerland," and bristling with a supply of technical terms seldom to be found outside a geological text-book. Nevertheless, that is how Sir John Lubbock's new book opens, and the title is accordingly somewhat qualified on the inner fly-leaf, where it reads in full, "The Scenery of Switzerland and the Causes to which it is due."

We have already had the æsthetic aspect of the Alps presented to us by such writers as Symonds, Ruskin, and Leslie Stephen; the mountaineering aspect by such famous climbers as Whymper, Freshfield, and Conway; the scientific aspect by Forbes, Tyndall, Bonney and others; and now Sir John Lubbock seeks to combine the æsthetic and the scientific aspects. It may be said at once that the book supplies to the cultured tourist a want which has been felt more and more for some years. Years during which Dr. Lunn's inexpensive tours have brought a journey to Switzerland within the reach of modest incomes, and when popular lectures on physical and geological subjects have attracted ever-increasing interest. Besides, these are *fin de siècle* days, when the mere sensuous enjoyment of the beauties of Swiss mountains is not enough to gratify the tourist! He wants to surmount their difficulties, either physically by climbing their summits, or mentally by mastering the secrets of their structure—to *come* and *see*—yes, but also to *conquer* the grandeur of the Alps!

The intellectual conquest of the Alps, however, is not yet completed by geology, and this is the very fact which has restrained many of the veteran geologists abroad from attempting a popular book on the subject. Prof. Fraas published in 1892 a useful book called "Scenerie der Alpen," which erred in being too geological for the ordinary tourist. In 1894, the Committee of the International Geological Congress published a special "Livret-Guide" of Switzerland, wherein pedestrian tours are planned and described geologically by the best Swiss authorities on the various areas of the Alps. With these exceptions, Sir John Lubbock entered an open field, and has done so with considerable success.

The book numbers 473 pages, arranged in twenty-five chapters. About two-thirds of it are devoted to the *geological* causes, while one-third discusses the *physical* causes which have moulded the surface features of Switzerland.

It is perhaps rather unfortunate that the book begins with three such difficult chapters as those entitled "The Geology of Switzerland," "Origin of Mountains," and "The Mountains of Switzerland." In the opening pages the reader finds himself perforce initiated into the involved question of the origin of gneiss.

> "The foliation of Gneiss is probably of two kinds: the one due to pressure, crushing, and shearing of an original igneous rock such as Granite, the other to original segregation-structure" (p. 3).

A sentence like this cannot but be a stumbling-block to the ordinary reader. Granite, Serpentine, the Crystalline Schists, and the successive geological periods from Carboniferous to Miocene and Glacial time are briefly dealt with. The second chapter contrasts "Table Mountains" with "Folded Mountains," and demonstrates that the Swiss mountains belong to the latter class, having been "thrown into folds by lateral pressure." Geological terms—such as outcrop, dip, and strike; fold, fault, and fold-fault; anticline, syncline, slickenside, and cleavage are explained; various examples are also given of the dynamo-metamorphic changes induced in rocks. Attention is directed in the third chapter to the fact that the main longitudinal valleys (*e.g.* the Rhone-Rhine valley which cuts through Switzerland in the direction of the main axis, S.W.-N.E.) occupy the troughs of the mountain-folds, whereas the transverse valleys (*e.g.* the Reuss and Ticino in N.W.-S.E. direction) are independent of the folds, being "entirely due to erosion." Denudation of the surface is discussed, and the geological proofs are given of the former presence of an arch of sedimentary strata above the crystalline rocks of the central chain of the Alps. Three well-known geological sections illustrate the text—Schmidt's section from the Rhone valley at Viesch to the Averser valley in the Engadine, Favre's "Mont Blanc" section, and Heim's "Windgälle and St. Gothard" section. A computation "gives 4500 metres or, say, 14,000 feet, which erosion and denudation have stripped from the summits of the mountains!" (p. 66).

There follows a lighter series of six chapters on glaciers, valleys, rivers, and lakes. The physics of ice and ice-movement, and the characteristic features of glaciers are carefully described. Evidences of the "Former Extension of Glaciers" are considered, and abundant examples quoted of the influence which ancient moraines had in diverting the courses of rivers and damming up lakes. The chapter on "Valleys" leads us into some confusion of ideas. A "fault valley" is said to be "comparatively rare" (p. 143). The writer repeats the principle mentioned above, that cross-valleys are valleys of erosion, while longitudinal valleys are of geotectonic origin. But he then asks himself the question, "Why should the rivers, after running for a certain distance in the direction of the main axis, so often break away into cross valleys?" (p. 148). "Three possible explanations," suggested by Prof. Bonney, are given, and then the following passage occurs:—

> "Under these circumstances I have ventured to make the following suggestion. If the elevation of the Swiss mountains

[1] "The Scenery of Switzerland, and the Causes to which it is due." By the Right Hon. Sir John Lubbock, Bart., M.P., F.R.S., &c. Pp. 473. (London: Macmillan and Co., Ltd., 1896.)

be due to cooling and contraction leading to subsidence as suggested in page 34, it is evident, though, so far as I am aware, this has not hitherto been pointed out, that, as already suggested, the compression and consequent folding of the strata (Fig. 43) would not be in the direction of A B only, but also at right angles to it, in the direction A C, though the amount of folding

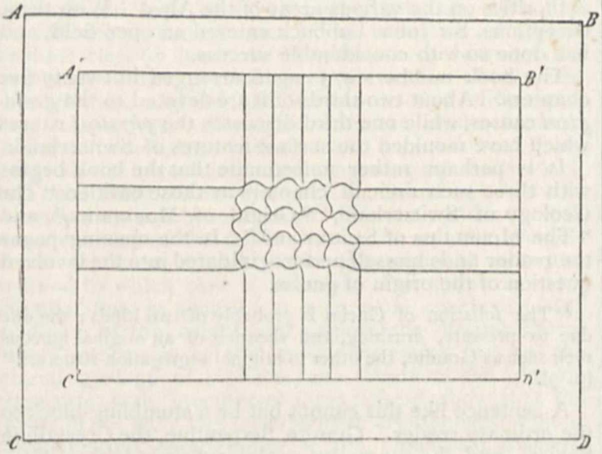

FIG. 43.—Diagram in illustration of mountain structure.

might be much greater in one direction than in the other. Thus in the case of Switzerland, as the main folds run S.W. and N.E., the subsidiary ones would be N.W. and S.E. If these considerations are correct it follows that, though the main valleys of Switzerland have been immensely deepened and widened by rivers, their original cause was determined by tectonic causes" (pp. 149, 150).

Thus the chief distinction previously made by the writer between longitudinal and transverse valleys is finally annihilated by his own suggestion that both may have had their primal cause in tectonic movements! But this idea finds by no means its first exponent in Sir John Lubbock. It is perfectly familiar throughout the writings of Austrian and German geologists. Take the following passage, which I translate from Rothpletz :—

"*As the youngest expression of the mountain-forming forces*, these (the transverse faults) have had a specially important influence on the present topography of the mountains, the direction of the flowing waters, and the origin of lake-basins. It is to them above all that the longitudinal synclinal folds of the Alps owe the outflow of their waters by transverse valleys; and the length of high ridges of rocks has been determined by them." ("Ein geolog. Querschnitt durch die Ost-Alpen." Stuttgart, 1894, p. 190.)

The stratigraphical facts observed by these geologists somewhat modify the theoretic suggestion of Sir John Lubbock. They prove that the transverse lines of weakness, whether of simultaneous origin or not with the longitudinal folding, were planes of movement long after the longitudinal folds had *ceased* to move, *i.e.* had become in technical language "dead" folds. *It is this relative youth of the transverse faults which has made them so often revolutionisers of Alpine drainage.* We would certainly have expected to have this important matter looked into by Sir John Lubbock, especially as he has devoted considerable space to minute matters of drainage in the three succeeding chapters on the "Action of Rivers," their "Direction," and "The Lakes."

With regard to the vexed question of the excavation of the lake-basins by glaciers, Sir John Lubbock states that "there are strong reasons against regarding glaciers as the main agents in the formation of the great Swiss and Italian lakes" (p. 210). The general reader may learn much from the chapter on "Lakes."

A very important subject is then introduced in Chapter x.—"The Influence of the Strata upon Scenery." If I may prophesy, this is the "coming" theme in popular geology. Combining as it does the interest of beauty of form with that of varied natural phenomena, it appeals alike to artist or tourist, geographer or petrographer, physicist, chemist, or geologist. This, I repeat, is at once the grandest, the most striking, and the most popular department of the Science of Scenery; and, what is more, the student of it would rightly choose Switzerland for his field of study in preference to any other country in Europe! Yet Sir John Lubbock has devoted only one chapter of twenty pages to this subject, and has treated it in a meagre, perfunctory manner. Only one sketch-section by Baltzer illustrates this extensive subject. The reader who brings enthusiasm to the book, and has Alpine pictures in his eye, will stir life into the bare facts, but the reader who has not will fail to be impressed.

All the subsequent chapters from xi. to xxv. are geological in their bearing, and take up the districts of Switzerland in turn. The geology of the Jura mountains is sketched in simple, clear style in Chapter xi. The Miocene and Glacial deposits of the "Central Plain" of Switzerland are described in Chapter xii. The next, entitled "The Outer Alps," is one of the best in the book. It runs easily along and describes, amongst other things, the geology of the ever-fascinating Rigi and its proud rival Mount Pilatus. One almost regrets that the chapter should be brought to its close in the cloud of controversy which overhangs the history of the "Klippen." The chapter on "Central Massives" is rather overladen with the opinions of many geologists, but concludes by regarding the Central Massives (1) "as an integral part of the general Alpine system, not as independent centres of upheaval; and (2) as complex systems of compressed folds" (p. 307).

Chapter xv., "The Lake of Geneva" is, like Chapter x., a sacrifice to science—useful, instructive, practical, but written with a marked economy of the imagination. Surely the most prosaic Englishman who has seen the view of the mountains from the northern side of the lake must remember it all his days, and feel the very words "Lake of Geneva" act like a charm upon him. This chapter in the "Scenery of Switzerland" commences as follows :—

"The Lake of Geneva is 45 miles in length, and about 10 in breadth. It is 375 metres above the sea, or 309 in depth.

"The bottom, moreover, is covered by subsequent deposits to an unknown depth, so that originally it was probably below, perhaps much below, the sea-level. Indeed, if the slopes of the mountains at Meillerie and Vevey (see Fig. 100) are continued under the bed of the lake, the alluvium must have a thickness of no less than 600-800 metres, which would make it 200-400 metres below the sea-level. The actual outlet at Geneva is in superficial débris, but the river comes upon solid rock at Vernier, 1197 feet above the sea-level, 33 feet therefore below the surface-level of the lake, and 951 above the bottom. It is, therefore, a true rock basin" (p. 308).

The same conclusion is arrived at in the same matter-of-fact way about other lakes, *e.g.* Lake of Neuchâtel (p. 259), Lake of Constance (p. 414). There are some graceful touches however :—

"The country about Vevey and Montreux is the Riviera of Switzerland. It is lovely now, but what must it have been before the monotonous terraces of the vineyards and the endless rows of vine bushes replaced the ancient forests of chestnut, birch, and beech; and the picturesque Swiss châlets were extinguished by whitewashed villas and gigantic hotels" (p. 310).

"The Massif of Mont Blanc," Chapter xvi., again falls distinctly short of the sublimity of the subject. Is it so necessary to begin with exact figures?

"'The Massif of Mont Blanc' is elliptical in outline, about 30 miles in length, and 10 in breadth, extending from S.W. to N.E. from the Col de Bonhomme, across the Valais at Martigny to the Dents de Morcles; the extreme N.E. portion being severed from the rest by the Rhone" (p. 322).

Again, why give the reader so little of Sir John Lubbock, and so much of other authors? De Saussure and Favre may indeed have "made" the geology of Mont Blanc, but why these long French quotations from their writings? Does the Pavillon de Bellevue stand in need of a testimonial to its beauty from any French writer, even Favre? (p. 327). A graver objection to Sir John Lubbock's treatment of the Mont Blanc massif is the inadequate account of its geotectonic relations. It is impossible to satisfactorily explain the "causes to which Mont Blanc is due," without setting forth its relations to the fold "trough" of the Briançonnais and the broken western end of the Valais "crest" of mountains. It is, indeed, the greatest blemish in Sir John Lubbock's book that he nowhere gives a geological insight into the structure of the Monte Rosa massif of mountains from the Simplon Pass to the St. Bernard. Yet this area is the Swiss frontier, whereas the Mont Blanc massif is almost wholly French and Italian. However fully, then, the succeeding chapter on "The Valais" treats the Rhone Valley, it misses its mark with regard to the mountains. The few notes on Zermatt and the Matterhorn, on p. 357, are quite insufficient.

The Bernese Oberland is more deftly handled than Mont Blanc. The intricacies of the overfold of gneiss are explained, and there are no fewer than six geological sections from Fellenberg and Baltzer to illustrate the fourteen pages. The Rhone, Upper Aar, Reuss, Ticino, and Rhine valleys are treated much after the fashion of the Swiss "Livret-Guide" referred to above, although without its daily itinerary. In these chapters we are made to feel that the author has himself gone over every step of the ground, but he follows the "Livret-Guide" too apparently in his geology. "Zürich and Glarus"—the title of Chapter xx.—gives an account of the variation in the movement of the old glacier which once filled the Lake of Zürich. The Glarus Mountains are described in accordance with Heim's well-known works. Chapter xxiv. on the Engadine is short. It explains the shifting northward of the watershed of the Alps, and the consequent formation of the line of lakes. The rocks of the Bernina, Julier, and Baselgia, are also indicated.

There are 154 illustrations in the book. Almost all are of the nature of geological sections or diagrams, 123 being reproductions from the works, mostly of Swiss geologists, and a few from English authors. The remainder are simple diagrams—with the exception of familiar photographs of the Rhone glacier, the Grimsel, and the valley of Chamonix; a successful photograph of the rock-fold at the "Cascade of Arpenaz," and another of a "Scratched Pebble" from the moraine at Zürich. Two figures specially deserve to be noted, Figs. 49 and 50, the front and side view of a river cone, as they, along with one or two drawings from Heim ("Bay of Uri," Fig. 141, and "Volcanic Group of the Hohgau," Fig. 138), and from Baltzer ("View near the Grimsel," Fig. 37, and "View of the Jungfrau," Fig. 124), are the only illustrations which present to the eye of the reader scenic effects in combination with geological or physical truths. Like the text of the book, the illustrations are too technical for a thoroughly popular book on "Scenery." On the other hand, if the book lacks in imagination and style, it is not wanting in valuable and trustworthy facts, and these may be enough for the utilitarian mind.

A standard work amongst us already shows what can be made of the "Scenery" of a country in the hands of a geologist who is gifted with an artist's feeling for nature, and is a master of style. I refer to Sir Archibald Geikie's "Scenery of Scotland." Without this, we might have demanded less from Sir John Lubbock in his "Scenery of Switzerland." As it is, he has conferred a boon on the travelling English public, and broken new ground in the literature of the Swiss Alps.

MARIA M. OGILVIE.

THE TOTAL ECLIPSE OF THE SUN.[1]

III.

TRONDHJEM, *August* 14.

SINCE writing my last notes, the eclipse has come and gone, and we are homeward bound, rather depressed but satisfied that the *Volages* and ourselves had done our duty, and that it was Dame Nature alone who was to blame.

Although on the 8th the weather in the forenoon was very fine and promising, towards the latter part of the day a change set in, and dark clouds came up.

Captain King Hall, who came over from the ship in the afternoon, soon detected what was wrong; there were two currents, an easterly and a westerly one, contending for mastery. This elemental war was watched with anxiety for two or three hours, and at times the weather chances improved, but later rain set in, and we could only hope against hope. It rained during our dinner-hour in the tent, an excellent one lent us by the War Department, kept dry under foot by a tarpaulin, and a deep trench outside cut in the peat. Lieut. Martin, the navigating officer, to whose constant care many of the admirable arrangements on the island were due, who had not only taken charge of the integrator, but who has *ipsissma manu* put up all three of the discs,[2] remained on shore and did the honours.

A dim memory of the Latin grammar suggested champagne as an accompaniment of the well-cooked provender, for were we not bound on the morrow to face not only the *ingens æquor*, but, if all went well, something still more awe-inspiring.

Dinner over, the process of filling up all dark slides with the plates for the morrow was accomplished by Lieut. Martin, Mr. Fowler, and Dr. Lockyer, after which it was suggested that we should turn in early.

The Rev. E. J. Vaughan, my son, and I occupied one of the army tents, while Mr. Fowler and Lieut. Martin had their stretchers placed in Kiö Town Hall, as the 6-inch hut had been called. Our last survey of the weather was not one to raise our spirits to any great extent, but we were still buoyed up by the observed fact that, as a rule, the early mornings, looking eastward, were moderately clear.

As we expected the *Garonne*, on her return from Spitzbergen, to anchor near our island some time in the early morning, we had arranged with the guard to light a beacon fire directly she was sighted, to show them our whereabouts.

At 1.30 my son took it into his head to take a stroll around outside; his attention was first drawn to the beacon burning brightly on the hill, and the four marines in their lammy suits standing by the side of it. Looming up very black and large, close to our island, was the good ship *Garonne*, before her time. It was not long before we received two nocturnal visitors, Captain Harry and Mr. Müller, who had come off to see about the day's arrangements. The weather was anything but pleasant, and their return to the ship was heralded by a downfall of heavy rain.

At 4 a.m. the parties, led by Captain King Hall, began to arrive from the ship, the first thing they did on landing being to make cocoa and breakfast. Mr. Thomas, in charge of the chronometer, and the readers of the thermometers, were the first to take their stations, and for these at the time of first contact the work began with the sky almost entirely covered with clouds, with narrow

[1] Continued from page 421.

[2] It may be worth while to state that the eye-pointers used in connection with the discs were impromptu affairs made by the ship's carpenter, but they promised to work well. There must be fine adjustments, because it is not likely that the point to be occupied by the eye will be calculated to an inch. For these adjustments, then, we have first a horizontal bar, on which hangs a vertical piece of wood about ten inches long, free to slide. On this piece of wood slides up or down a piece of brass carrying a pointer marking the place of the eye; this is brought into position at the beginning of totality by the amanuensis.

breaks near the sun's place, and wider ones near the horizon, a condition of things which relieved Mr. Fowler from his spectroscopic determination of the beginning of the eclipse.

Gradually everybody fell into their stations; the sketchers went up the hill, but there was no need for them to carry out their instructions to shield their eyes by turning their backs to the sun.

There had been no sun to adjust the siderostat, so it was clear that the 9-inch prismatic camera would in all probability not be employed. Still Dr. W. Lockyer stood by at the mirror to make final adjustments.

A few minutes before totality, the delicate crescent was seen dimly through one of the breaks. I watched it in the $3\frac{3}{4}$-inch for a minute or two, but the clouds closed up before the commencement. I gave it a little time, and then gave the signal, "Go," in order especially to start the 6-inch prismatic camera, as the important ten-

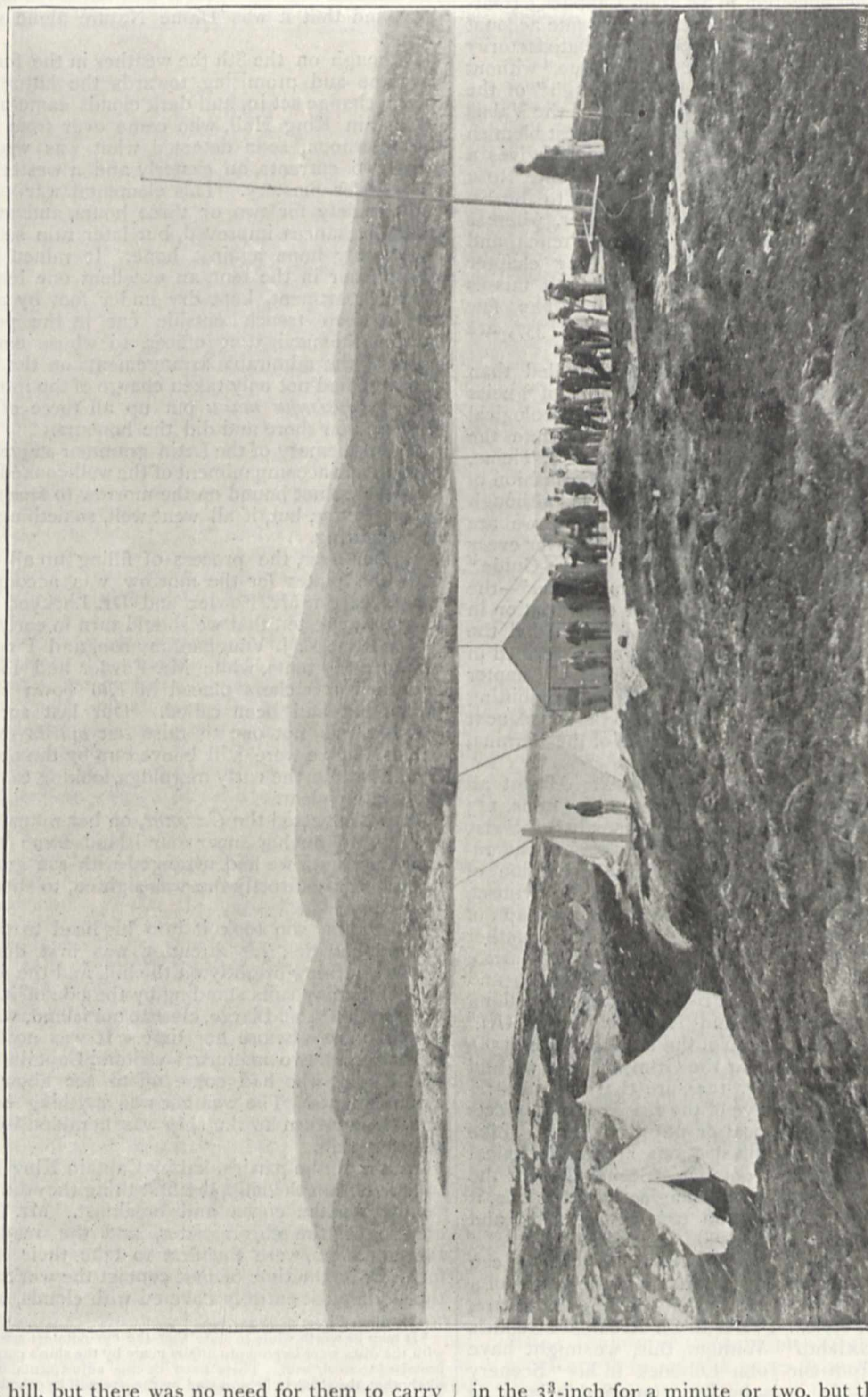

FIG. 9.—The Camp on Kiō Island, showing the Fjord and the Island and Land to the eastward.

seconds-before-totality-signal could not be given in the way agreed upon. All the photographic work, with the exception of the 9-inch, then went on as if the eclipsed sun were visible. The actual commencement of totality occurred shortly afterwards, the swoop of the shadow being almost felt. This instant was noted by Mr. Thomas amid a cry for lamps, especially from the time-keepers and some of the observers in the huts.

The time of the end of the eclipsed eclipse was also noted by Mr. Thomas, and the affair was over for most of us, although the colour observers and the meteorologists continued their notes till the fourth contact.

And then an unexpected thing happened. Captain King Hall called his men together, and, in a few admirably chosen words, expressed to me the regret of the *Volages* that such an important attempt to advance knowledge

Fig. 10.—The Eclipse Observers. Photograph taken by Mr. Fowler immediately the Eclipse was over.

had been frustrated. In reply, I told him that I thought an almost more important thing than the observation of a single eclipse had been accomplished. He had demonstrated that with the minimum of help, and that chiefly in the matter of instruments, such a skilled and enthusiastic ship's company as his could be formed in a week into one of the most tremendous engines of astronomical research that the world has ever seen; so that if the elements had been kind, all previous records of work at one station would have been beaten.

I added that I felt sure that the leaders of British science would thank him, his officers and men, for what they had done in aid of science when it came to be known, and further, that the kindness which the eclipse party had received on board the *Volage* had inspired a gratitude which it was not easy to express in words.

The party subsequently fell in to be photographed by Lord Graham and Mr. Fowler; then away to the ship for breakfast, and a curtailed Church service.

The repacking of the instruments was begun after breakfast, as the *Volage* was to rejoin the squadron the next day. Under these circumstances the Town Hall was left standing for the benefit of the friendly Lapps whose island we had invaded, but who seemed rather to enjoy our doings than otherwise. Talking of the Lapps, it would be interesting to know the Lapp mythology and folk-lore concerning eclipses. Immediately after totality, or rather so soon as it was light enough to render the channel separating Kiö from the island to the eastward clearly visible, we saw a large boat full of Lapps firing a *feu de joie*. The fact may be chronicled. I was all the more struck by it, as it seemed to be possibly connected with the Eastern custom to light fires to frighten away Rahoo, whose swallowing of the sun causes the eclipse.

It seemed quite certain that the parties at Vadsö had fared no better than ourselves, and this was confirmed by the news brought by the *Calypso's* steam cutter in the afternoon. This cutter subsequently conveyed my son and myself to the *Garonne*, meeting her about a mile outside Kiö, and while the island was being rapidly left astern, full particulars were told me of all the camps which many of my shipmates had visited after the eclipse.

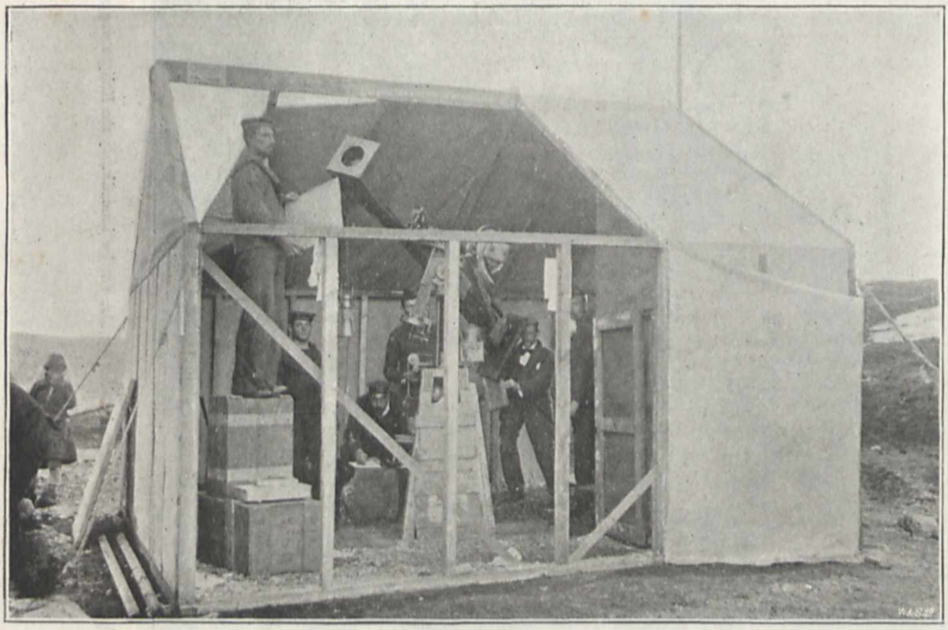

FIG. 11.—The 6-inch Hut, showing Mr. Fowler and his Assistants at drill.

It was at Hammerfest that we first had news of any success, and that at Bodö. I had heard that there was a strong party of German astronomers at this place, but one of the fortunate ones, who subsequently came on board, told me, to my great regret, that there were no fixed instruments there at all, and that the photographs of the corona were taken with a small camera of the ordinary make.

Since my return home, it has been rendered evident that in inflicting upon us at Kiö so great a disappointment, Dame Nature was not really cruel, but was pointing a moral, namely, that in attempting to obtain records of eclipses, no stone should be left unturned in occupying every coign of vantage, however inconvenient or unpromising.

Hence she allowed a grand success to be scored at Novaya Zemlya, which would not have had a British observer within hundreds of miles had it not been for the chapter of accidents and the public spirit of Sir George Baden-Powell, who took a party there in his yacht *Otaria*. In this party was Mr. Shackleton, one of the assistants in the Solar Physics Observatory, who did such good work during the eclipse of 1893 in Brazil, and who, as already stated in NATURE, was hurriedly equipped after the larger eclipse instruments had been sent off.

It is on his results that I wish here to say a few words. I am sorry to say he is too unwell to give an account himself of his doings, but I have gathered from an article in the *Yorkshire Daily Post* that the voyage itself was by no means uneventful.

He left home on July 7, and joined the *Otaria* at Hammerfest, whence, after touching at Vardö, the party sailed for Novaya Zemlya, making for the Samoyede settlement of Karmakul, in the southern island. The intention was, after meeting some Russian astronomers, and obtaining information as to the navigation, to take up a point of observation some ten miles further south, in Gooseland, on the central line of the shadow-path. Although the party had not a very good chart—no trustworthy ones of these remote regions being published—they got into the bay on Bank Holiday Monday, and were going at a good speed—about ten knots—when the vessel gave three bounds and stood still, heeling over on her side.

The account continues:—

"Everybody hung on to something, for it was impossible to stand. Fortunately, however, the reef was only of soft rock, and it did little damage to the ship; only for four days we remained like that, about a mile away from the nearest land. We could not walk except by holding on to ropes, and had to get our meals on our knees or on the floor with cushions. After four days' hard work the sailors nearly emptied her, and pumped out all the drinking-water, and then at a high tide pulled her off."

It appears that

"The mishap arose from a little want of familiarity with the Russian cartography of these parts, which is naturally better than ours. It turned out that the soundings of the deeper portions were, so to say, in fathoms and the shallower in feet. A few of the deeper soundings having been verified by the lead, the rest were taken for granted, with the unpleasant result already detailed."

Still, in spite of this mishap, everybody working with a will, things were more or less ship-shape on the eclipse morning. There had not been many opportunities of adjustment, but, not unmindful of possibilities, I had taken the precaution of having every portion of the more important instruments adjusted, and each adjustment plainly marked before I sent it off.

Mr. Shackleton obtained twenty-one photographs with the prismatic camera, thirteen during totality, and five of the corona. I have already enlarged and begun to discuss these photographs, and I have seen enough already to be able to say that in my opinion the results obtained are of the highest possible value. In fact, we may almost say that the long-talked-of "flash" has at last been photographed. This brings a test to apply to contending theories, and there will be a good deal to be written about it later on.

It is not too much to say that "the winter of our discontent" at Kiö is turned into "glorious summer" by the sun of Novaya Zemlya!

I must not forget to add that the photographs of the corona, though they are of much lower value from the theoretical point of view, will be very useful in enabling the change in the appearances of the corona from eclipse to eclipse in relation to the sun-spot period, to be chronicled.

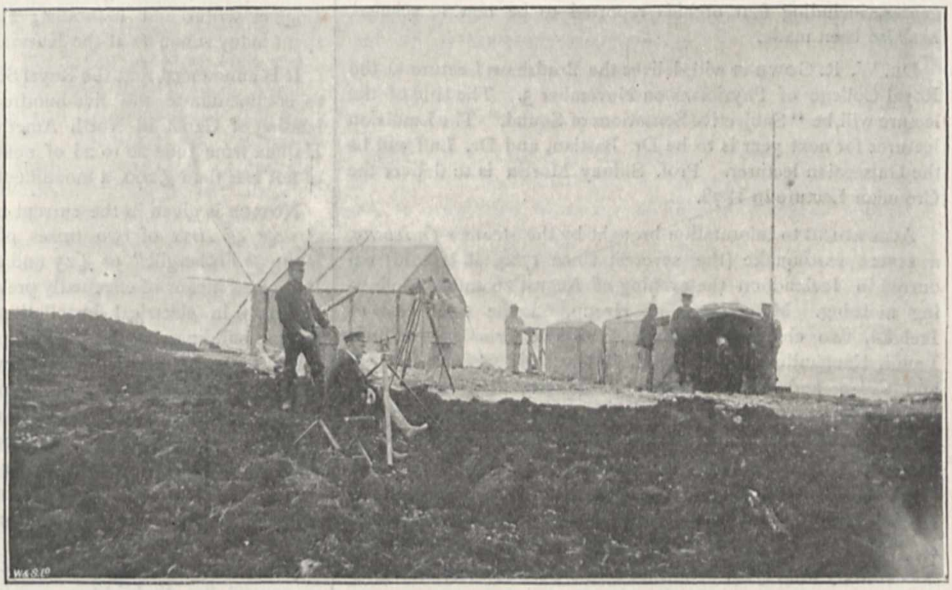

FIG. 12.—Lieut. Martin, R.N., setting up a disc.

The *Yorkshire Daily Post* states that Dr. Stone, who also accompanied Sir George Baden-Powell, has obtained some photographs of spectra.

I must be permitted one other extract from Mr. Shackleton's statement, as it indicates the success of Sir George Baden-Powell's cruise in another direction, and is interesting as an account by an eye-witness of a most interesting event.

"After the eclipse we were busy repacking and getting all on board again. Our intention had been to go to the northern island to see about the safety of some stores which had been left there for Dr. Nansen, but we found it prudent to make direct for Hammerfest. Some of the Russian astronomers were about to make the attempt to cross Novaya Zemlya by means of dogs and sledges. . . ."

"At Hammerfest, on our return, we heard that Dr. Nansen had arrived outside, and as the steamship *Thor* came in and dropped anchor alongside, the intrepid explorer recognised Sir George, whom he knew well, and halloed, 'Hallo, Baden-Powell, is that you? I did'nt expect to see you here.' Our cutter was out, and at once Sir George was rowed off to the *Thor*. Dr. Nansen returned with him immediately, to the disappointment of the Norwegians, who were playing their National Anthem, and making other demonstrations in his honour. This was on Tuesday, the 18th. Mrs. Nansen arrived by express steamer, and the Doctor was very anxious to see her again. When she arrived there was an affecting scene. The reunion proved too much for the feelings of the faithful wife, who fainted away, and did not recover consciousness for a considerable time. Then came redoubled rejoicings. The people of Hammerfest were too much delighted to leave their countryman much opportunity of private happiness, and made a feast in the public hall. Dr. Nansen was very anxious about the *Fram*, though he felt quite confident that she would be coming in. 'It is only,' said he, 'a question of a week or two,' but at the same time he appeared disappointed that she had not preceded him. Our yacht took Nansen on to Tromsö, but I left her at Hammerfest to return by express steamer. The *Fram*, as you will have seen from the papers, turned in near Tromsö. When our steamer reached Tromsö the people there were very much disappointed that we had not brought Nansen back with us. At Bodö we learnt of the receipt of a telegram announcing that the *Fram* had returned, but at first were inclined to treat the news as a joke. It, however, turned out to be correct; so for the second time we hoisted all our flags and bunting in honour of the Arctic exploring party."

Mr. Shackleton is loud in his acknowledgment of the kindness shown him by Sir George and Lady Baden-Powell, and they may, I think, rest assured that the scientific public of these islands, to speak of no wider territory, are grateful to them for their efforts in the cause of science.

J. NORMAN LOCKYER.

NOTES.

THE Sanitary Institute has been holding its Congress at Newcastle-on-Tyne during the past week, and has got through a great deal of work. The Congress was opened on September 2 by the Duke of Cambridge, as President of the Sanitary Institute, after which the inaugural address was delivered by Earl Percy, the President of the Congress.

THE steam-yacht *Windward*, with four members of Mr. Jackson's expedition on board, arrived in the Thames on Saturday. The yacht was the bearer of a voluminous mail from the leader of the expedition, some valuable maps, and several cases of scientific collections. The returned explorers, as was to be expected, had a narrative of the highest interest to relate; but as this has been very fully reported by the daily press, we need do no more than report that Mr. Jackson has been able to confirm some of the more important discoveries of last year, and to produce a map of Franz Josef Land, which for the first time lays down with approximate accuracy its geographical outline, and at the same time entirely alters the previous records. Valuable botanical discoveries are reported to have been made, and numerous photographs taken of birds and beasts of the country in their native habitat and under ordinary conditions.

After an absence of rather more than two years, Dr. Forsyth Major has returned to England from his scientific mission to Madagascar. His task was a very difficult one to perform, in consequence of the unsettled state of the country at the time of his visit, but Dr. Major seems to have succeeded in doing some solid scientific work. The explorer's collections have been deposited in the Natural History Museum, and include many specimens of *Æpyornis* bones from the marshes at Sirabé, and an extensive series of skins representing the recent fauna of the island. A fine collection of specimens of the flora of Madagascar, including four orchids reported to be new to science, has also been made.

Dr. W. R. Gowers will deliver the Bradshaw Lecture at the Royal College of Physicians on November 5. The title of the lecture will be "Subjective Sensations of Sound." The Lumleian lecturer for next year is to be Dr. Bastian, and Dr. Luff will be the Gulstonian lecturer. Prof. Sidney Martin is to deliver the Croonian Lecture in 1898.

According to information brought by the steamer *Quiraing*, a severe earthquake (the severest since 1784, it is said) occurred in Iceland on the evening of August 26 and the following morning. Many farms at Hrepp, on the east coast of Iceland, two churches, and nearly all the farms in Hollum, Laudi, Kangaullum, Hollkrapp and Fgolshlid were destroyed, and sheep and cattle killed. Reykjavik, Bargarfjord and Hrulafjord suffered slightly. No lives seem to have been lost. The centre of the disturbance was apparently Hecla, where an eruption appeared imminent.

A Reuter telegram of September 2, from Yokohama, reported a disastrous earthquake in the north-east provinces of Japan on the evening of August 31. The town of Rokugo was entirely destroyed, and other towns were severely damaged. Many lives were lost. On the same day extensive damage was done in the southern parts of Japan by a typhoon.

The death is announced of Mr. R. W. R. Birch, a hydraulic and sanitary engineer of repute. Mr. Birch had been for many years a member of the Council of the Sanitary Institute, and of the Royal Meteorological Society.

News has come from Annemasse (Haute Savoie) of the death of M. Henri Aimé Résal, the mining engineer. M. Résal, who was the author of numerous books on mining mechanics, was a member of the Academy of Sciences, editor of the *Journal des Mathématiques Pures et Appliquées*, and President of the Société Mathématique de France. He was born in 1828.

The death is recorded, at the age of seventy-three, of Prof. Egli, the geographer, who is perhaps best known for the "Nomina Geographica" which he edited.

The new Gatty Marine Laboratory at St. Andrews, intended to replace the wooden structure in which Prof. McIntosh has worked for the past ten years, is to be formally opened on October 8. Its more noticeable features will be a tank-room 30 feet square, and a research-room of the same dimensions. The latter is being fitted to accommodate six workers.

The fungus foray of the Yorkshire Naturalists' Union, which has now been for several years an annual event, is to take place this year at Selby, from which as a centre excursions are to be made to various woods in the East and West Ridings, on September 19, 20, 21, and 22; the members of the party meeting each evening at the "Londesborough Arms," to compare notes and arrange the fungi gathered. On Monday evening, September 21, a conference will be held, at which papers will be read by Rev. Canon Du Port, Mr. George Massee, Mr. Carleton Rea, and Mr. Harold Wager, and in illustration of their remarks a lantern will be provided by Mr. W. Norwood Cheesman. Mr. A. Clarke will exhibit a number of stereoscopic photographs of fungi, and microscopes will also be provided. Mycologists who may wish to attend will be heartily welcomed, and circulars will be sent on application to Mr. W. Denison Roebuck, Sunnybank, Leeds, or to Mr. W. Norwood Cheesman, The Crescent, Selby.

A block of granite bearing the following inscription has, says the *Academy*, been recently placed on the southern shore of the Lake of Sils in the Engadine:—"In memory of the illustrious English writer and naturalist, Thomas Henry Huxley, who spent many summers at the Kursaal Hotel, Maloja."

It is announced that the Royal Society of Canada has resolved to commemorate the five-hundredth anniversary of the first landing of Cabot in North America by holding a meeting at Halifax from June 20 to 26 of next year, and to erect, at a cost of not less than £200, a monument at Sydney in Cape Breton.

Notice is given in the current number of the *Journal of the Society of Arts* of two prizes offered by the Society. One is the "Fothergill" of £25 and a silver medal, for a paper on "the best means of effectually preventing the leakage of current to earth in electrical installations from generating heat and setting buildings on fire." The paper should consist of about eight thousand words, and be written with a view to being read and discussed at an ordinary meeting of the Society. Papers submitted for the prize must reach the Secretary by October 1 of this year. Each paper must be type-written, and bear a motto, the name of the writer being enclosed in a sealed envelope with a similar motto. The other prize announced is a gold medal and the sum of £20, and is to be bestowed, under the terms of the Benjamin Shaw Trust, "for any discovery, invention, or newly-devised method for obviating or materially diminishing any risk to life, limb, or health, incidental to any industrial occupation, and not previously capable of being so obviated or diminished by any known and practically available means." Descriptions of the inventions of intending competitors must reach the Secretary of the Society of Arts not later than December 31, 1896.

The Sanitary Institute has just issued a list of its twenty-second course of lectures and demonstrations for sanitary officers and students. The course, which is to be commenced on Monday, September 28, by a lecture, by Mr. Wynter Blyth, on "The Education, Status, and Emoluments of Sanitary Inspectors," has been arranged for the special instruction of those desirous of obtaining knowledge of the duties of sanitary officers, and of others desirous of obtaining a practical knowledge of sanitary requirements and regulations. The lectures will be delivered at the Sanitary Institute, London, and the introductory lecture is to be free.

Captain Robertson, of the Dundee whaling vessel *Active*, which has just returned from a voyage to the Arctic regions, has, says the *Times*, forwarded to Mr. Dickson, of Oxford, the result of certain observations made, at the request of the latter, during the cruise, together with samples of the water through which the *Active* sailed. The observations were taken with a view to ascertaining the distribution of food fishes in relation to their physical surroundings; and the samples of water brought home number 130, taken from the sea each day at noon, the surface temperature and other particulars having been noted. It is understood that the results of the inquiries will be communicated to an international congress of men of science interested in this and kindred questions.

AN account of an interesting plant which has the apparent property of turning its leaves in a north and south direction, thus behaving like the needle of a compass, is given in *Garden and Forest*. Mr. E. J. Hill, of Chicago, who seems to have been investigating it, gives the name of the plant as *Silphium lacinatum*, and says that the *Silphium terebinthinaceum* is affected in the same way, seventy-five per cent. of the latter orienting themselves in the manner mentioned above. The tendency to orientation seems to be a function of the ages of the leaves in question, the younger ones being said to point more accurately north and south than those of greater age, the latter falling off and therefore supplying an insufficient amount of evidence. It is mentioned that Sir Joseph Hooker remarked the uses which might be made of the peculiarity of this plant; it is stated, also, that he was able when travelling to note perfectly the change in direction of the train by observing the general appearance of these plants which were scattered over the plain.

IN consequence of the great number of earth movements that occur in Turkey and on the boundary of the Ottoman Empire, the Meteorological Observatory of Constantinople had been charged to make a study of them. The first year's observations were begun on January 1, 1895 and the director, Dr. Agamennone, has given in the *Bulletin* some details of the results obtained. The mean number of movements per day amounted to over two, the total number amounting to 753, and out of these 400 had been observed in Turkey, 236 in Greece, and 56 in Bulgaria. Tabulating these movements in order of their magnitude it is shown that the small ones are the most frequent, amounting to 519. The moderate ones are 225 in number, while the remaining 9 have resulted in large calamities. The importance of this new branch will be demonstrated when the observations extend over a larger period of time, as certain marked indications, which appear to precede large disturbances, will be more fully studied. In this way warnings may be eventually given of disturbances likely to do damage.

The current number of *Kosmos* (No. 606) gives the results obtained by Mr. Eginitis of the velocity of the earth-wave during the earthquake at Constantinople. Employing the method of Dutton and Hayden, he finds that the depth of the centre of disturbance was 34 kilometres, a distance not very different from that obtained by Mr. Lecomte. The velocity of the wave he found to be between 3 and 3·6 kilometres per second, a value equal to that found for the progress of the wave movement in the last earthquake at Locride. Mr. Eginitis reminds us of the seismic period which two years ago affected the eastern part of the Mediterranean, Zante, Thebes, Locride, Constantinople, and Sicily, without mentioning some of the minor movements in Europe and Asia. These countries lie nearly in a straight line.

IN the *Comptes rendus* for August 17, M. Berthelot gives an interesting account of some recent explorations of the copper mines of Sinai, the most ancient workings mentioned in history. These mines were worked by the Egyptians from the time of the third dynasty (about 5000 B.C.), and were abandoned about 3000 years ago owing to the poorness of the deposits and their distance from Egypt proper. The ores consist of turquoises, containing about 3·3 per cent. of oxide of copper, and sandstone impregnated with carbonate and hydrosilicate of copper, the metal forming two or three per cent. of the rock. The minerals were carefully sorted and fused with oxide of iron and carbonate of lime in crucibles made of quartzose sand cemented by clay. The furnaces were built of sandstone, and the fuel used was wood. Both fuel and carbonate of lime must have been brought from some distance. Some of the slags consist largely of $2FeO.SiO_2$, with the addition of crystals of magnetite; others are less basic, and contain lime. It is remarkable that the existing fragments of furnaces and crucibles, the slags and the scoriæ contain the same products, and show the same characteristics as those in modern smelting-works, and that the general method of extracting the metal differed little from that still employed in the treatment of similar ores. At a time when weapons of wood and stone were used by the Egyptians the copper must have been highly prized by them; moreover, the hand-labour of slaves cost little. The continuous working of such poor deposits need not therefore occasion surprise.

THE Vienna correspondent of the *Times* states that an interesting report of its first year's work has just been issued by the Austrian State Institute for the preparation of anti-toxin serum. Of 1100 cases of diphtheria treated with the serum, 970 recovered, a very favourable result compared with the previous mortality. When the remedy was applied on the first and second day of the illness, the percentage of deaths was only 6·7. After the third day, however, the mortality reached 19 per cent., rising to 33 per cent. after the sixth day. Of 318 cases of preventive inoculation only twenty were attacked by the disease, mostly in a mild form, and all recovered.

THE winter session of the medical schools and colleges in the United Kingdom will open at the beginning of next month, and in connection with many of the institutions an address or a lecture will be delivered by a prominent medical man. We glean from the *British Medical Journal* the following information respecting the opening arrangements of most of the schools:—St. Bartholomew's Hospital College session will begin on October 1, when (or on the succeeding day) a dinner of past students will be held in the great hall of the hospital. Charing Cross Medical School will re-open on October 5, on which day, at 4 p.m., Prof. Michael Foster will, as has already been stated in these columns, deliver the first Huxley lecture on "Recent Advances in Science, and their bearing on Medicine and Surgery." At the opening of the St. George's Hospital School, on October 1, an address may be expected from Mr. W. Adams Frost. In the evening of that day the annual dinner of past and present students will take place at the Hôtel Métropole. The winter session of Guy's Hospital Medical School will begin on October 1. The biennial festival dinner of the school will be held the same evening at the Hotel Cecil. The London Hospital Medical College will re-open on October 1, and in the evening the annual dinner will take place in the college library. An introductory address will be given at the opening of the session of St. Mary's Hospital School, on October 1, by Mr. Morton Smale. The school's annual dinner will be held at the Holborn Restaurant on the same day. At the Middlesex Hospital School Dr. W. Essex Wynter will, on October 1, deliver an address, and past and present students and others will meet for dinner at the Café Royal in the evening. At the school in connection with St. Thomas's Hospital the prizes will, on October 2, be distributed by the Lord Justice Lindley, and in the evening former and present students will dine together at the Whitehall Rooms. The session of the Faculty of Medicine of University College will commence on October 1, when Prof. Sidney Martin may be expected to deliver an introductory address. Past and present students will meet for dinner in the evening at the Hotel Cecil. Dr. Wills will deliver an address at the re-opening of the Westminster Hospital Medical School, and the prizes will be subsequently delivered by Archdeacon Furze. The annual dinner will take place in the evening of that day at the Westminster Palace Hotel. Mr. Jonathan Hutchinson will, it is announced, deliver an introductory address at the opening of the session at the Owens College on October 2. At University College, Liverpool, the session will commence on October 1, on which date Sir William O. Priestley will distribute the prizes. Mr. Victor Horsley has consented to open the session of the Medical Department of the Yorkshire College, on October 1, with an introductory address; he will also distribute the prizes. The winter session of the Queen's Faculty of Medicine, Mason College, will commence on October 1; so also will the sessions of the College of Medicine, University of Durham, and the Sheffield School of Medicine. At Durham, the scholarships and prizes will be distributed by the Bishop of Newcastle; and at Sheffield, Sir Henry Littlejohn will deliver an introductory address.

The current issues of the *Lancet* and the *British Medical Journal* are almost wholly devoted to information likely to be of service to those who are students, or who are about to become students, in one or other of the medical schools of this country. The *Chemist and Druggist* for September 5 contains articles and details specially written for the future chemist and druggist.

Mr. Edgar Thurston, Superintendent of the Government Museum, Madras, has, with the assistance of Mr. T. N. Mukerji, prepared a copious index to the valuable "Dictionary of the Economic Products of India," by Dr. G. Watt, a review of which appeared in our columns of November 1, 1894. Those who have to refer from time to time to Dr. Watt's great work will, we have no doubt, be grateful to the compilers of the present volume. It is issued from the office of the Superintendent of Government Printing, Calcutta.

The Sub-Committee charged with the reception of the British Association have done a very excellent work in compiling an interesting handbook to Liverpool and its neighbourhood, entitled "A Scientific Handbook to Liverpool," a work which, though mainly intended for the benefit of those attending the meeting, will possess a considerable value after the meeting is over. We do not know to whom the happy idea originally occurred, but are probably not far wrong in attributing it to Prof. Herdman, who certainly undertook the duties of editing and general arrangement, and has carried them out very happily. The various authors by whom he has been assisted are not only peculiarly qualified to deal with the subjects severally treated, but each has apparently been solicitous to collect a mass of details which will save any one interested in a similar research a great amount of time and trouble. We have only space to give the bare titles of the several chapters; but this is of the less consequence, as the little book, it may be hoped, will find its way into the hands of all intending visitors. Mr. W. H. Picton, able to draw on the work and research of his father, deals with history and antiquities; while Mr. G. H. Morton is responsible for the notes on the geology of the district. Dr. Forbes, of the Liverpool Museum, treats of the vertebrate fauna; Prof. Herdman reserving to himself the marine fauna. Mr. W. E. Sharp and Mr. R. Brown share the entomological and botanical interests. Mr. Plummer gives statistics connected with the climate of Liverpool and Birkenhead; and Dr. Oliver Lodge contributes an article on the Mersey and its tides. The article on the Docks and the principal engineering features of the city is jointly produced by Prof. Hele-Shaw and Mr. Percy Boulnois, the city engineer; while Sir W. Forwood treats of the city's trade and commerce. The history of the chemical industries is entrusted to Dr. Kohn. This list of names amply justifies the remark that each section has been entrusted to the authority best qualified to deal with it. An appendix supplies some useful information concerning the Isle of Man, where it is proposed to hold a subsidiary meeting at the conclusion of the Liverpool meeting properly so called. Five maps are included in the book—a geological map of the district, a biological chart of the Irish Sea, a chart of Liverpool Bay, a geological map of the Isle of Man, and a chart of the sea round the southern extremity of the isle, including the biological station at Port Erin. Such a book cannot but add greatly to the interest of the meeting, and afford much valuable instruction not only to the members of the British Association, but also to the inhabitants of Liverpool, who must have often felt the want of such a handbook. It is issued for the British Association by Messrs. Philip, Liverpool.

In addition to the above-mentioned guide-book, the British Association has issued, also through Messrs. Philip, an "Excursion Guide Book," in which is to be found just the information likely to be of interest and use to those taking part in the numerous outings arranged; and being partly the work of leaders of the excursions, and under the editorship of one of the local secretaries of the meeting, its contents may be thoroughly depended upon.

The additions to the Zoological Society's Gardens during the past week include a Mona Monkey (*Cercopithecus mona*, ♀) from West Africa, presented by Mr. F. Wyville-Thomson; two Garnett's Galagos (*Galago garnetti*) from Mombassa, East Africa, presented by Rear-Admiral Rawson, C.B.; a Brown Capuchin (*Cebus fatuellus*, ♀) from Guiana, presented by Miss Cissie Wade; a Suricate (*Suricata tetradactyla*, ♀) from South Africa, presented by the Rev. Wilfred Fisher; an American Black Bear (*Ursus americanus*, ♂) from Vancouver Island, presented by Lieut. Bryan Godfrey Faussett, R.N.; a Llama (*Lama peruana*, ♂) from Peru, presented by the executors of the late Colonel J. T. North; a Moorish Tortoise (*Testudo mauritanica*), a Chameleon (*Chamæleon vulgaris*) from North Africa, presented by Mrs. Fraser; an Alligator (*Alligator mississippiensis*) from Florida, presented by Mr. Hugh Mytton; a Brown Capuchin (*Cebus fatuellus*, ♀), a —— Bell Bird (*Chasmorhynchus*, sp. inc.) from Guiana, three Painted Terrapins (*Clemmys picta*) from Nova Scotia, deposited; a Long-tailed Glossy Starling (*Lamprotornis æneus*), two Yellow-backed Whydah Birds (*Coliopasser macrurus*, ♂ ♀) from West Africa, purchased.

OUR ASTRONOMICAL COLUMN.

New Comet.—A telegram from Kiel announces the observation of Comet Giacobini on September 4 last, at 8h. 44m. Nice mean time. Its position was then R.A. = 17h. 10m. 30s., Declination = − 7° 29′. The given movement per day is 1·8m. in R.A. and 0′·25 in declination, so that the comet should be looked for soon after sunset, the above position being about 22° due south of α Herculis, making also a very obtuse isosceles triangle with ζ and ν Ophiuchi. Another telegram gives particulars of a second observation of Comet Giacobini at Nice, on September 6, 8h. 26·5m. Its position as observed was R.A. = 17h. 14m. 16s.; Declination = − 7° 49′. The comet is noted as very feeble.

Comet Brooks (1896).—A telegram received from Kiel announces the observation of this comet at Geneva on September 4, at 10h. 0m. It was then in R.A. = 13h. 30m.; Declination = + 55° 40′. This gives a position admirably suited for observation, being about 2° due east of ζ Ursæ Majoris. The motion of the comet is eastward. Another observation of the comet has been made at Lick Observatory. Its position as seen there on September 6, at 11h. 56·5m., was R.A. = 13h. 51m. 44s.; Declination = + 55° 25′. The motion per day is 6·5m. in R.A. and 36″ in Declination, the general direction being easterly. No mention is made of the appearance of the comet.

Telegrams to "Astronomischen Nachrichten," No. 3376.—We gather the following information from the current number of the above journal. Prof. Holden, writing from Mount Hamilton, dated August 11, says: "A telegram just received from Schaeberle says that the sky was wholly clouded at his eclipse station in Japan." Mr. Lowell telegraphs from his observatory at Arizona on August 31: "Companion Sirius re-discovered by Dr. See. Angle 219°. Distance 5″·9." Prof.

Pickering telegraphs, also on September 1, from Cambridge, Mass., to the following effect: "Bailey at Arequipa finds μ' Scorpii spectroscopic binary. Period 35h."

THE PLEIADES.—Some time ago, we gave an account of several legends and myths connected with that most interesting cluster of stars, the Pleiades. These myths were, for the most part, gathered from an article which appeared in *Globus* (Bd. 64, p. 362). It seems, however, that our stock is by no means complete, for Dr. Heinrich Samter, in the current number (Bd. 70, p. 176) adds considerably to it. We make this reference for those readers who take a special interest in folk-lore, and would wish to look up this article.

METEORS TRANSITING THE SOLAR AND LUNAR DISCS.—What apparently appear to be unique observations, recorded quite recently in America, are given in the current number of the *Revue Scientifique*. It seems that during the night of July 21 and 22 last, Mr. William Brooks, the director of the Smith Observatory at Geneva (New York), saw all at once a round dark body pass slowly before the bright disc of the moon, the latter being almost full. The apparent diameter of the body is given as about one minute, and the duration of its transit amounted to three or four seconds, its direction being from the east towards the west. The second observation was made about midday on August 22, by Mr. Gathmann, an American astronomer, but the place of observation is not stated. He saw a meteor pass before the solar disc, occupying a period of time amounting to eight seconds in its transit. It is suggested that this body is one of a great number which circulates round our planet; it does not seem at all necessary to assume that our earth is the centre of attraction, indeed it seems rather improbable, as the observation would then, no doubt, be more common. Our present idea of space is that it is a meteoritic plenum, and full of bodies traversing through it at various speeds and at various distances from us, so that the chances of making such an observation, especially at periods of shooting-stars, is not altogether impossible, but is likely to occur, provided the observer is fortunate and happens to watch a comparatively slow-moving meteor.

THE GREAT SEISMIC WAVE OF JAPAN.

FULL particulars of the terrible wave which devastated the coast of Japan last June, causing the destruction of 20,000 lives and 12,000 houses and other buildings, have recently been given in the daily papers. The official report made to the Japanese Government having now reached this country, it may be interesting shortly to summarise the particulars of this occurrence, and to give the causes which have been assigned for its creation; and also to refer to waves of a similar character that have occurred on former occasions and in other localities.

The wave appears to have originated at a short distance from that part of the coast of Japan which trends in a north-easterly direction from the northern part of Sendai, midway between Tokio and the island of Yezo or Hokkaido. From Kiukasan, the northern island of the Archipelago, the coast is fjord-like in character, abrupt mountain ridges running down almost to the water edge. In the bays and estuaries that interrupt the shore line several important towns and many fishing villages were situated; with a few exceptions these have all been destroyed. The distance over which the effect was felt has been variously given as extending over a length of coast of from 200 to 300 miles.

Suddenly, almost without warning, between eight and nine o'clock in the evening of the 15th, three successive waves, the highest estimated as being fifty feet in height, swept over the land bordering on the coast, and in a space of a few minutes had caused a frightful devastation of property and the death of nearly all the inhabitants. There was nothing to presage the disaster or give warning. The barometer gave no indication of anything abnormal in the atmosphere. About half an hour before the catastrophe three or four shocks of earthquake were felt—not violent shocks, but of the vertical kind, which are known to be dangerous. Shortly afterwards a booming sound came from the direction of the sea. At first the noise was only like that of a coming gale; rapidly it increased until the sound assumed the volume and din of artillery; then in a moment three successive waves, varying in height from twenty to thirty feet, came rolling on the shore. In a space of time of about two minutes these waves had accomplished their fearful work of devastation and ruin.

Beyond the destruction of life and property some remarkable incidents occurred. At Kamaishi one wave came curling round the land-locked bay from the left in a semicircle, meeting another wave, which came in from the right, and before the waters could recede a third wave came in from the centre. In five minutes the town was wiped out. Temples, houses, and vessels lying in the bay, were alike swept away, broken up and destroyed. A large two-masted schooner of 200 tons was left lying almost uninjured five hundred yards inland, in the centre of what had been a wheat field. Another had its bows stove in, its stern post and rudder carried away, its deck ripped open, and the planking of its sides broken in short lengths. Altogether nineteen schooners and junks were cast ashore. In one place, men swept out to sea from one side of a bay were thrown up alive on the opposite beach; and in another case, several persons were deposited on an island nearly three miles from the town whence the wave had carried them.

The disturbance was not felt at sea at any great distance from the shore. Fishermen engaged in their occupation near the centre of the disturbance off the coast of Shizukawa heard, as they supposed, the booming of big guns in the distance; looking seawards they saw the surface of the ocean heave in huge masses, which, after rising to a great height, broke in the middle and swept northward and southward, striking the coast with a deafening roar. The waves passed under the boats without swamping them, but the water in the vicinity of the shore remained so rough throughout the night that the fishermen could not make the land until the morning. In other parts fishermen, plying their trade four miles from the coast, on returning to shore in the early morning after the catastrophe, received the first notice of what had occurred; others, engaged three miles out in the same locality, encountered heavy breakers rolling from the north. A steamer which left Hakodate in the morning of the day of the disaster, and must have been near the scene of the calamity at the time it occurred, experienced nothing out of the common; and other passing steamers reported only an abnormal current.

The Japanese Government have self-recording tide gauges fixed at various parts of the coast. The three nearest stations to the scene of disturbance are situate at Ayukawa, in the Oshiaka district; at Hanasaki-mura, in the Hanasaki district; and at Misaki-Machi, in the Miura district in Choshi Bay. At the first station the sea had been calm all the day of June 15. Suddenly at 8.25 p.m. the water fell 7·9 inches; five minutes after it rose 4·59 feet; and after an interval of five minutes had fallen down again. After this there occurred a succession of waves at intervals of about four or five minutes. At 11 p.m. the height of the wave, as indicated on the gauge, was 6·56 feet; the difference between the maximum and minimum height of the waves being 8·86 feet. After this the water gradually subsided to the ordinary sea-level.

At the second station, at 8.50 p.m. the water fell 3·28 feet, followed by five or six disturbances in an hour. After this an accident to the gauge prevented any further record. At 8.10 the next morning, when the gauge was visited, the sea had become calm.

At the third station some small waves began to show at 8.40, their height being 7·90 inches, and occurring at intervals of five minutes, gradually decreasing in height until the normal condition was obtained.

From these records it appears that the influence of the wave was greatest at the north station, and that an interval of twenty minutes elapsed before the gauge at the southern station was affected.

The effect of this seismical disturbance of the crust of the earth was sensible all over its surface, so far as may be judged from the records of instruments thousands of miles distant. On June 15, the day of the earthquake at Japan, at about 8.30 p.m., Prof. Vicentini, in Italy, noted the commencement of the disturbance on the seismograph, and a similar disturbance was recorded on the instrument at Shide, in the Isle of Wight.

As to the cause of the disaster, Prof. John Milne, in an article in the *Geographical Journal*, states his opinion that this was due to a seismic, rather than volcanic origin. The disturbances which have occurred in this locality have been, without exception, confined to the eastern sea-board of Japan, where the land suddenly sweeps downward beneath the deep Pacific. Along the line of this submarine slope, which forms one of the longest and sharpest contours on the surface of the earth, earthquakes are frequent. Some opinions have been expressed that the disturbance had its origin in a sudden collapse of the sides of the subterranean crater known as the Tuscarora Deep, a triangle-like depression off the north-east coast of Japan, which has a depth of 4665 fathoms, or over five and a half statute miles. This deep, however, lies too far away from the supposed site of the generation of the wave. The kind of disturbance that probably occurred in the bed of the ocean may be illustrated by what happened on land at Bandai-San in 1886. Here millions of tons of earth and rocks were hurled in a given direction with such force that an enormous wave of solid material traversed a distance of many miles at great velocity. Any similar disturbance happening at the bottom of the ocean might fully account for what took place on the coast of Japan in June last. The earthquake which took place in Japan in 1891, the shock of which was so great as to be sensible in Europe, resulted in a fracture upon the surface of the earth for a distance of from forty to sixty miles. The ground, which on one side rises from 4000 to 6000 feet, was lowered relatively to that on the other side from 20 to 30 feet; river-beds were compressed, and valleys narrowed by the lateral movement.

That great submarine earthquakes result in the change of the ocean bed, is well known to those who have charge of cables near volcanic regions It has been ascertained that when a cable has been broken at two points, the soundings have shown that there has been so great an increase in the depth that it has been necessary to select a fresh line for the cable in order to avoid the site of the disturbance. That the movement originated in the bed of the ocean, is evidenced by the fact that deep-sea shell-fish were found stranded on the high ground swept by the waves; and that in one place the fishermen found their nets floating on the surface upside down, they evidently having been cast up by the submarine disturbance.

Ever since the ninth century records exist of earthquake-waves which have devastated these coasts, but in no case have the results been so disastrous as on this occasion. The great earthquake-wave of 1891 caused the loss of life of over 7000 persons.

The exact locality of the disaster extends from the island of Kinkwa-San on the south (N. lat. 38° 15', E. long. 141° 30') to Hachinohe on the north (N. lat. 40° 30', E. long. 131° 30'), the coast here assuming a convex shape. Between these points nearly every town and village were visited by the wave. The general direction of the wave appears to have been north by east.

Of previous examples of earthquake-waves, that due to the Lisbon earthquake of 1755 is matter of history. This wave rose to a height of forty feet in the Tagus, leaving the bed of the river dry as it rolled inwards. It was experienced at sea 120 miles west of St. Vincent, shaking vessels so violently that men were thrown from the deck; and its effect reached as far as this country, the water rising from eight to ten feet on the coast of Cornwall.

In 1868, and again in 1877, earthquake-waves rolled over the coasts of Peru, causing great devastation and loss of life. On the former occasion the U.S. warship *Watteree* was thrown up on the coast and carried inland one and a half miles; the second wave, in 1877, carrying it inland a still further distance. These waves, originating at a distance of about 9000 miles, off the South American coast, took nearly twenty-four hours before their effect reached the coast of Japan, where they rose and fell at intervals varying from ten minutes to half an hour, alarming the inhabitants and causing them to fly to the high land.

The volcanic upheaval at Krakatoa, in 1883, shook the whole of Java, and the sea-wave inundated the coasts of that country and Sumatra, causing a loss of 36,000 lives. The lava, mud, and ashes from this eruption darkened the air for fifty miles, and reddened the light of the sun for months after the catastrophe. The coast-lines were altered, and peaks on which lighthouses had been erected disappeared.

Several instances were given in NATURE of March 7, 1895, of earthquake-waves having been encountered by vessels at sea; and again, in November 10, 1895, of an earthquake-wave which burst on the shores of Madeira in 1891.

In January 1894, the *Normania* (of the Hamburg-American line), when 750 miles out from New York, encountered one of these waves. A stiff gale which had been blowing had moderated, and, while the vessel was running at full speed, an enormous wave was observed "masthead high" coming forward like a solid wall, and reaching as high as the bridge, wrecking the upper-deck-house, containing the music-room, ladies' room, and officers' quarters, and injuring several of the crew.

Numerous other instances could be quoted of these waves, which are frequently erroneously called "tidal waves," but which no doubt have their origin in some volcanic disturbance in the bed of the sea.

THE AMERICAN ASSOCIATION MEETING, 1896.

THE forty-fifth annual meeting of the American Association took place from August 24 to 29, at Buffalo, at which town it has now met four times, and although one of the smallest attended of recent meetings, seems to have been a very pleasant gathering. In most of the Sections full complements of communications were presented, notably so in those devoted to Chemistry, Botany, Geology, Anthropology, and Physics. The arrangements, a programme of which has reached us, appear to have been made with great care, and evidently no pains were spared to ensure the success of the meeting. Space will not permit us to print the addresses of the retiring President and Vice-Presidents; suffice it to say that they well sustain the standard of merit fixed by previous deliverances.

The retiring President, Mr. Edward W. Morley, took as the subject of his address "A Closed Chapter in Science." He spoke of the investigations into atomic weights of elements, in reference to their mutual relation so long supposed to be expressed in integrals in accordance with Prout's hypothesis. This hypothesis is now seen to be erroneous, so that it marks a closed chapter. The careful and repeated investigations of Morley himself and of others for many years, but mainly during the decade since the last Buffalo meeting, have proved that the ratio of atomic weights of hydrogen and oxygen, for instance, can only be expressed by a fraction, and is very nearly that of 1 to 15·88; it cannot possibly be that of 1 to 16. The same result has been found for many other elements with sufficient accuracy to establish the conclusions finally, and beyond the possible limits of error.

Mr. Carl Leo Mees, Vice-President of Section B (Physics), spoke on "Electrolysis and some associated Problems in Molecular Dynamics." In Section C (Chemistry), Mr. W. A. Noyes took as the subject of his address "The Achievements of Physical Chemistry." Mr. F. O. Marvin, in Section D (Mechanical Science and Engineering), discoursed on "The Artistic Element in Engineering." The subject of the address of Mr. B. K. Emerson, before Section E (Geology and Geography), was "Geological Myths." Section F (Zoology) was addressed by Mr. Theodore Gill on "Some Questions of Nomenclature." In Section G (Botany) the address was by Mr N. L. Britton on "Botanical Gardens." Miss Alice C. Fletcher spoke to Section H (Anthropology), on "The Emblematic Use of the Tree in the Dakotan Group"; and Section I (Social and Economic Science) was addressed by Mr. Wm. R. Lazenby, on "Horticulture and Health."

It will have been noticed that no mention is made in the foregoing list of Section A (Mathematics and Astronomy); but we are informed that Mr. Wm. E. Story, the Vice-President of the Section, was not present at the meeting, and his proposed address was not received, and could not therefore be delivered. The Vice-President of Section F (Zoology), instead of speaking, as he intended, on "Animals as Chronometers for Geology," spoke on nomenclature.

A commemorative meeting was held in recognition of the sixty years of professional work of Prof. James Hall. Prof. Hall was present at the meeting of the Association, as was another founder of the Association, Dr. Charles E. West, of Brooklyn.

Three founders of the Association have died within a few months, viz. Bela Hubbard, Thomas T. Bouvé, and Josiah D. Whitney.

The nominating Committee have presented the name of Wolcott Gibbs for President, and they recommend that the next meeting be a merely formal one, to be held at Toronto, August 17, 1897, to welcome the British Association for the Advancement of Science.

Among the business transacted was a resolution deprecating legislation against vivisection; while another favoured the metric standard of weights and measures, and recommended further legislation to secure its adoption.

APPLICATION OF RÖNTGEN RAYS TO THE SOFT TISSUES OF THE BODY.

WHEN the photographs which accompanied Prof. Röntgen's original paper were reproduced, the question was frequently asked, Shall we ever be able to photograph every part of the human skeleton? The developments have been very rapid, and now that it has been demonstrated that we can practically photograph the whole human skeleton in life, and throw shadows of a great portion of it upon fluorescent screens, we wonder the question was ever raised. It was quite natural that a similar demand should spring up for further extension of the art, so that other tissues than the osseous might be revealed by the same methods. Like many other observers, I early satisfied myself that we could examine and photograph certain organs within the cavities of some of the lower animals, such as the frog, rabbit, fish, &c. Further, in a considerable number of photographs of the deeper-seated structures, faint shadows of the human body were now and then obtained indicating the position of certain muscles, fasciæ, and even organs like the heart itself. While experimenting, like others, with the object of overcoming the difficulties of photographing the skeleton, I made a series of observations with a view to testing how far it would be possible to obtain photographs, or shadows upon fluorescent screens, of the contents of the three great cavities of the human body as well as the surrounding osseous walls. So far these experiments indicate promise of future development, and a few photographs are here reproduced, more by way of showing what may yet be accomplished than as an evidence of what has already been done.

In placing the following statements before the readers of NATURE, I desire to emphasise the importance of combining the study of the physical with the purely medical aspect of the question. To begin with, whatever progress may in the future be made with Röntgen rays, it must be remembered that the discovery itself came from the physical laboratory. Naturally, in the advancement of the study, certain aspects of the question will be more easily overcome by those familiar with normal and pathological tissues; others will just as naturally fall to be investigated by those engaged in physical research. Of course no line of demarcation can ever be drawn between these two, and the physician or surgeon who desires to pursue the subject must to a certain extent be conversant with physical science. On the other hand, the physicist will require to make himself somewhat familiar with the needs of those engaged in the study of animal and vegetable tissues. In this paper, therefore, while demonstrating some of the earliest examples obtained in this newer branch of the art, I desire to point out wherein we need the aid of those engaged in the physical laboratory. In so doing, I shall refer for the most part to the examination of the soft tissues of the human body, although it must never be forgotten that the use of Röntgen rays is not limited to any one part of the animal kingdom, and, further, that the structures in the vegetable kingdom are also being investigated by its means.

In attempting to photograph the soft tissues of the body, it might be thought they offered so little obstruction to the passage of Röntgen rays as compared with the bones, that less force would be required to demonstrate their presence. In other words, the natural suggestion was that if the bones of the extremities were to be photographed with certain apparatus in a given time, by diminishing the exposure we might be able to catch the soft tissues before they disappeared. This, of course, is true to a certain extent, and, in a certain number of my experiments, I was able, by carefully judging the exposure, to photograph not only the bones themselves in disease, but the fleshy parts, and this with such accuracy that the surgeon could see the internal pathological change and the external configuration of the part as well on the same plate. But when it came to the examination of the organs of the body, it was found that the rule did not apply as might have been expected, and instead of a less force it became evident that we would require more force. For example, in one successful attempt to photograph the lungs of the frog, I was able to demonstrate their presence and a deposit in one of the lobes of the right side, and this with an ordinary Paget plate, the exposure only being something like the time represented to give twenty successive flashes of the tube due to twenty interruptions of a mercury interrupter with a current registering ten volts and ten ampères across the terminals, the spark being about six inches, and the focus tube one of Newton's small earliest pattern. In this case, however, the

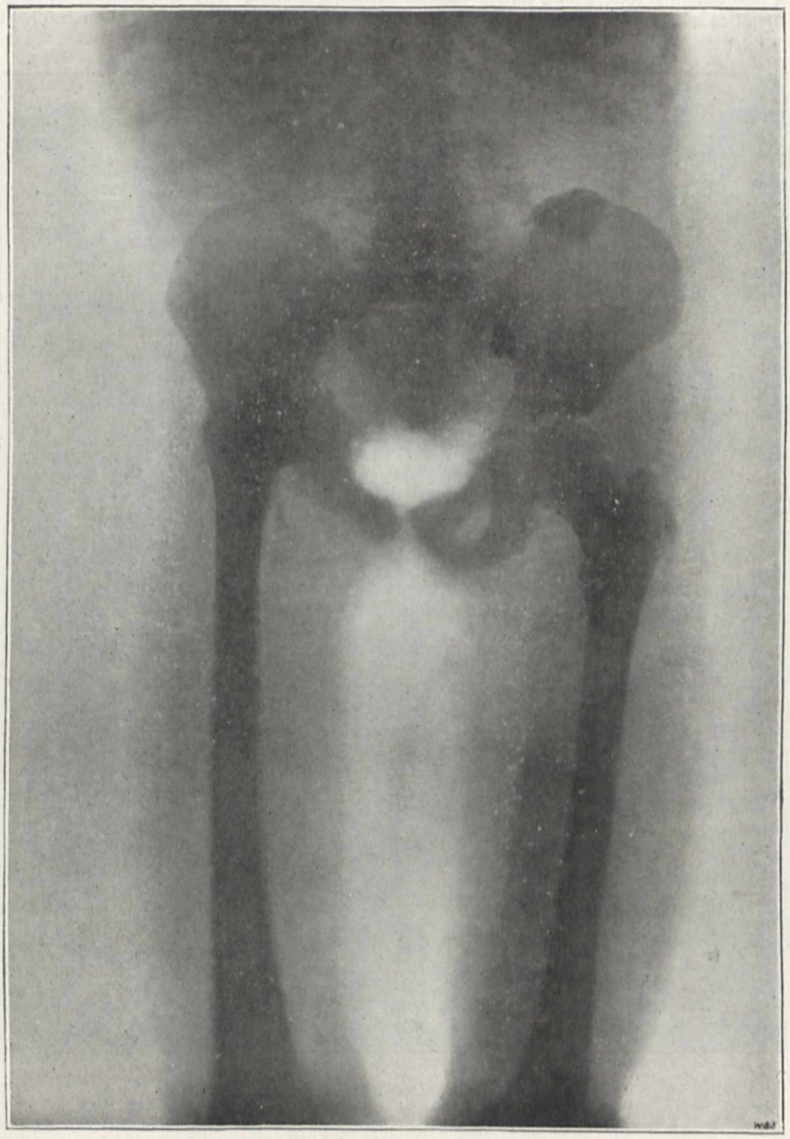

FIG. 1.—Pelvis of lad with femora, &c.

tube was removed six inches from the animal. Those familiar with this work will immediately see that, considering the difference in size of the human body, a tube placed at that distance could not possibly give the same result on a plate or fluorescent screen. To begin with, we know that there is a definite relationship between the distance at which the photographic plate is removed from the object to be photographed on the one hand, and the distance between the object and the Crookes' tube on the other. In other words, to get anything like sharp definition it becomes necessary to remove the tube to a considerable distance, which means of course loss of power, and consequently more difficulty in seeing objects on a fluorescent screen, and a longer time in exposing a plate. The distance must vary in given cases, and experience, after careful experiment, in the present state of our knowledge can only determine at what distance the tube is to be placed, although we very often get a valuable suggestion by first examining an object on the fluorescent screen, and noting the distance of the tube from the object.

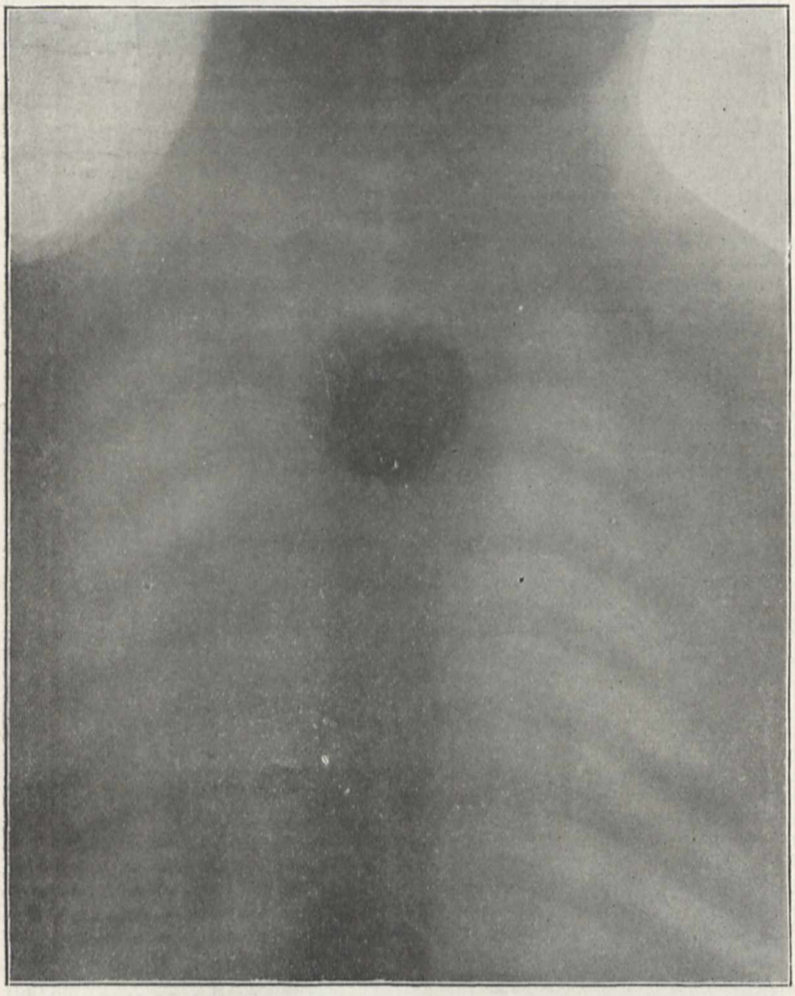

FIG. 2.—Coin impacted in gullet of boy aged six.

But another difficulty has now to be considered. Suppose we wish to try to photograph the heart. The patient must be placed on his face so that the organ may be as near the photographic plate as possible, and naturally the spine and other organs which we do not wish to be photographed will be between the object and the Crookes' tube. On the other hand, if we wish to photograph the spine, it may be necessary to omit the tissues of the heart and lungs. A still better example may be found in the case of the head, where the rays have to pass through the whole of the cranium, and yet the surgeon may desire to photograph the inside of only one side of the skull. Again, with renal calculus we do not wish to photograph the intestines lying in front, nor the muscles of the back behind. Fortunately the construction of the focus tube helps us in this way, and in an earlier number of NATURE of this year I pointed out a method by which this might be accomplished. The Röntgen rays springing from the platinum anode diverge from a point, consequently if we place the tube near the right side of the head, and the photographic plate on the left, the shadows caused by those structures immediately next the tube are so diffuse that they scarcely appear on the negative, while a sufficient number of the rays still pass through to photograph the part of the head which is in contact. By carefully arranging the tube therefore, one may photograph the heart, sternum and ribs by the same method; and if the patient be placed on his back, lying on the sensitive plate, these structures will be omitted, but the spine will be photographed. We can, also, by the same method photograph any part of the skull at will. Considering what has been said in the previous paragraph, it might be here argued that, seeing we are placing the tube near the body, less power will be required; but if we reflect in the case of the abdominal, thoracic, and cranial cavities, there is such density of tissue to overcome that we are more than ever in need of greater energy.

Following out these indications, I made a series of experiments and observations upon the apparatus at my disposal, and came early to the conclusion that more powerful currents would be necessary. Instead of measuring these in the usual way by the length of the spark of the coil, I placed Lord Kelvin's cell tester and ampère-meter in the circuit with a rheostat, so as to control the current at will, and taking a large German coil, in which the wires were thicker than the English form, the currents were gradually increased up to nearly thirty ampères. The experiments were pushed to such an extent that the focus tubes would not stand the molecular strain, and for this reason, at the instigation of Dr. J. T. Bottomley, several strands of wire were fused in the end of the tube bearing the kathode, while the anode was made adjustable so that the platinum might be removed at any distance from the kathode until the maximum result was obtained. There must be a relationship between the amount of energy passed into the coil, on the one hand, and the force coming out from the focus tube after being transformed. In other words, the coil is simply a transformer of a certain amount of energy which gives rise to conditions within the tube, which again give rise to X-rays. It was evident I had pushed this to the limit of the present make of tube. The question will naturally here suggest itself to those familiar with the subject, Is it necessary to use such currents, or could we not do with less energy by properly economising the force in the transformer and vacuum tube? The question is a very proper one, as all experimenters know that some tubes will give better results than others with a certain amount of force passed through a particular apparatus. This is yet to be settled, as well as the questions involving the amount of current absolutely necessary; the best form of coil; whether the coil itself is the best kind of transformer; and lastly, and probably most important of all, the conditions of the tube itself, and they all afford examples of what has been previously stated about the further need for physical research. What is here meant by the above statements is simply: with the apparatus as it stands at present, to get certain results, one is forced to use greater currents than might have been expected. But throughout the experiments, either upon fluorescent screens or in photography (I do not meantime enter upon the question of whether the maximum luminescence on the screen is the proper condition for obtaining the best result on the sensitive plate), the conditions were kept as nearly as possible uniform. In a previous paper in NATURE, I pointed out the advantage of a good interrupter, emphasising in attempts at instantaneous photography the value of the mercury form; but whether we use the latter or render the screw of the Apps' coil more tense so as to get larger sparks, any one watching the effect upon the ampère-meter and the fluorescent screen at the same time, will soon appreciate how important it is to control the current by means of the rheostat throughout the experiment. I have made experiments upon different kinds of glass for tubes; different sized kathodes; thicknesses of anodes; various materials for the latter; tubes have been sent to me by Mr. Friedrich, with a request that they might be compared with English forms; the Berlin Electrical Company have also placed their tubes at my disposal, but after many trials I know nothing so important as the constant attention to the vacuum throughout the exposure. Some of the best photographic results in the deeper structures of the body were obtained by the small and earliest form of Newton's tube. Another method of control is to place the two poles attached to the secondary coil at a certain distance from each other. This, of course, is used in testing the length of the spark before beginning the experiment. If these be too near during the exposure the sparks fly across, and the current being short-circuited the tube is cut out, but when the space is increased the tube becomes luminescent. This distance should be noted, and may be used to control the amount of electricity passing through the tube, as alteration in the vacuum causes the sparks again to fly across. By means of the spirit-lamp or Bunsen burner a little heat applied to the bulb at once corrects the vacuum, and a certain uniformity of condition within the tube results.

It may here be pointed out that in using fluorescent screens for the deeper structures of the body, barium-platino-cyanide in some instances gives a better result or a darker shadow than the potassium salt. I am quite aware of the fact that the potassium is more luminous, and it may be that it is a matter of construction of the screen or the particular specimen employed, because samples of these salts vary in their effects. After using a large number of different materials I, like others, have fallen back entirely upon the potassium or barium salts, but employ both, and the barium has the great advantage of being a good practical agent well suited for hospital purposes, and durable. I have still in my possession a screen made of this salt early in March of this year, and, although small in size, it gives as good results as any of my newer screens. I find a darkened room for medical purposes much better than any form of cryptoscope. Under favourable conditions many parts of the face and head can be distinctly seen on the screen. In some instances I have seen foreign bodies, such as shot in the scalp; in another I was able to differentiate, in a case of paralysis of the extremities, between fracture of the skull with pressure on the soft tissues from the effusion of blood and obstruction due to a star-shaped fracture, as opposed to the diagnosis of a bullet which was thought to be situated at a particular spot. The tissues of the neck may easily be searched for foreign bodies which obstruct the rays. Photographs of all these can of course be obtained, and I need hardly point out that, in the present state of our knowledge, the photographic plate reveals in some instances what the screen fails to show. There is one curious exception to this, where the movements of the organ are rapid, such as in the heart, because this necessarily interferes somewhat with success owing to the movement during the exposure of the plate. Passing to the chest, the outline of the pleural spaces may be seen, and in one case condensation of the apex of the lung was thrown as a shadow upon the screen. The heart itself as a body in motion, the ascent and descent of the diaphragm, the liver covered with the diaphragm, can also be made out. The majority of those conditions have been photographed as well as observed, and I have a series of pictures showing enlargement of the heart, enlargement of the liver, and in one case renal calculus. It need hardly be said in addition that every part of the trunk and extremities, as far as the osseous parts are concerned, have been photographed. I do not use fluorescent screens in photography, one amongst other reasons being that the plates used were much larger than any screen in my possession.

While these statements seem to indicate considerable progress in the art, I desire expressly to interpret them in the light a surgeon or physician would view them, lest any misconception

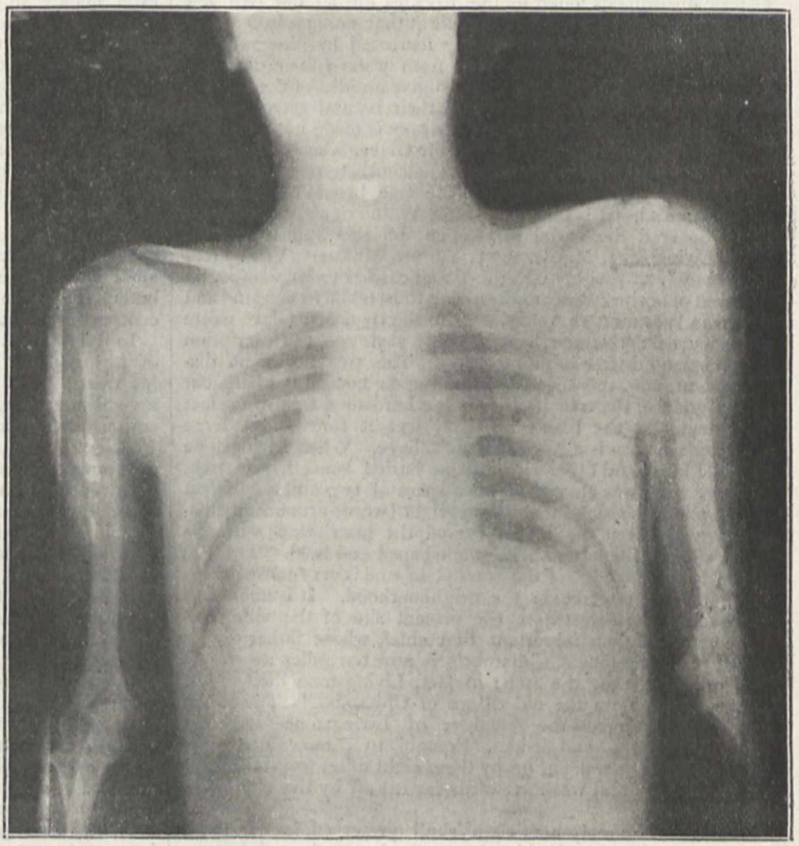

FIG. 3.—Thorax and upper extremities (adult), faint shadows of viscera.

should result. When one reads of instantaneous photography, direct inspection or photography of so many of these tissues, it may be argued that we have now brought the subject to a thoroughly practical issue; but it is not so. For this reason I have placed these statements before your readers, in the hope that those engaged in the physical research may know how much we are yet in need of their aid. Take the statement of rapid or instantaneous photography; a careful perusal of the valuable summary in the pages of NATURE for April 30, shows that this statement is applied to the extremities for the most part. It need hardly be pointed out that what the surgeon desires is instantaneous photography of every part of the body, particularly where there is movement. Further, the reader may imagine that in seeing the movements of the heart, one can examine it much as the physiologist does the beating of the same organ in the frog during dissection; but it is not so. Before the movements of the diaphragm and heart, the limits of the pleural cavities, and the pathological changes in the tissues of the same, can be of great value to the physician, much more has yet to be done. The serious investigator is more impressed with what has yet to be done, than elated with what has already been accomplished. It is with great pleasure that I read in the columns of NATURE of the continued advances of those well fitted to engage in the study of the properties of Röntgen rays in the physical laboratory; and while we have reason to be pleased that the rays have been clearly proved to be of great value in the diagnosis of certain affections, every part of the apparatus must be investigated and improved upon before we obtain thoroughly satisfactory results. JOHN MACINTYRE.

SCIENCE IN THE MAGAZINES.

PROF. H. F. OSBORN, curator of vertebrate palæontology in the American University of Natural History, New York, contributes to the *Century Magazine* a popular account of prehistoric quadrupeds found in the Rockies during the past few years,and to be exhibited to the public at that museum in October. Interest in his description is greatly increased by nine remarkably fine illustrations (reproduced from water-colour drawings by Mr. Charles Knight), designed to give an idea of the animals as they probably appeared in life in their natural surroundings. Another interesting article in the *Century* is made up of extracts from the journals of the late Mr. E. J. Glave, whose journey to the Livingstone Tree had such a melancholy termination. On July 8, 1894, Mr. Glave reached the tree beneath which Dr. Livingstone's heart is buried. Jacob Wainwright, the Nassick boy who read the burial service, cut on the tree the words: "Dr. Livingstone, May 4, 1873. Yazuza, Mniasere, Vchopere." The body was roughly embalmed and carried to Bagamoyo, on the coast opposite Zanzibar, afterwards to be taken to England and buried in Westminster Abbey. As to the tree, Mr. Glave wrote in his journal: "Although done twenty years ago, the inscription is in a splendid state of preservation. The tree shows no disfigurement, and, moreover, the carving is not on the bark but on the grain of the tree itself. It is a hardwood tree, three feet in diameter at the base; at thirty feet it throws out large branches; its top is a thick mass of foliage. When Livingstone died the heart and other viscera were buried beneath this tree, and the bark was cleared off for a space of two and a half feet square; in this space Jacob Wainwright (whose account my discovery verifies to the letter) carved the inscription with no dunce's hand, the letters being well-shaped and bold. The tree is situated at the edge of the grass plain, and is very conspicuous, being the largest tree in the neighbourhood. It is about five miles south south-west from the present site of the village of Karonga Nzofu, an important Bisa chief, whose father was a friend of Livingstone. Chitambo's is now ten miles away. It was originally near the tree; in fact, Livingstone died a few minutes' walk from the old village of Chitambo." The tablet which Mrs. Bruce—the daughter of Livingstone—sent out by Captain Bia and Lieut. Franqui to commemorate the explorer's death, was put up by them eight miles from the spot where he died, and was afterwards carried off by the chief of a slave caravan.

"There is scarcely a modern skull preserved in our great anatomical museum beside those of abnormal malefactors. There is no fairly representative collection of the variations of our race; and there is no means of learning the characteristics of it in contrast to those of other races. This is far more the case in other directions; any solid comparative study of man's framework is as yet utterly impossible. Of many races not a single skeleton is preserved; and those of which we know a little are only shown by a few scanty specimens, of which the history and details are scarcely ever recorded. Of both past and present races a collection of at least a few dozen specimens of each race, precisely dated and localised, are the smallest amount of material which would enable us to begin a scientific treatment of the varieties of man." So writes Prof. Flinders Petrie in the *National Review;* and he suggests that, to systematise the study of man, a large museum should be established where examples of every object of human workmanship can be preserved. He is sanguine enough to think that this great repository of the works of man will be realised in the course of a few years. Such an institution would undoubtedly be of service to science. From this proposal of Prof. Petrie's, ethnologists may profitably turn their attention to a paper on "African Folk-Lore," contributed by A. Werner to the *Contemporary*. While staying for some months in East Central Africa, the authoress collected a number of traditional tales of the Mangánja, and she now relates them. Many of these stories deal exclusively with animals; and all of them proceed on the assumption that animals, human beings, and inanimate objects feel and act in much the same manner. There is a striking similarity between these myth-stories and the stories of "Uncle Remus"—a fact which goes to confirm the opinion that the latter originated with the African.

Prof. Ray Lankester reviews Mr. Archdall Reid's speculations on "The Present Evolution of Man" in the *Fortnightly*. "Mr. Reid," he says, "seems to be under the impression that the lines, or rather two of the lines of the present evolution of man have been definitely and satisfactorily indicated by his speculations. I am far from admitting that he has done more than demonstrate and draw attention to some tendencies of that evolution. . . . I am by no means convinced that the present and future evolution of man is being determined exclusively or even mainly in the simple way and by the obvious factors which he has placed before us."

Two editorial notes in *Scribner* deserve mention. In one a plea is made for the adoption of the metric system throughout the United States. The Bill introduced last session, and which will again be brought before Congress in the coming session, provides for the substitution of the metric system immediately in practically all the departments of the Government of the United States, and the adoption of the metric system of weights and measures as the only legal system to be recognised after the first day of January, 1901. The second note referred to is on Summer Schools, or vacation courses. It appears from a report of the U.S. Bureau of Education, that more than three hundred vacation courses, dealing with all branches of knowledge, are now held at various educational centres throughout the world.

In the *Strand Magazine*, Sir Robert Ball, continuing his series of astronomical articles, describes the discovery of Neptune, his treatment of that well-worn subject being illustrated with several interesting pictures. A number of reproductions from curious photo-micrographs form the chief feature of Mr. W. G. FitzGerald's article on "Some Wonders of the Microscope" in the same magazine. There is also a story dignified as an "Adventure of a Man of Science," which has for its scientific foundation the cure of madness by mysterious capsules. Even this flimsy basis is better than the description, in last month's *Strand*, of the use of a camera to obtain a photograph, by means of Röntgen rays, of a stolen diamond inside the thief's body. We should have thought it was known by this time that cameras are not used in Röntgen photography. Sir C. H. T. Crosthwaite shows a little better acquaintance with the subject in a story entitled "Röntgen's Curse," contributed by him to *Longman's*. The central figure of the story concocted a liquid which, when painted on the insides of his eyelids, made him as perspicaceous as a platino-cyanide screen excited by Röntgen rays. The capacity thus gained proved anything but a source of enjoyment to the experimenter. The idea may be good enough for a story, but a cautious man of science would have tried his wonderful liquid on one eye, and not on both.

In the *Sunday Magazine* there are two popular articles of interest to naturalists: one describes and illustrates sculptures of animals adorning a number of ecclesiastical buildings; and in the other Mr. C. J. Cornish writes on nightingales' nests, his account being illustrated by photographs from life.

Chambers's Journal has, as usual, several popular articles on science.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

MR. H. R. NORRIS, Mathematical and Science Master of Ipswich Grammar School, has been appointed Head-master of Barry Intermediate and Technical School, Glamorganshire.

THE Finance Sub-Committee of the Bradford Corporation recently held a special meeting and decided to allocate the following grants under the Technical Instruction Act:—Bradford Technical College, £2875; Free Library, £300; Boys' Grammar School, £500; Girls' Grammar School, £100; Mechanics' Institute, £300; School Board, £1000; Church Institute, £100; Blind Institute, £50.

THE Holiday Courses of Lectures delivered last month at Jena are reported to have been a great success. The lectures were grouped as follows:—(*a*) Natural Science, including Astronomy, Botany, Physics, Zoology; (*b*) School Hygiene, Physiological Psychology, Philosophy, Pedagogics; (*c*) Conversational German, Literature, History. The attendance at the courses was better than at those of last year's gathering, no fewer than 108 being present, representing thirteen nationalities. Seventeen of the students were English.

THE Committee of Technical Instruction, in their annual report to the Oxfordshire County Council, remark "that the District Committees have in most cases carried out their duties in a satisfactory manner. Those District Committees who have availed themselves of the assistance of the Parish Councils have found the benefit of so doing, as they have been able to get into closer touch with the needs of each parish." The wisdom expressed in the last paragraph seems obvious; yet we are afraid the hint needs to be repeated to other than the District Committees located in Oxfordshire. The report in question tells of much good work accomplished.

THE Report of the Governing Body of the Battersea Polytechnic for the years 1893-94-95 contains much information of a gratifying character. During the period the institution has been open—some two years—not less than 6000 individual students have attended its classes. The sum of £67,840 has been raised; the Polytechnic is in receipt of its full endowment, and is now in its third educational session, with a regular attendance of 2850 students. In accordance with the provisions of the scheme, and the requirements of the chief industries of the neighbourhood being borne in mind, it was, at the outset, decided that the initial work of the Polytechnic should consist of (*a*) evening classes for young men and women in technology, science, art, domestic economy, music, commercial and general subjects, with provision for gymnastics and other recreative and social work; (*b*) day schools for boys who have passed through the elementary schools and desire further education of a technical and scientific character; (*c*) Saturday classes of an advanced character for teachers. Success all along the line seems to be the summing up of the report.

THE British Consul-General at Frankfort, in the course of his latest report, quotes certain official information supplied to the Italian Government in regard to the cost of University study in Germany. To obtain the degree of Doctor of Law at Berlin costs 1300 marks, and for a Doctor of Medicine about twice that sum. The details are as follows:—Fee for matriculation, 18 marks; fee for examination for the medical faculty, 242 marks; diploma fees for the law faculty, 335 marks; for the faculty of medicine, 440 marks; fees for all lectures necessary to pass the various examinations in the law faculty, 400 to 500 marks, and in the medical schools, 800 to 1200 marks. To these must be added 150 marks for printing the candidate's dissertation, 300 marks for books for a law student, and 500 marks for the books and instruments of a medical student. These, of course, do not include the cost of living. For a law student who studies in a town where his parents do not live, 5000 marks must be allowed for board, lodging, and clothing during his course, and 7600 to 8000 marks for the $4\frac{1}{2}$ years of a medical student's course. The cost of a civil engineer's course, including that of living, is estimated at 6000 marks for four years. At other German Universities the cost would be somewhat less, but the difference would not be very great, for the main item—the cost of living—is very much the same in all University towns. Foreign students often prefer the smaller Universities, especially those in South Germany.

A RECENTLY published Parliamentary paper shows that out of the funds entrusted to the Board of Agriculture for educational purposes in Great Britain during the financial year ended March 31 last, sums amounting to £7850 have been distributed in specific grants to eighteen institutions named. Since the first grant made by Parliament in 1888 the sums have increased from £2930 to £7850. These sums are divided under two main heads—general agricultural education under collegiate centres, including dairying and experiments (this item has increased from £200 to £6100); and special and provisional grants, which have decreased in eight years by nearly £1000. Major P. G. Craigie, Director of the Intelligence Division, who has drawn up this report for the President of the Board, says that considerable local efforts are now being made to make up for the conspicuous lack of educational facilities among the agricultural community of Great Britain to which the inquiries of the Departmental Committee of 1887-88 directed attention. The grants awarded were to the following eight collegiate centres in England and Wales:—University College of North Wales, Bangor, £800; Yorkshire College, Leeds, £800; Durham College of Science, Newcastle-on-Tyne, £800; University College of Wales, Aberystwith, £800; University Extension College, Reading, £700; University College, Nottingham, £450; Cambridge and Counties Agricultural Education Committee, £400; South-Eastern Agricultural College, Wye, £150; to the Eastern Counties Dairy Institute, Ipswich, £300, and the British Dairy Farmers' Association £300—in each of these two cases for dairy instruction; and to the Bath and West and Southern Counties Society £350, for special cheese and cider research and agricultural experiments. This brings the total for England and Wales to £5850. The remaining £2000 is distributed in Scotland thus:—Two collegiate centres, Glasgow and West of Scotland Technical College £650, and University of Edinburgh £550; University of Aberdeen, for agricultural instruction, £150; Scottish Dairy Institute, Kilmarnock, for dairy instruction, £300; the Highland and Agricultural Society, £100, and the Aberdeen Agricultural Research Association, £100—in both cases for agricultural experiments; and the Royal Botanic Garden, Edinburgh, £150, for instruction to working foresters and gardeners.

SCIENTIFIC SERIALS.

Symons's Monthly Meteorological Magazine, August.—"The Thames run dry," by the Editor. It is less than 200 years since men walked across the bed of the river, near London Bridge; but the old bridges were almost like weirs in the obstruction offered to the flow of the water. The various dates since the year 1114 are given, the last being September 14, 1716. In this year, owing to a long drought and a strong westerly storm at the time in question, the Thames lay perfectly dry above and below bridge, with the exception of a very shallow channel, and many thousand people are said to have passed it on foot.—The first use of kites in meteorology, by A. L. Rotch. It has been stated that the first use of a kite in connection with meteorology was by Dr. Franklin in his experiments on atmospheric electricity in 1752; but Mr. Rotch points out that Dr. A. Wilson, of Glasgow, explored the temperature of the higher regions by raising a number of paper kites, with thermometers appended, in 1749. An account of one of the experiments is contained in *Trans.* Roy. Soc. Edin., vol. x. part 2. This method was successfully employed on several occasions in that and the following year.

Wiedemann's Annalen der Physik und Chemie, No. 8.—Contact electricity, by W. Nernst. The author formulates a theory of contact electricity based upon ionic velocities. Both ions of an electrolyte must diffuse equally rapidly, as otherwise an enormous accumulation of electricity would take place. The unequal velocities due to the unequal mobility of different ions must be compensated by a potential difference $\frac{dP}{dx}$. Hence the equation

$$U\left(\frac{dp}{dx} + c\frac{dP}{dx}\right) = V\left(\frac{dp}{dx} - c\frac{dP}{dx}\right),$$

where U and V are the mobilities of the anion and kation, p the osmotic pressure, and c the concentration of the solution.—Bolometric investigations of the absorption spectra of fluorescent substances and ethereal oils, by Bruno Donath. The measurements were made with a quartz prism, and all lenses were replaced by mirrors. It was found that the fluorescent bodies uranine, eosene, fluoresceïne, æsculine, and chlorophyll show no absorption of the thermal spectrum down to wave-lengths of $2{\cdot}7\,\mu$. A chlorophyll solution 3·2 mm. thick has a region of strong absorption extending from the visible band in the red to the green rays. This region cannot be detected by the eye alone.—Emission spectrum of a black body, by Willy Wien. The author endeavours to reduce the number of hypotheses at the basis of the present theories of radiation. He also utilises Maxwell's theory of the distribution of velocities of molecules, but otherwise obtains his results on purely thermodynamic lines.—The new elements in cleveite gas, by J. R. Rydberg. This is an attempt to disentangle the spectrum of the supposed third new constituent of the gas from cleveite. The author calls it "parhelium" (Pa) and assigns to it an atomic weight of about 3.—Distance action of the force of absorption, by W. Müller-Erzbach. The author claims to have proved that the absorptive force exercised, say, by iron oxide upon carbon bisulphide vapour is capable of acting across a thin layer of a substance like water or glycerine which is perfectly neutral itself. This molecular force is, unlike that of ordinary molecular attraction, capable of action at distances not exceeding 0·0025 mm. across intervening bodies.—Röntgen rays, by Otto Müller. In the course of an attempt to produce diffraction of X-rays, a shadowgraph of wire gauze was obtained under a metallic cylinder which screened the plate from the action of the rays. The distance between cylinder and plate was 20 cm. The author interprets the observation as a proof of the turbidity of the air to some at least of the X-rays, and ascribes the effect to diffusion.

Bollettino della Società Sismologica Italiana, vol. ii., 1896, No. 2.—New methods for geodynamical investigations, by G. Grablovitz. A valuable description of the instruments erected in the geodynamic observatories of the island of Ischia, including various forms of levels, horizontal pendulums, instruments for measuring the vertical movements of the ground, and seismoscopes.—New form of continuously recording seismometrograph, by A. Cancani.—On the so-called presentiment of earthquakes by animals, by A. Cancani.—On some facts resulting from microseismic observations, by G. Vicentini. A reprint of a paper already noticed in NATURE.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, August 31.—M. A. Chatin in the chair.—The Perpetual Secretary announced the death of M. Henri Résal, member of the Section of Mechanics.—On the subject of prime numbers, of which any given number cannot be a primitive root, by M. de Jonquières.—External characters and modes of distribution of the small tubercles or tuberculoids of the Leguminosæ, by M. D. Clos. A morphological study of the tuberculoids on the roots of nine sub-species of the Papilionacæ. In the two other groups of the Leguminosæ Cæsalpiniæ and the Mimosæ, the presence of the tubercles is by no means so frequent as in the Papilionacæ.—Memoir on the Law of Newton and on some problems in general mechanics, by M. E. La Combe.—On the effect of systematic errors in levellings of precision, by M. Ch. Lallemand. It is shown that, with a few exceptions, levellings of precision are subject to systematic errors, which may vary from ·05 mm. to 0·3 mm per kilometre, and hence are of more importance than the accidental errors to which, up to now, attention has been chiefly directed. It has not been found possible to connect these systematic errors with the particular instruments employed, with the observers, with the nature of the ground, or with the atmospheric conditions.—On a class of propositions analogous to the Miquel-Clifford theorem, by M. Paul Serret.—The deflection of the X-rays behind opaque bodies, by M. E. Villari. A gold-leaf electroscope, placed in the cone of shadow of a sheet of lead, was found to be discharged by the X-rays at rates which showed that the shadow was deepest at the centre.—Researches on the double chlorides, by M. R. Varet. A thermochemical study of the double chlorides formed by mercuric chloride with other chlorides.—Action of the soluble oxidising ferment from mushrooms on the phenols insoluble in water, by M. E. Bourquelot. The two naphthols are oxidised by this ferment in a manner that may serve to distinguish them, α-naphthol giving a violet colouration, β-naphthol a white precipitate, which dissolves to a yellow solution in ether.—On the freezing-point of milk, by MM. Bordas and Génin. Fifty samples of milk gave freezing points varying from $-0^\circ{\cdot}44$ C. to $-0^\circ{\cdot}56$ C., and the conclusion is drawn that the determination of dilution with water by cryoscopy is neither simple nor certain.—On the organisms causing disease of the silk-worm, by M. J. M. Krassilschtschik.—A telegraph cable attacked by Termites, by M. E. L. Bouvier.—On the secretory nerves of the trachea, by M. V. Thébault.—On the conjugation of the zoospores of *Ectocarpus siliculosus*, by M. C. Sauvageau.—On the velocity of sound, by M. G. W. Pierces.—On the resolution of the general equation of the fifth degree, by M. L. Mirinny.—On the geographical situation of submarine islands, by M. Reilly.

GÖTTINGEN.

Royal Society of Sciences,—The *Nachrichten*, Part 2 (Mathematico-Physical Section), 1896, contains the following memoirs communicated to the Society:—

April 25.—On the theory of automorphic modular groups, by R. Fricke.—On an optical effect of an electric field conditioned by the dependence of the dielectric coefficients on the strength of the field, regarded from the standpoint of the electromagnetic theory of light, by F. Pockels.

May 9.—Researches from the Göttingen University Laboratory (IV.), by O. Wallach. (1) Condensation-products of cyclic ketones, and syntheses within the terpene group; (2) a bicyclic ketone $C_{14}H_{22}O$; (3) benzylidene-methylhexanone $C_7H_{10}O : CHC_6H_5$; (4) dibenzylidene-methylhexanone $C_6H_5CH : C_7H_8O : CHC_6H_5$; (5) benzylidene-menthone; (6) benzylidene pulegone; (7) dibenzylidene-suberone $C_6H_5CH : (C_7H_8O) : CHC_6H_5$; (8) dibenzylidene-methylpentanone $C_6H_5CH : C_6H_6O : CHC_6H_5$.—On the principles of Hamilton and Maupertuis, by O. Hölder.

June 20.—Attempted demonstration of orientation in the surface-conduction of electricity; on the continuous transition of an electrical property through the boundary-layer between solid and fluid bodies; on the conduction of electrified air; an experiment on magnetic currents, each by Ferdinand Braun.

July 4.—A contribution to the theory of complex magnitudes consisting of *n* primary units, by David Hilbert.

July 18.—Fluorescence and the kinetic theory, by W. Voigt.—On the change in the mode of vibration of light in passing through a dispersing or absorbing medium, by W. Voigt.

BOOKS AND SERIALS RECEIVED.

BOOKS.—Outlines of Psychology: E. B. Titchener (Macmillan).—Babylonian Magic and Sorcery: L. W. King (Luzac).—By the Deep Sea: E. Step (Jarrold).—British Association, Liverpool, 1896. Excursion Guide-book (Liverpool, Philip).—A Dictionary of the Economic Products of India. Index (Calcutta).—The Book of the Dairy: Dr. W. Fleischmann, translated by C. M. Aikman and R. P. Wright (Blackie).—Elementary Quantitative Chemical Analysis: Dr. F. Clowes and J. B. Coleman (Churchill).—Lehrbuch der Algebra: Prof. H. Weber, i. Band (Braunschweig, Vieweg).

SERIALS.—Geological Magazine, September (Dulau).—Geographical Journal, September (Stanford).—Edinburgh Medical Journal, September (Pentland).

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