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THE BERMUDA ISLANDS.

A Contribution to the Physical History and Zoology of the Somers Archipelago. With an Examination of the Structure of Coral Reefs. By Angelo Heilprin, Curator-in-Charge and Professor of Invertebrate Palæontology at the Academy of Natural Sciences of Philadelphia, &c. With additions by Prof. J. P. McMurrich, Mr. H. A. Pilsbry, Dr. George Marx, Dr. P. R. Uhler, and Mr. C. H. Bollman. (Philadelphia: Published by the Author, 1889.)

THIS work is mainly the outcome of researches concerning the physical history, geology, and zoology of the Bermudas, which were accomplished under the auspices of the Academy of Natural Sciences of Philadelphia in the summer of 1888. The author's principal object was to satisfy his own mind on certain points connected with the structure of coral reefs, and but little zoological work was contemplated. Fortunately, however, the collection of zoological material proved more extensive than was expected, and in this respect Prof. Heilprin was greatly assisted by the students who accompanied him.

After a pleasant chapter of "general impressions," the author gives the results of his examination of these islands, and then proceeds to make such a vigorous attack on the views advanced by Agassiz, Murray, and their followers, concerning the origin of coral islands, that those attacked may be pardoned if they regard him as an apostle of the old belief.

Coming from the pen of Prof. Heilprin, this volume will, however, be welcomed by both sides in the controversy, but he must expect from his opponents an energetic reply to some of his criticisms, and an unmistakable dissent from some of his conclusions. Thus when the author asserts that the existence of an atoll in the present position of the Bermudas is not demonstrable, and that we have yet to learn to what form of coral structure these islands belong, he is at variance with most other authorities on the subject; and it becomes at the same time a little difficult to follow him in his conclusion that the results of his researches go to sustain the atoll-theory of Darwin. However, laying this difficulty aside, and accepting the fact, fairly established in this volume, that these islands have undergone recent movements, first of upheaval and then of subsidence, we may ask: "Of what use is this double testimony to any theory, whether of upheaval or of subsidence, unless a direct connection is first established between the form of a reef and the character of the movement?" The direct testimony of a single atoll that can be proved to have grown in a stationary area will, unless this connection be established, far outweigh the presumptive evidence derived from a slight subsidence of every atoll in the Indian and Pacific Oceans.

Dr. Rein, in the instance of the Bermudas, was the leader of one of the early skirmishes in this controversy, and it was to his description of these islands that the opponents of the atoll-theory of Darwin pointed in support of their views. They miss, therefore, in this book, any special exposition on the author's part of the relation of his own views to those of Dr. Rein. They also will fail to see how Murray's explanation of the origin of the inner basins of the Bermudas by solution can be met merely by a statement of contrary conviction unsupported by experimental proof. Nor will they agree with Prof. Heilprin's assertion that the recent memoir of Agassiz on the Hawaiian Islands can scarcely be said to contribute materially towards the solving of the problem.

The author in this volume treats as absurd my attempt to show that a true conception of the relative dimensions of an atoll is necessary to understand the nature of the problem. I was aware that, if my meaning was not understood, I should lay myself open to some curious reflections, and therefore the point is further elucidated in my description of the Keeling Islands, in the *Scottish Geographical Magazine*. To Prof. Heilprin's inquiry as to how near are we brought to an understanding of the character of an atoll by a true conception of its relative dimensions, I would answer with the query, "How far are we misled from the truth by the woefully-distorted sections of atolls that are employed by lecturers and by the authors of text-books?" Let me cite a single instance—that of Darwin's section of the Great Chagos Bank, which gives that atoll (which is 76 miles in width and 40 to 50 fathoms deep) the relative dimensions of a soup-plate. Some go further, and draw, with a free hand, a deep, saucer-shaped section of such reefs. Illustrations of this kind practically beg the question at the start, if we are arguing in favour of the theory of subsidence. The mind is at once informed by the eye that there is a deep basin to be accounted for, whereas a section on a true scale would exhibit no appreciable depression. In the exaggeration of the relative depth of an atoll is concerned the very essence of the problem, and a side-note cannot remove the impression made by a false section on the mind. Our conception of the problem can scarcely be assisted by a section of an atoll representing in the lagoon greater oceanic depths than the *Challenger* ever plumbed.

Passing from these controversial matters to the zoological section of this volume, we find a very interesting chapter on the relationship of the Bermudian fauna. The number of known species of marine Mollusca has been increased from 80 to about 170, none of the eleven species peculiar to Bermuda having been described before this exploration. Strangely enough, though "overwhelmingly Antillean in character," the marine Mollusca include a Pacific element. The land mollusks have been increased from about twenty to thirty species, of which eight appear to be confined to these islands; but, in explaining the mode of transport of the non-peculiar species, the author scarcely seems to have laid sufficient importance on the transporting agencies of commerce. A remarkable fact noted in connection with the Bermudian crustaceans is the occurrence of three macrurans—*Palæmonella tenuipes*, *Palæmon affinis*, and *Penæus velutinus*—hitherto only recorded from the Pacific. Prof. Heilprin arrives at some interesting conclusions in this chapter, and perhaps the most important one is connected with the large proportion of peculiar forms amongst the land-shells, a circumstance which is pointed to as evidence not only of the antiquity of a portion of the fauna, but also of its derivation from some pre-existing fauna in those islands. Much other zoological matter is to be found in this volume, though only a portion of the collections are here described. We are informed, however, that a great deal of systematic work still remains for the naturalist in the Bermudas, and Dr. Uhler, in respect of the insects, avers that much arduous collecting, particularly of the less conspicuous kinds, is still needed.

I do not know whether any argument for the considerable antiquity of the Bermudas from the character of the fauna has been advanced before. At all events, Prof. Heilprin's valuable suggestion opens up a line of inquiry in the case of coral islands generally, which might be pursued with profit. From investigations of the coral phenomena alone, I arrived at the conclusion that Keeling Atoll has a life-history of from 15,000 to 20,000 years, and that it is now in the last quarter of its existence. If this coral island is a type, then atolls must possess a high antiquity; and, taking our cue from Prof. Heilprin, we may ask whether, in the fauna and flora of a typical Pacific or Indian Ocean atoll, there is anything to suggest that they are derived from a pre-existing order of things. Confining ourselves to the flora, we find that oceanic atolls are mostly characterized by Hemsley as possessing no endemic element amongst their plants. Yet some of these large atolls must have once engirt, according to the theory of subsidence, a mountainous island possessing an upland flora, and, as in the case of the Fijis, not a few peculiar species. The islands formed on the encircling reef, just like the coral islands that often front the shore of a mountainous island in the Western Pacific, would possess, in addition to the common littoral plants, a number of plants derived from the slopes of the adjacent island. How comes it, then, that, if these large groups of oceanic atolls mark the disappearance of mountain-ranges, we find no sign of the vanished upland flora amongst the common littoral plants that are now brought by currents, winds, and sea-birds to every atoll? The Island of Tahiti could hardly disappear beneath the ocean without leaving a Tahitian impress on the flora of the surviving atoll. A similar reflection often occurred to me whilst on the Keeling Islands.

In conclusion, I would remark that partisanship in matters of scientific dispute cannot affect the value of this work by an American naturalist on one of the oldest of British possessions. The book is illustrated with several beautiful phototypes of general views in the islands, as well as of the æolian formations and of the coast scenery; and seventeen lithographic plates accompany the zoological descriptions. H. B. GUPPY.

THE USEFUL PLANTS OF AUSTRALIA.

The Useful Plants of Australia (including Tasmania). By J. H. Maiden, F.L.S., F.C.S., &c. (London: Trübner and Co. Sydney: Turner and Henderson. 1889.)

ALTHOUGH designed in the first instance as a hand-book to the specimens in the Technological Museum at Sydney, this work in its present form is really a concise text-book treating of "all Australian plants which, up to the present, are known to be of economic value, or injurious to man and domestic animals."

The literature of Australian economic botany may be said to date from the Great Exhibition of 1851. Owing, however, to the unsettled nomenclature of Australian plants previous to the publication of the great "Flora Australiensis," by Bentham and Mueller, the properties of the same plant were often found described under numerous botanical names. The publication of the "Flora," and the subsequent issue of Baron Mueller's "Census of Australian Plants" (with annual supplements), have now rendered species names easily accessible to workers in all parts of Australia, and the ground is well prepared for such a publication as that which lies before us. It is a bulky volume of 700 pages, well arranged, well got up, and furnished with an excellent index of botanical names, and also one of vernacular names. As Mr. Maiden reminds us, this is the first attempt made to grapple with the economical botany of Australia. He has wisely followed Baron Mueller in all essential details of classification, and due credit is given throughout the book to this learned and indefatigable worker, now, the greatest living authority on all that relates to Australian vegetable life. The arrangement of subjects has been adopted as that found most convenient in the Museum. This is not, perhaps, the best arrangement for a text-book, as it involves considerable repetition of names and synonyms under each section; but on that point we are not disposed to quarrel with the author. It opens, with human foods, and food adjuncts; and these are succeeded by forage plants, drugs, gums, resins and kinos, oils, perfumes, dyes, tans, timbers, fibres, and it closes with plants having miscellaneous uses not previously enumerated. A glance at the book shows very clearly, that if we except timbers, a description of which occupies about one-half the contents, the economic products of Australia are not of extraordinary importance. It is noticeable that the northern parts, where the flora is reinforced by representatives from the Malayan Archipelago and Southern Asia, yield most of the plants possessing medicinal properties. The genus Eucalyptus, comprising more than 130 species, yields excellent timber, kinos, and essential oils, and probably the chief economic products of Australia derived from native plants. Mr. Maiden has brought together practically all that is known about the industrial application of "gum"-trees, but we cannot now attempt to follow him.

Eucalyptus Gunnii (a large plant of which grows in the open air at Kew) yields a sweetish sap converted by settlers into an excellent cider. This, and manna, from *E. viminalis* and *E. dumosa* are probably the only food products derived from Eucalyptus trees. In the production of Eucalyptus oil (from *E. amygdalin* and *E. globulus*), Australia, it appears, has powerful competitors in Algeria and California, where gum-trees have been largely planted during the last twenty years. In the latter country, a large quantity is available as a by-product in the manufacture of anti-calcaire preparations for boilers.

The widely-spread Acacias of Australia, locally known as wattles, are hardly less useful than the gum-trees. Owing to the immense number destroyed for the sake of the bark used in tanning, the wattles in some districts are said to be threatened with extinction. Some whose leaves are eaten by stock are also becoming scarce. To counteract these influences, systematic attempts have been made to plant wattles on a large scale. It is doubtful, however, whether, except in South Australia, such plantations will be ultimately successful. Gum arabic, of good quality, is yielded by various species of Acacia, but owing "to the great cost of unskilled labour in Australia, and the impossibility of utilizing the services of the aboriginals, it will never find its way into the world's market to any very great extent." Australian indigenous edible fruits, roots and leaves and stems, are apparently wisely left to the appreciation of "school-boys and aboriginals." Almost more important than food in a dry country is a constant supply of water. The aboriginal method of obtaining water from the fleshy roots of certain trees such as *Hakea leucoptera*, and from the stem of *Vitis hypoglauca*, is similar to that adopted in other countries, but Mr. Maiden has wisely given prominence to the fact, as the knowledge of it may be the means of saving the lives of many lost in the bush. Very few native Australian plants yield valuable fibres. The aboriginals appear to prepare their fishing-nets by chewing fibrous plants, and "this practice causes their teeth to be worn down to a dead level." In the same manner, we may add, the natives of Formosa prepare certain fibres for making clothes.

The best fodder grass of Australia is said to be *Anthistiria ciliata*, known as the "common kangaroo grass." There are several poison bushes (species of *Gastrolobium*, *Swainsonia*, and *Sarcostemma*) dangerous to stock so widely distributed as to render extensive tracts of country unoccupiable. These of late years have been reinforced by noxious weeds from other countries.

It is not to be supposed, however, that our knowledge of the economic uses of Australian plants is yet complete, and we are glad to learn that the author is actively engaged in observations that no doubt will be incorporated in a later edition. In the meantime, however, we cannot do better than commend this work as a most trustworthy guide in a handy form to the useful plants of Australia.

D. M.

MOUNT VESUVIUS.

Mount Vesuvius. A Descriptive, Historical, and Geological Account of the Volcano and its Surroundings. By J. Logan Lobley, F.G.S., &c. (London: Roper and Drowley, 1889.)

MANY people have been puzzled by the fact that there are so few English books on Vesuvius, especially of the descriptive type. The appearance of this work was looked forward to with ardent expectations, but it is doubtful whether it will fulfil them. Prof. Phillip's work was a remarkable one considering the short stay he made in Naples, but possessed those defects that all books must have which are written from little experience. Prof. Phillips wrote immediately after his visit. The first book of Prof. Lobley was prepared under similar circumstances, but apparently he has not re-examined the district for twenty years. Nearly every geologist on his visit to the type volcano of the world is attacked by a fever to write something about it—witness the 1300 or more books and articles in all languages referring to it—but a few months bring him safely through his complaint, and leave him satisfied that years of careful study on the spot will hardly qualify him to produce even a short description. This leads us to the main defects of the work, which spring from the author's want of personal observation, and the necessity of his obtaining information second-hand. Many recent authorities do not seem to have been consulted by Prof. Lobley. In consequence, he constantly makes statements that are incorrect or only partially accurate. Another fault to be found is the very incorrect and old-fashioned illustrations which would much bother a new-comer to the district with this work as a guide. Many of the crystal forms are incorrectly drawn, and in Plate xiv. dykes should not be represented as pipes branching out from the main chimney, but principally as radial sheets.

The accounts of the Phlegrean Fields, so far as they go, are very attractive, but lack that accuracy that a recent visit would have conferred. In describing Vesuvius, he mentions the library of vulcanology collected in the Naples section of the Italian Alpine Club, stating that 25,000 volumes are there preserved, which is more than three times the number. Neither will most people have had such a favourable experience of Vesuvian guides as Prof. Lobley. Yet altogether, the chapters on Vesuvius are the best part of the work, and are quite as much as a visitor with a couple of days to give to the mountain can comfortably absorb. The chapter on the geology of the volcano is clear and well written.

Unfortunately the book is spoiled—more perhaps than by anything else—by the author's views as to the causes of volcanic action. In the first place, the class of readers to whom the rest of the book appeals are not likely to possess sufficient physical and geological knowledge to be able to enter into the question, and to them chapter viii. is likely to prove a bore, and should they begin to peruse the book at this point, the effect will probably be that they will read no more. Even if it be supposed that the questions regarding the mechanics of the extrusion of igneous matter on the earth's surface are an easy matter of comprehension, the method of putting the subject into numbered paragraphs is much to be deprecated when the reader is not a specialist.

In the same way it is doubtful whether a description of rocks not occurring in the district is likely to be of use. Why mention the rare local rocks, "analcimite," "haüynophyre," "tholeite," &c., while "gabbro," "diorite," "syenite," are neglected?

The chapter on the minerals of Vesuvius is little more than a catalogue of every one that can possibly be raised to a species; some being obtained by dissolving saline crust in water, and allowing the solution to crystallize—a method that is hardly justifiable. Of far greater interest would have been a chapter on the general mode of occurrence, origin, &c., of the principal species, their characters being left to the systematic treatises on mineralogy.

The book is neatly got up and well-divided into separate chapters, so that the traveller, who will make most use of it, can easily turn up to a short account of any particular locality or subject. The language is clear, and not overburdened by petrological or other very learned words. Altogether, putting aside the above-mentioned blemishes, the work is likely to be of much use in leading travellers to observe for themselves one of the most interesting of geological phenomena.

OUR BOOK SHELF.

Index of British Plants, arranged according to the London Catalogue (Eighth Edition), including the Synonyms used by the Principal Authors, &c. By Robert Turnbull. Pp. 98. (London: George Bell and Son, 1889.)

THIS alphabetical synonymic list of British flowering-plants and vascular Cryptogamia is similar in general plan to that which was published about a year ago by Mr. Egerton-Warburton, which we noticed at the time of its issue (NATURE, vol. xl. p. 306). The author uses as a basis the last edition of the London Catalogue, and gives the synonyms of all the species that are described under different names in "English Botany," Bentham's "Handbook," Babington's "Manual," Hooker's "Student's Flora," "British Wild Flowers," Lindley's "Synopsis," Hooker and Arnott's "British Flora," Withering's "Arrangement," Notcutt's "Hand-book," and Hayward's "Pocket-book." The author has carried out his task very carefully, and has added an English name for each species, and given at the end a list of English names in alphabetical order. Two things lately have combined to cause considerable change in plant-names, the revision and redescription of the genera by Bentham and Hooker, and the increased attention which has been paid in tracing out priority by Mr. Daydon Jackson and Mr. Britten in England, and by Ascherson, Nyman, and many other writers on the Continent. We have noted a few slips in turning over the pages. For instance, there are only two native species of *Achillea*, not five—*decolorans*, *serrata*, and *tanacetifolia*, being manifest introductions. No wonder the author has not been able to refer some of the older bramble names to their London Catalogue synonyms. *Guntheri*, Bab., and *saltuum*, Foche, are both synonyms of the plant called *flexuosus* in the London Catalogue. The book will be found useful to many collecting botanists scattered up and down the country who have been puzzled to understand what was intended by many of the newly-introduced names. J. G. B.

Practical Observations on Agricultural Grasses and other Pasture Plants. By William Wilson, Jun. (London: Simpkin, Marshall, and Co., 1889.)

MR. WILSON tells us that "agriculturists have allowed themselves to run too much after a channel of indoor investigations." We do not know that this has been a fault in agriculturists, and are not convinced of the fact. Mr. Wilson appears to have omitted to acquire one important accomplishment in a writer on any subject—namely, the power of writing intelligibly. He tells us that "soil may be described as earthy matter on the surface of the globe"; that "climate has been described as a very complex matter, depending on a great variety of conditions"; but he does not say by whom it has been so lucidly "described." We are told that "sweet-scented vernal grass is one which most writers on grasses give a place as a useful grass, but not very definite as to what place it belongs, as it is not very readily eaten in some parts where there is a considerable quantity of it." Speaking of rough-stalked meadow-grass, he says:—"The Rev. J. Farquharson, F.R.S., mentions in his paper, which I have previously spoken of, as having cultivated it successfully on such soil, testifies as to the fondness of animals—both cattle and horses—for it, both as pasture and hay." Again, he informs us that "the fact has been pretty well borne out that a great fault has been to look at cultivation too much in the light of a matter which has been thoroughly investigated, when in reality it has little more than reached its infancy." Now, with all respect to Mr. Wilson, it appears to us to be mere cant to talk of the most ancient of all arts as having only reached its infancy. The style in which this little eighteen-penny book is written is poor and obscure, and the above quotations may be considered as fair samples of it. For instance, the eye falls by chance on the following passage (p. 70):—"The results of my observations have led me to the same conclusion as Mr. Sinclair—am of opinion that a mixture of it (*sic*) on dry soil would prove satisfactory, but should not be sown on clay moist soil." That this work should have reached a second edition is certainly strange, and appears to indicate that the agricultural palate is, as yet, particularly fresh. It must require a good deal of open-air exercise to enable a reader to digest Mr. Wilson's crudities.

W.

The State. Elements of Historical and Practical Politics By Woodrow Wilson, Ph.D., LL.D. (Boston, U.S.A.: Heath and Co., 1889.)

THIS work may be regarded partly as a text-book of political science adapted to the education of the young, partly as a repertory of what the writer calls "governmental facts," useful to readers of all ages. In the first part of his task Mr. Wilson has encountered great difficulties. He has no predecessors in whose steps to follow. Also the loose mass of facts and opinions which make up what is called political science does not admit of being compressed with safety. Again the class to whom Mr. Wilson offers a highly concentrated intellectual pabulum are little able to assimilate this species of nutriment even in its most digestible form. The young man, says Aristotle is not fit to be a student of political science. These difficulties appear to have been surmounted by Mr. Wilson better than might have been expected. He avoids the dogmatism to which short catechisms are liable. For instance in his section on the probable origin of government he does not rule that the earliest constitution of the family was patriarchal, or "matriarchal," as we believe it is now the fashion to say. While inclining to the former view he presents also the latter; and gives references by the aid of which the enquiry can be pursued. He stimulates curiosity and affords the means of gratifying it. The "evolution of government" is traced from the origin of the Aryan family through the changing types of Greek and Roman governments. This "institutional history" is somewhat dry; but the writer expects that the topical skeleton furnished by him will be clothed upon by the lessons of the intelligent teacher. Coming to modern times, we find a description of the principal pieces of political machinery which are now in use in the civilized world. This compilation seems to serve the purpose of a sort of magnified "Whittaker." If anyone who has not exhausted the subject of Home Rule wishes to refresh his memory as to the relations between Austria and Hungary or Sweden and Norway, he can here look out, as in a political dictionary, the main facts. We come nearest to the "practical politics" announced in the title in the chapter which discusses what are the proper objects of government. "This," says Mr. Wilson with much good sense, "is one of those difficult problems upon which it is possible for many sharply opposed views to be held apparently with almost equal weight of reason . . . It is a question which can be answered, if answered at all, only by aid of a broad and careful wisdom whose conclusions are based upon the widest possible inductions from the facts of political experience in all its phases." Mr. Wilson's solution of what Burke has called the "finest problem in legislation" is thus stated:—"It should be the end of government to *accomplish the objects of organized society*.... Not licence of interference on the part of government, only strength and adaptation of regulation. The regulation which I mean is not interference, it is the equalization of conditions, so far as is possible, in all branches of endeavour." Perhaps this teaching would have been more impressive if the writer, condescending to particulars, had discussed pretty fully any one question such as whether in any assigned country, the railways ought to be managed by the state. Once more however we admit that the scope and limits of his work have imposed upon him almost insuperable difficulties.

Introductory Lessons in Quantitative Analysis. By John Mills and Barker North. (London: Chapman and Hall, 1889.)

THIS book of eighty-five pages is the first part of a larger work by the same authors, which will shortly be published. It is designed mainly for the use of "students in evening classes who have but little time to spare in acquiring such knowledge," and also to be of service for the Science and Art Department examination, as well as those of London University. The descriptions contained in the three chapters constituting the book, and which treat of preliminary operations, gravimetric analysis, and volumetric analysis, respectively, are meagre in the extreme, and lack many details essential to a primer. Slips and loose statements are numerous. For example, the student is led to infer that the ash of *any* of Schleicher and Schüll's filter-papers is negligible. Lead is estimated by means of "bichromate of potash," which is formulated as K_2CrO_4. On p. 62 the authors assert that "Normal solutions of *univalent* substances like iodine, silver nitrate, sodium chloride, &c., contain *their molecular* weight in grams in one litre." Whatever be the meaning attached to this, it is in no way confirmed by what follows on p. 63—namely, that "The *atomic* weight of iodine being 126·5, a normal solution would contain *this* number of grams in one litre."

The general scheme of work set out in the lessons is satisfactory, and if carefully elaborated might be useful. In its present condition, however, the effect of the book on the beginner cannot be other than confusing.

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.*]

Note on a Probable Nervous Affection Observed in an Insect.

WHILST walking in the garden one bright September morning, my attention was called to a moth fluttering in a peculiar manner on the ground; it kept going round and round in a circle, running with its feet on the stones, its wings meanwhile being in rapid motion.

I captured the insect, which proved to be a quite fresh specimen of a male *Orgyia antiqua* (vapourer moth), of which there were many in the garden.

I replaced the insect without injury on the path, and watched it more closely.

The movements of the wings were irregular, convulsive, and very rapid in character; the feet and body were also in rapid movement, resulting in a circular motion of the whole insect from right to left—that is, in the same direction as the movements of the hands of a watch.

I again captured the insect, thinking that perhaps one of its antennæ might have been injured; but on careful examination with a hand lens, I could detect no lesion nor the presence of any parasite which might account for the condition.

I again placed the insect on the path, when it immediately began to rotate as before. It seemed unable to keep still, though evidently trying to do so.

Occasionally it would wedge itself in between two or more small stones, with its head downwards, and the under surface of its body upwards, its wings resting on the stones below; in this position it appeared to obtain some relief, as the movements were less continuous, though every breath of wind caused a convulsive twitching of the wings and body. On one occasion a leaf fell upon the insect whilst wedged in, causing a very violent convulsion of the whole insect, by which it was jerked quite out of its retreat, when the gyrating movements at once began again.

I tried stroking the antennæ with the point of a pencil, but this had no effect, nor could I obtain cessation of movement by stroking the body or the wings; on the contrary, when the insect was wedged in each touch caused a convulsion, varying with the intensity of the stimulus applied.

These movements continued without interruption for fully forty minutes, the insect gyrating in a space about a foot square. At the end of that time I placed it upon a piece of smooth paper, when the movements became more rapid and the gyrations less ample, it completing a turn in much less time than on the stones, owing, no doubt, to there being no projections on the paper to cause the insect to deviate.

I then placed it in a shallow cardboard box in the full sunlight, but protected from the wind. In this way the convulsive movements were less intense and less frequent; the insect, however, was often jerked over on to its back, then, after a struggle or two, would right itself, and begin to go round. When, however, it managed to press the top of its head against the side of the box, so that its antennæ were pressed between the head and the side of the box, all movement ceased till some external stimulus again set it in motion.

At the end of one hour the insect seemed quite exhausted, a strong stimulation being required to develop one convulsion.

On examination I found that it had worn away, in its movements, all its legs with the exception of the left hind leg, which was apparently pretty intact, and had broken both its wings on the right side, so that the greater part of them hung useless over its body.

After a few more violent convulsions, the upper wing of the right side was broken off, and the insect now began to revolve from left to right, owing, I suppose, to the movements of the left leg; the others being reduced to mere stumps would have little power of propelling the insect.

About twenty minutes later, during a convulsion, the right hind wing was broken off.

Shortly afterwards I noticed that the convulsive movements of the antennæ, which had been slight up to that time, were much increased; indeed, they were moving so rapidly as to have the appearance of two small black wings.

One hour and fifty-five minutes after I first noticed the insect all convulsions had ceased; no stimulus could excite any; the moth was dead.

Conclusion.—The insect, suffering from no apparent injury, and being attacked by no internal or external parasite, was, I believe, suffering from some nervous lesion. I was unfortunately unable to examine the insect microscopically to ascertain if the nervous centres exhibited any pathological characters.

E. W. CARLIER.

Does the Bulk of Ocean Water increase?

THE idea was, I think, suggested by myself, and has been referred to with approval by Mr. Jukes-Browne, that much of the water on the surface of the globe was originally occluded in the molten interior, and has been emitted by volcanic action in the course of ages. Mr. Mellard Reade argues against this, that the moon is covered with volcanic craters, and yet has no water on its surface, and that if the accumulation of surface water has followed volcanic action on the earth, it ought likewise to have done so on the moon. He concludes:—"At all events, it seems a reasonable question to ask why oceans should be supplied with water from the perspiring pores of mother earth, while her offspring, the moon, is so dry as to have absorbed into herself all evidence of any aqueous envelope that may have formerly existed."

It is a singular coincidence that one possible answer to this objection is suggested by a notice in the "Astronomical Column" of the same number of NATURE which contains Mr. Reade's letter. Therein Prof. Thury attributes apparent changes in the aspect of a lunar crater to the melting of snow or ice around it. Neither is he the only selenologist who thinks that those crater-rings consist more or less of frozen water. If they do so, then there *is* water on the moon, although in a solid state. On the other hand, Proctor, in his work on the moon, says that her surface is more nearly black than white, which seems to render the existence of snow fields upon it less probable, unless they are covered with volcanic dust, as the end of a glacier usually is with rock *débris*.

But even if we take Mr. Reade's view, it is still conceivable that steam may have been the explosive agent in the moon's volcanoes, while her internal temperature was very high, and that the resulting water may have been subsequently absorbed after the body became cool, because the water would occupy less space within the interstices, which this theory of imbibition postulates, than the equivalent vapour did, when the temperature was high. The case of the earth would not be a parallel one, because it has not yet cooled.

Although not myself a selenologist, I have a suspicion that very little is known about the constitution of the moon; and that it is not even certain that its enormous craters are all of them really volcanic. It has been admitted by Prof. Darwin, in discussing the subject with Mr. Nolan, that on his view of the genesis of the moon it must have originally existed as a "flock of meteorites." These falling in during the later stages of the building up of its mass would have produced pits on a viscous surface, much like some of the craters.

At any rate it seems unsafe to rely upon arguments respecting the condition of the earth's interior, of which we know little, drawn from that of the moon's body, of which we know less.

Harlton, Cambridge. O. FISHER.

Exact Thermometry.

THE interesting experiments of Dr. Sydney Young, recorded in NATURE of December 19 (p. 152), seem to leave no doubt that the main part of the permanent ascent of the zero-point of a mecurial thermometer, after prolonged heating to a high temperature, is not due to compression of the bulb—rendered more plastic by the high temperature—by the external atmospheric pressure. Researches on the effects of stress on the physical properties of matter have convinced me that the molecules, not only of glass, but of all solids which have been heated to a temperature at all near their melting-point, are, immediately after cooling, in a state of constraint, and that this state can be more or less abolished by repeatedly heating the solid to a temperature not exceeding a certain limit, and then allowing it to cool again (it is not only the heating but the cooling also that is efficacious). It appears that the shifting backwards and forwards of the molecules, produced by this treatment, enables them to settle more readily into positions in which the elasticity is greatest and the potential energy is least.

This "accommodation" of the molecules, as Prof. G. Wiedemann and others have called it, is, as one might suppose, attended with alterations of the dimensions and other physical properties of solids, and is not confined to the release of molecular strain set up by thermal stress, but is extended to the strain set up by any stress whatever. As years roll on, the time of vibration of a metal pendulum gradually alters (and so, no doubt, do the lengths of our standard measures), the bulb of a thermometer diminishes in volume, a steel magnet parts with more or less of its magnetism, a coil of German-silver wire gains in electrical conductivity, &c. The changes in all these cases would probably be far less than they actually are if the temperature throughout the whole time could be maintained constant; but this last is not the case—heating and cooling goes on more or less every day. We may assist the effect of time by artificially increasing the range of temperature, but it would appear that we must not exceed a certain limit of temperature, which limit depends partly upon the nature of the substance and partly upon the stresses that are acting upon it at the time. Thus, the internal friction of a torsionally oscillating iron wire which has been previously well annealed may be enormously diminished by repeatedly raising the temperature to 100° C., keeping it there for several hours, and then allowing it to fall again. The amount of diminution of internal friction depends upon the nature of the wire, and on the load which there is at the end of it (if the load exceeds a certain amount, the friction is increased instead of diminished). In attempting to "accommodate" the molecules in this manner the heating must, at any rate in some cases, be prolonged for several hours, and the substance should then be allowed to remain cold for a still longer period.

I have not had much experience with glass, but I think it probable that the settling down of the zero-point of an ordinary thermometer into its ultimate position could be very materially facilitated by the heating and cooling process mentioned above.

HERBERT TOMLINSON.

36 Burghley Road, Highgate Road, December 23, 1889.

Self-luminous Clouds.

WITHOUT venturing to call in question the occasional occurrence of self-luminous clouds, I may be permitted to relate an observation which seems to reveal a possible source of error in the records of such phenomena.

On June 14, 1887, about 10.45 p.m., I witnessed an appearance over the north-north-west horizon which struck me as very remarkable. Amidst the strong glow of twilight a few fragments of cirrus cloud shone with a pure white light having so much the character of phosphorescence that it was difficult to believe the objects were not self-luminous. Looking out again an hour later, I found no trace of bright clouds, but in their place were small bands of cirrus showing dark and grey against the feeble twilight that remained. I could not but conclude that the clouds in both instances were the same or similar, lit up by the direct rays of the sun at the time of the first observation, and having lost his rays at the time of the second observation. Had they been self-luminous they should have become brighter instead of darker as the twilight faded.

It has been suggested to me that the bright clouds seen at 10.45 p.m. may have owed their brightness, not to the sun's rays falling on them at the time, but to a temporary phosphorescence, the result of exposure to the sun's rays in the day-time, and that this temporary quality had died out in the interval between the two observations.

I think this explanation is unnecessary for the following reasons. In the first place, it is certain that if a cirrus cloud were present in the atmosphere at a sufficient height to catch the sun's rays at 10.45 p.m. of a midsummer day, it would appear as a bright object amidst the surrounding gloom. And, secondly, there can be nothing incredible in the presence of a cirrus cloud at that height, when the persistence of twilight proves the presence of atmospheric particles of some kind at a greater elevation still.

GEORGE F. BURDER.

Clifton, December 19, 1889.

Duchayla's Proof.

I HAVE read with much interest the new proof given by Mr. W. E. Johnson of "the parallelogram of forces," in NATURE of December 19 (p. 153), and regard it as deserving a place among the best proofs that have been given.

I think, however, that, in his criticism of Duchayla's proof, Mr. Johnson runs to excess, when he says, "To base the fundamental principle of the equilibrium of a *particle* upon the transmissibility of force, and thus to introduce the conception of a *rigid body*, is certainly the reverse of logical procedure."

Duchayla's proof only requires us to suppose the transmission of force by *strings*. A particle is unthinkable. In presenting to a learner the conception of three equilibrating forces acting on a particle, we cannot do better than represent the forces by pulls in strings, and the particle itself by the knot where the three strings are tied together. All the steps of Duchayla's demonstration that the resultant force is directed along the diagonal of the parallelogram can be presented in tangible form with the aid of strings. I do not think this is an illogical or unnatural procedure.

J. D. EVERETT.

Belfast, December 23, 1889.

The Satellite of Algol.

THE results of Vogel's photographs as to the satellite of Algol are of great interest to your astronomical readers. The observations made at Greenwich tended to the same result, but were unfortunately intermitted before anything approaching certainty was arrived at.

Regarding it as certain that the variations of Algol are due to the interposition of a satellite, the question of the slight change in its period and the much larger change observed in the period of another variable of the same class in Cygnus becomes important. Besides the possibility of a third disturbing body it may be remarked that the existence of the solar corona and perhaps other appendages of the sun suggests that a resisting medium may exist in the entire space traversed by Algol and its satellite at each revolution. Also if the influence of gravitation is propagated in time (with whatever degree of velocity) the very rapid angular motion of a satellite which performs a complete revolution in less than three days (and in another variable of this class in twenty hours) could hardly fail to exhibit traces of this time-propagation. The attractive force, in fact, would never act in the line joining the centres of the principal star and satellite, and the deviation would probably be perceptible. I hope some mathematical astronomer will take up the problem, and show what the effects of each of these supposed causes would be. W. H. S. MONCK.

16 Earlsfort Terrace, Dublin, December 21, 1889.

Maltese Butterflies.

IN reading Mr. Wallace's "Darwinism" I am reminded by his observations on Island fauna (p. 106) of the impressions made upon me by the natural productions of Malta. My time was so fully occupied that I had little opportunity of exploring the country districts. I paid one visit to the extraordinary ruins of a Phœnician temple at Hagiar Kim, and one to the curious islet in St. Paul's Bay. On the latter I noticed several strange thistles and a beautiful flower—something like a large pink or purplish Tutsan. On the barren wastes round Hagiar Kim many familiar wild flowers grew, but all seemed shrunk and shrivelled as compared with those of Britain. The only unfamiliar one was called by the natives "the English flower." It was a tall trefoil with a drooping yellow trumpet-flower (not at all papilionaceous in form), and grew plentifully by the edges of the dustiest roads—unlike anything I know in England.

I lived for some time at the Imperial Hotel, at Sliema, which has a somewhat extensive garden, in which I used to spend about half an hour every morning. During April and May it was very lovely. The oleanders were then in their richest bloom; a shrub like a gigantic heliotrope, both in flower and leaf, was frequented by myriads of humming-bird moths; there were a few strawberry-plants, the fruit of which was delicious, although even smaller than that of our own wild kind; but most attractive to me were the clumps of valerian and scabious which were haunted, just as at home, by crowds of butterflies. These included blues, coppers, wood-ladies, painted-ladies, red-admirals, tortoise-shells, and swallow-tails. All of these were smaller than their English relatives are, and much less brilliant in colour. The swallow-tails were especially dwarfed in their proportions. I am puzzled to account for their presence in Malta, as there is nothing like a marsh or a fen in the whole island, whilst in England they are only to be found in the district of the meres. Can any of your readers throw light on this mystery? I saw several of the larger hawk-moths. They did not seem to suffer in size, but even they were dimmer in their colours.

Hoping to get a general idea of Maltese entomology, I visited the University Museum—only to find a few cases of insects in which every specimen had been devoured by mites! GEORGE FRASER.

Leighside, Tunbridge Wells, December 22, 1889.

A Preservative.

I HAVE been very much troubled in conducting classes in mammalian anatomy by the want of a preservative medium which would retain the natural colour and texture of tissues, would impart to them no offensive smell, would be inexpensive, and easily handled. Various experiments with freezing, alcoholic, glycerine, and other media have all proven failures, and this fall I turned to experimentation upon the simplest and cheapest of all chemical reagents—water and table-salt. My entire success with these was so satisfactory that I shall, at the risk of telling an old story, state the experiments here.

I tried preserving squirrels in three strengths of salt solution, one of 5 parts by weight of salt to 95 of water, a second of 10 per cent. salt, and a third of 15 per cent. All gave satisfaction, but the 10 per cent. seems best, because the weakest solution in which putrefaction could not take place. Specimens placed in five times their bulk of this solution retain the natural flexibility of all the tissues; the peculiar look of nerve-tendon and blood-vessel against muscle is retained; the tint of muscle is faded somewhat by the solution of hæmoglobin from the blood, but it is still distinctly reddish; there is no putrefactive odour; all of this after four weeks standing in the laboratory.

This is so simple a preservative that I wonder that it is not in common use. H. LESLIE OSBORN.

Hamline University, St. Paul, Minnesota, December 7, 1889.

The Evolution of Sex.

IT is a fact well known to pigeon fanciers that the two eggs laid by pigeons almost invariably produce male and female. But no attempt appears to have been made to ascertain which of the two eggs produces the male, and which the female. The second egg is laid about twenty-four hours after the first. I have kept pigeons for seven or eight years, and have only met with one or two instances of the young birds, produced from the two eggs, being of the same sex. Recently I have made several experiments to ascertain if any relation exists between the order in which the eggs are laid and the sexes of the young birds produced. The results show that the egg first laid produces the female, the second egg the male. It may, perhaps, be well to give the experiments.

(i) Egg 1 of pair A produced a female; egg 2 was bad.
(ii) Egg 1 of pair B produced a female; egg 2 a male.
(iii) Egg 1 of pair B produced a female; egg 2 a male.
(iv) Egg 2 of pair B produced a male; egg 1 was bad.
(v) Egg 1 of pair C produced a female; egg 2 was bad.
(vi) Egg 2 of pair D produced a male; egg 1 was broken.

These experiments were made on white fantail shakers. A large number of experiments must be made to prove if this relation does exist; should it be found correct, an examination of the eggs and of the ovary of the parent might throw some light upon the "evolution of sex." M. S. PEMBREY.

Oxford, December 14, 1889.

Fighting for the Belt.

A FIGHT has been going on in my verandah for the last half-hour between two young birds—minas—with four birds of last season looking on.

Now the fight is just over. I have watched it throughout, and am positive that one of the on-lookers walked often round the combatants without interfering; and that another on-looker came, when he (or she?) could, and attacked one of the fighters. I say "came when he could," because the other on-looker prevented him if possible—even fighting to that end. It seemed to me very much as if two youngsters from different nests were fighting for the belt, and the parents looking on—the one complacently at her offspring's success, the other angry and breaking the rules of the ring to help the weaker. F. C. CONSTABLE.

Karachi, December 1, 1889.

The British Museum Reading-Room.

THE proper ventilation of this spacious room is a problem, surely not insoluble, but still awaiting solution. Is it not a serious grievance that to make use of one of the finest libraries in existence, means, for many, injury to health? Bad headaches and other ills, due to the stuffy and impure atmosphere which collects about the desks, are a common experience; and I know men who have given up going to the place on that account. For readers who live by work which can only be done there (some of whom are women), the matter is especially grave. Officials, again, will tell you that they often feel thoroughly done out after their day's work, which in itself is not generally severe. It seems to me the atmosphere improves after the lamps are lit; possibly owing to the upward current of heated air. If this were verified, it might offer a clue to improvement. The whole matter calls for thorough scientific investigation; and I would suggest, as a preliminary step, that analysis be made of the air (say) on a Saturday afternoon, with regard not only to its gaseous constituents, but also to micro-organisms, which are no doubt plentiful. A. B. M.

"*AMONG CANNIBALS.*"[1]

IN the year 1880, Mr. Carl Lumholtz—as he explains in the preface to the work the title of which is given below—undertook an expedition to Australia, partly at the expense of the University of Christiania, with the object of making collections for the zoological and zootomical museums of the University, and of instituting researches into the customs and anthropology of the Australian aborigines. His travels occupied four years, and the first part of that time he spent in the south-eastern colonies, South Australia, Victoria, and New South Wales. From November 1880 to August 1881 he was in Central Queensland, and at the latter date he began his first journey of discovery, in the course of which he penetrated about 800 miles in Western Queensland—the results, he says, in no wise corresponding to the hardships he had to endure. He then went to Northern Queensland, where he spent fourteen months in constant travel and study, his head-quarters from August 1882 to July 1883 being in the valley of what he describes as "the short but comparatively broad and deep Herbert River," which flows into the Pacific at about 18° S. lat. From his base on this river he made expeditions in various directions, extending in some instances to nearly 100 miles, and he repeatedly came in contact with savages who had never before been visited by a white man.

It is to the period spent by him in the camps of the northern aborigines that Mr. Lumholtz chiefly devotes attention in the present volume, and it would hardly be possible to praise too highly the manner in which he has recorded his experiences. In every part of his narrative he displays a remarkable power of keen and accurate observation, and he presents his facts in a style at once so fresh and so simple that from beginning to end the reader's interest is maintained. Hitherto students of anthropology in Australia have derived their materials mainly from the southern part of the continent. Mr. Lumholtz may almost be said, therefore, to have broken new ground, and it is ground which it was well worth while to break, for the northern aborigines—from an anthropological point of view—are even more interesting than the southern tribes. They are decidedly at an earlier stage of development, and many of them have been only slightly and indirectly influenced by the ideas of European settlers.

If there are any survivors of the school of Rousseau, who attributed so many fine qualities to "the noble savage," it would be wholesome for them to study what Mr. Lumholtz has to tell about the savages of Northern Queensland. A more unlovely picture than his description of these poor people it would hardly be possible to imagine. He went to Australia full of sympathy with the natives; when he left it, he found that his interest in them was as deep as ever, but that his sympathy had nearly vanished. That they are cannibals is beyond doubt. Luckily, they do not take to white flesh; it has too salt a flavour for their taste. But native flesh, when they can get it, provides them with the meal they like best, and they are quite willing to talk freely about the parts which they consider the most delicious morsels. They are not only treacherous, but seem to have not the faintest idea that treachery is anything to be ashamed of. If anyone is kind to them, they at once mistake his motive: they fancy that his generosity springs from fear, and if this notion gets into their minds, it is time for their benefactor to look about him, for they will not scruple to kill him in order to obtain possession of his goods. Mr. Lumholtz found that, when accompanied by a party of natives, it was unsafe for him to walk in front; he had always to bring up the rear, and to keep every one well in view. At night, before going to sleep in his tent, he had to fire his gun as a reminder that he had the means of defending himself. For this weapon they had the most profound respect; also for his revolver, "the baby of the gun." The supreme ambition of the native is to have as many wives as possible, their number being regarded as a test of his wealth and importance. And he takes good care that they shall not earn his approval too easily. All the hard, disagreeable work has to be done by women, and when they excite the displeasure of their lords they may think themselves well off if they are not severely beaten.

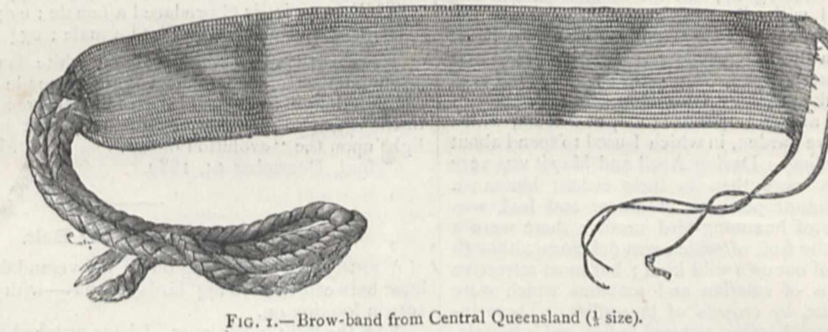


FIG. 1.—Brow-band from Central Queensland (⅓ size).

In every way these savages are creatures of impulse. It is difficult for them to fix their attention on anything, and they can look ahead only a very short way. Fortunately for themselves, they have no intoxicating stimulants, but tobacco gives them intense delight, and it was chiefly by promising to reward them with small quantities of it that Mr. Lumholtz was able to secure their services. When they have a chance, they gorge themselves with food; and on a hot day they plunge like dogs into water they may happen to pass. At the approach of night they become timid, trembling at every sound they hear in the bush; but with sunrise all their fears are dispelled, and after they have become thoroughly awake—a rather slow process—they are ready for any pleasure that may come in their way. It is a happy moment for them when they discover a tree in which there is honey. This they eat with rapture; and Mr. Lumholtz says he has known cases in which they have lived upon it for three days in succession. If a savage finds such a tree, and is not able at once to take possession of its treasure, he marks the tree, and the mark will be respected by members of his own family or clan. There is, however, no conception corresponding to the idea of property, so far as anything claimed by strangers is concerned.

[1] "Among Cannibals: an Account of Four Years' Travel in Australia, and of Camp Life with the Aborigines of Queensland." By Carl Lumholtz, M.A. With Maps, Coloured Plates, and 122 Illustrations. (London: John Murray, 1889.) We are indebted to the kindness of the publisher for the use of the cuts reproduced in this article.

As the people live in small groups, they have, of course, the germs of social life; but more than this they can scarcely be said to possess. But they have aptitudes which have been naturally developed in the circumstances

Fig. 2.—Wallaby Hunt.

in which they spend their lives. They display extraordinary cleverness in climbing trees, and their sense of

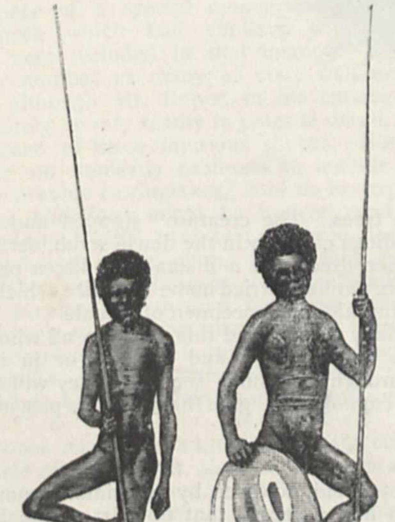


Fig. 3.—Peculiar position of natives resting.

smell is so keen that it is invaluable to them when they are tracking wild animals. In various kinds of handiwork they have considerable skill. Fig. 1 represents a browband of native workmanship ($\frac{1}{3}$ size). This specimen however, comes from Central Queensland. The Australians are generally supposed to throw the spear well, but Mr. Lumholtz never discovered any remarkable ability of this sort among the blacks of Herbert River. Fig. 2, represents a wallaby hunt, which he had an opportunity of seeing. He says:—

"Soon those who had remained behind spread themselves out, set fire to the grass simultaneously at different points, and then quickly joined the rest. The dry grass rapidly blazed up, tongues of fire licked the air, dense

Fig. 4.—Message stick, with interpretation of inscription.

clouds of smoke rose, and the whole landscape was soon enveloped as in a fog. I fastened up my horse and went into this semi-darkness, watching the blacks, who ran about like shadows, casting their spears after the animals that fled from the flames. But though many spears whizzed through the air, and though a large field was burned, not a single wallaby was slain."

Mr. Lumholtz often noticed natives resting in a most peculiar position, represented in Fig. 3. "They stood on one foot, and placed the sole of the other on the inside of the thigh, a little above the knee. The whole person was easily supported by a spear." This custom is said to prevail among the inhabitants of the Soudan and the White Nile district.

A kind of sign language is occasionally used by the Australians. It consists of figures scratched on "a message stick" made of wood, about four to seven inches long, and one inch wide. Fig. 4 represents one of these sticks. It conveys a message from a black woman named Nowwanjung to her husband Carralinga, of the Woongo tribe. "Other message sticks," says Mr. Lumholtz, "are engraved with straight or circular lines in regular patterns as in embroidery; this has caused an entirely different view of their significance, which supposes them to be merely cards to identify the messenger. This view may be correct, but it is not corroborated by my experience on Herbert River."

Mr. Lumholtz secured a valuable collection of zoological specimens, and some of the best passages in his book are those relating to this part of his work. Fig. 5 represents

Fig. 5.—Young Cassowary.

a young cassowary, which the natives one day brought to him, with two eggs. He at once asked the natives to guide him to the nest, near which, in a bed of loose leaves, he placed the young bird, hoping to attract the old one. After the lapse of about ten minutes they suddenly heard the voice of the cassowary. This usually sounds like thunder, "but now, when calling its young, it reminded us of the lowing of a cow to its calf." Soon the beautiful blue and red neck of the bird became visible among the trees. The creature "stopped and scanned its surroundings carefully in the dense scrub, but a charge of No. 3 shot, fired from a distance of fifteen paces, laid it low." Six natives carried home the prize, which proved to be an unusually fine specimen of a male.

We cordially recommend this book to all who take an interest in anthropology and zoology, or in incidents of travel through unfamilar scenes. They will find in it much that cannot fail to give them genuine pleasure.

BRITISH EARTHQUAKES.

It is somewhat remarkable that the ordinary notion that Great Britain has a special immunity from serious earthquake phenomena, still very generally obtains credit. An explanation of this popular fallacy may perhaps be found in the simple fact that, on the average, few people living at any one time chance to have experienced any considerable shock; whilst in the case of those few—we except the many who were affected by the disastrous Essex earthquake five years ago—who have felt the sensation, as a momentary mental impression it has been soon forgotten. It should, however, by this time be more generally known and accepted that no part of the habitable globe is entirely exempt from seismic action, and that earth-tremors of considerable amplitude and intensity are by no means necessarily connected with volcanic disturbances, as was formerly supposed. When it is duly recognized that, at the lowest computation, 600 disconnected shocks are known to have taken place in this country during the present era, the popular belief respecting "our tight little island" may well be entirely shaken. This number includes many earthquakes of considerable magnitude, and the additional seismological evidence of modern compilations furnishes the testimony that as many as six or eight minor shocks have occurred annually in recent years. In evidence of the prevalence of such phenomena in England, it should be also remembered that it was on this island that Prof. George Darwin first discovered the fact of the continuous microseismic vibration of the earth's crust.

The new edition of the late Mr. William Roper's excellent summary of the principal earthquakes that have been recorded in Great Britain and Ireland during this era, which has lately been issued,[1] bears witness both to the frequency of such phenomena, and, even more strikingly, to the great advance that has taken place within recent years in the study of seismology in Britain. The increased attention which has been devoted to the subject is doubtless partly due to the extensive shock which occurred in this country in 1884.

The famous Catalogue compiled by Robert Mallet will ever remain the cyclopædic work of reference upon which all subsequent earthquake catalogues will necessarily be based; and the name of Mallet, as the authority, naturally figures most extensively in Mr. Roper's list. Until recently, it may, indeed, be said that the work of Mallet, and of M. Alexis Perrey, of Dijon, stood almost alone as the historical register of seismic force in the world. Within the last few years, however, the valuable experimental work of Prof. Milne and others in Japan, and of numerous European and American seismologists, has been supplemented by several treatises devoted to British earthquakes alone. Some of these publications—as the detailed report of the great Essex earthquake, and Mr. E. Parfitt's Devonshire Catalogue—being issued in connection with particular areas, and by local scientific bodies, have had a restricted application; whilst others, as Prof. O'Reilly's catalogue, and the one just mentioned, have included the entire British Islands in their scope. It was the intention of the present writer, when engaged, in conjunction with Prof. Meldola, upon the Report of the East Anglian earthquake,[2] to furnish a full list of British earthquakes; but, from the quantity of material accumulated from very many sources, it was found that so extensive a catalogue grew entirely out of proportion to the purpose of a special monograph, and only those disturbances which had similarly caused structural damage were included in that memoir. These alone, however, number as many as sixty well-authenticated records, although Mr. Roper, in his catalogue, which, unfortunately, is very scanty in point of detail, omits fully 25 per cent. of these injurious shocks. But since his catalogue too modestly professes to include only "the more remarkable earthquakes," it is to be expected that numerous omissions might be noticed, and we could readily add to his list over two or three dozen records (both mediæval and modern) which fully equalled the average intensity of those he has included. In fact, while it may be said to form the most comprehensive list of British earthquakes that has yet been produced, it is incomplete, and it is much to be regretted that the compiler did not survive to finish his erudite undertaking, as is explained in a prefatory note by his son.

Mr. Roper has, in effect, unconsciously erred unduly on the side of moderation, since he includes most of the fabulous stories that belong to mediæval times, while he has omitted many important shocks. This recalls a somewhat strange incident in connection with the 1884 earthquake—namely, that more damage actually occurred in the out-of-the-way villages chiefly affected by the shock, than was ever reported in the London newspapers—a fact which does credit to the caution exercised by the daily press writers at the time. Too much, on the other hand, was made of the really slight but widely distributed shock which took place on May 30 in the present year, when no displacement of furniture nor stoppage of clocks then resulted; the experience being limited to the rattling of windows and the swaying of walls, as may be seen on referring to the summary which appeared in NATURE for June 6 (pp. 140–42).

Covering so considerable a period of history, and including so much subject-matter, Mr. Roper's work certainly deserved a more extended treatment than it has received. An introductory analytical chapter would have added considerably to the interest of such a catalogue, while a fuller elaboration and thorough editing would have advantageously extended the work beyond its unpretentious limit of fifty pages. The convenient method adopted by Mr. Roper of inserting a preliminary list of "principal authorities cited," is almost compulsory in such a work, for the purpose of establishing a code of abbreviations for subsequent use in the columns of the list; but the titles are generally given imperfectly or incorrectly, without the requisite details of publication, while the dates, where given, are not throughout those of the original, as they should be, but of later reprints. These and similar slight defects are inconvenient in an historical treatise, and we hope they may receive attention in the event of another edition of this interesting list being called for.

The total number of distinct earthquakes included in this catalogue—regarding the series of repeated shocks which sometimes take place within a brief period as a single record—amounts to 582, and an analysis of these records may be of interest here, as furnishing some slight indication of the chronological distribution of the chief seismic disturbances which have been accounted in British annals as having taken place within our area. They may, for convenience, be arranged as they occurred during each century, and term of 500 years: thus—

1st century	6	
2nd ,,	5	
3rd ,,	8	Total during the 1st 500 years 34
4th ,,	9	
5th ,,	6	
6th ,,	7	
7th ,,	6	
8th ,,	7	,, ,, 2nd ,, 28
9th ,,	3	
10th ,,	5	
11th ,,	27	
12th ,,	28	
13th ,,	26	,, ,, 3rd ,, 97
14th ,,	12	
15th ,,	4	
16th ,,	20	
17th ,,	36	
18th ,,	132	,, ,, 4th ,, 423
19th ,, (to 1889)	235	

It may perhaps be fairly assumed from this table that no true estimate of the actual number of shocks happening within each period can be arrived at, for the chief reason that the records are entirely subject to the irregularities of the few capable observers of the early centuries. It is to be observed that 423 shocks, or nearly 75 per cent. of the total number, have occurred since 1600, which may be considered as the period from which the more trustworthy accounts commenced. There is no reason whatever for supposing that the frequency of seismic shocks has increased since that period; and the evidence indicates little more than the activity of the observers, who appear to have fallen off considerably at times, as during the fourteenth and fifteenth centuries. This point is worth remarking, on account of the misleading statement that has been more than once made,

[1] "A List of the more Remarkable Earthquakes in Great Britain and Ireland during the Christian Era." Compiled by William Roper, F.S.S., F.R.Met.Soc. (Lancaster: Thos. Bell.)

[2] "Report on the East Anglian Earthquake of April 22, 1884." By Raphael Meldola, F.R.S., &c., and William White. (Essex Field Club Special Memoirs, vol. i.) (London: Macmillan and Co., 1885.)

that the twelfth century was specially subject to earthquakes.

Since the development of telegraphy, and the consequent rapid production of daily press news, the means of recording such phenomena with prompt accuracy has of course been greatly facilitated. This is very apparent when the number of shocks which have occurred within the present century is apportioned into decades of ten years. Thus—

In 1800-10	there were	9	shocks recorded.
,, 1811-20	,,	36	,,
,, 1821-30	,,	23	,,
,, 1831-40	,,	49	,,
,, 1841-50	,,	27	,,
,, 1851-60	,,	12	,,
,, 1861-70	,,	25	,,
,, 1871-80	,,	18	,,
,, 1881-88	,,	34	,,

Making a total number, between 1800-88, of 233 shocks.

Although it appears from this artificially divided list as if a low decade was followed, as a rule, by a high decade, the number being often doubled, no safe computation whatever can be inferred; and the more one considers the facts accumulated, the more one feels that there is no real evidence upon which the various conjectures respecting earthquake periodicity have been made. About a dozen only of the numerous Comrie shocks are included in the above figures, but even this number is sufficient to materially affect any such calculation, whilst very many other well-authenticated shocks, as already mentioned, are omitted in Mr. Roper's list. With regard to Comrie, in Perthshire, it may further be remarked that, during the month of October 1839, as many as sixty-six separate shocks are reported to have taken place; and during the years 1839-42, altogether upwards of 200 vibrations were experienced in that district (*vide* NATURE, vol. xxiii. pp. 117 and 170).

With regard to the trustworthiness of the earlier records, it may be generally assumed that some earth vibration did actually take place at the time stated, notwithstanding the exaggerations and extraneous notions that were mixed up with such phenomena in superstitious times. But whether the occurrence was in every case an earthquake in the proper sense of the term is open to doubt. It is, indeed, highly probable that such occurrences as that recorded under the date of June 7, 1750, and other more recent cases, were not earthquakes at all, but the effect of bursting bolides, similar to the phenomenon which was described very fully in *Symons's Meteorological Magazine* for December 1887. Others, again, appear to have been no more than extensive landslips, or other superficial rock displacements resulting from aërial denudation; while some others were probably only connected with violent storms, or the frost-cannonadings which are commonly produced on exposed chalk cliffs during the winter season.

The absurd statements that were made respecting some of the older occurrences are evidently either intentional or unintentional falsehoods; but many of them contain so much quaint humour that a few samples are well worth quoting. In the year 132 A.D. there was a terrible earthquake in England, when "men and cattle were swallowed up"; but this fashion in recording events had been set at least twenty-nine years earlier, for in the year 103, "a city is said to have been swallowed up." In 418 there was one that was "great and general; then famine, plague, hail, snow, cold, and meteors." In 505 one lasted for three hours. At about three o'clock on August 11, 1089, there was a terrible one in England, which caused great scarcity of fruit, and a late harvest; while twelve years later there was another that "terrified all England with a horrid spectacle, for buildings were lifted up and then again settled as before." Again, in 1177, near Darlington, "the earth swelled up to a great height from nine in the morning to the setting of the sun, and then with a loud noise sank down again"; there was another that took up all the day in 1110; while on September 11, 1275, a great earthquake was felt in Newcastle, with "dreadful thunder and lightning, blazing stars, and a comet, ... with the appearance of a great dragon, which terrified the people between the first and third hour of the day." This savours somewhat of the Chinese dragon fables, while some others almost match the deluge of Noah in their vast extent. In 974, for instance, "a great one shook the whole of England"; while earlier still, in 856, one occurred "over the greatest part of the known world." In 1133, "in manie parts of England an earthquake was felt so that it was thought that the earth would have sunke under the feete of men, with such a sound as was horrible to heare." In 1290, there was one felt in England that was described as being "nearly universal (!) in Europe"; while we are assured, with circumstantial evidence, that, in the year 1426, "on the even of St. Michael the Archangel, in the morning before day, betwixt the hours of one and two of the clocke, beganne a terrible earthquake, with lightning and thunder, which continued the space of two houres, and was universal through the world. The unreasonable beasts rored and drewe to the townes with hideous noise; also the fowls of the ayre likewise cried out."

Space does not permit of other equally curious accounts, as marvellous almost as the more primitive traditions of patriarchal times regarding the vindictive forces of Nature.

Whatever may be said about the accompaniments and absurd effects which have been ascribed to earthquake action, the majority of those shocks which are recorded as having caused damage to buildings may fairly be set down as facts, and although they may have occasionally been exaggerated, some of the details are generally authentically described.

A curious problem may be raised with regard to the effect of earthquakes upon river courses. That shoals have frequently been produced along marine coasts is well known, a striking case being that which happened early in January 1885, off Malta, to the extent of dangerously affecting navigation; but there are several accounts which agree in the assertion that the beds of such navigable streams as the Trent and the Thames have been temporarily raised by local earthquakes so as to permit of people "passing over dry-shod." What became of the river course during the operation is a problem that does not appear to have required solution. Yet sufficient circumstantial evidence has been produced, in connection with the shock in 1110 at Nottingham, and in 1158 at London, to almost warrant the idea that a certain amount of credence may be given to the stories. Whether it may be inferred from such statements that a change in the bed of the rivers in question then took place is doubtful, as history yields us no information on the point.

As a general statement we may safely infer finally that earthquakes in Great Britain, including the microseismic disturbances which are now so frequently recorded, were as common in the past as in the present period of more scientific observation; though, fortunately, such calamitous results as attended the catastrophe in Essex within recent times continue to be rare. It is still a matter for regret, however, that no steps have yet been taken to establish seismographs in different parts of this country. Until this is done, the chance records of various individuals—whose impressions, being inevitably affected more or less by the personal equation, produce only doubtful data—must continue to take the place of precise observation.

WILLIAM WHITE.

EFFECT OF OIL ON DISTURBED WATER.

GENERALLY speaking, proverbs are the resultant expression of observed facts, but the efficacy of oil upon troubled waters would appear to be a proverb which, instead of being preceded by and founded upon trial and experiment, has rather led to the scientific demonstration and establishment of the truth it asserts. From the very earliest ages the effect of oil when poured upon disturbed water appears to have been widely known. Aristotle mentions it, and accounts for the phenomenon by assuming that the thin film of oleaginous matter into which oil resolves itself when poured upon water prevents the wind from obtaining a hold upon the water, and so checks the wave formations which are the usual results of wind at sea. Pliny, too, observes that among the officers of his fleet the soothing influence of oil was matter of common knowledge, and that the Assyrian divers were in the habit of sprinkling the surface water with oil when they wished to smooth down ripples, and so obtain a better light for prosecuting their work below. Coming down to more recent times, the custom of oiling the waves with a view to facilitate navigation would appear to have fallen into desuetude. Benjamin Franklin, however, seems to have been led, from observing the effect of pouring overboard some greasy water, to test its potency in a thoroughly scientific manner, when on a voyage across the Atlantic. Having experimented with great success upon the surface of a pond near London, he tested the effects of oil upon the sea itself. A stormy day was chosen, and from a boat, some half a mile from the beach at Portsmouth, oil was poured upon the sea. The experiment met with a very small share of success, for, while a greasy patch of water was discernible right to the shore, the surf continued to break upon the beach with unabated vigour. Subsequent and recent investigation has confirmed Franklin's finding, and proved that the greatest benefit derived from the use of oil is obtainable in deep water, where wave-motion is merely undulatory. When a shore-approaching wave ceases to find enough depth to impart to its neighbour its peculiar undulatory motion, it is no longer a wave pure and simple, but becomes an actual moving body of water which moves rapidly forward, until it breaks with great violence upon the shore; upon such waves as these, oil has little or no effect.

The knowledge of the influence of oil upon a rough sea has long been known to those engaged in the whale and seal fisheries, and its application is of common occurrence. When their vessels or boats are overtaken by a storm, they usually, by means of a drogue or sea anchor, make what is nautically termed a dead drift, *i.e.* they suffer themselves to be slowly drifted before the wind. In such circumstances as these, the application of oil to the waves insures that the area into which the boat drifts is one of calm, as the oil spreads more rapidly than the boat moves, and consequently prepares a smooth patch for the vessel to drift into. If the captain, however, prefers to run his vessel before the wind, then she ranges ahead of the oiled patch, and thus the effect of oiling the waves is very materially discounted.

The native Eskimo, when engaged in transporting his family from place to place, always insures a smooth passage for the *oomiak*, or women's boat, by trailing a punctured skin filled with oil from the stern of his *kayak*, which he propels at some considerable distance ahead of the boat containing his wife and children.

Within the last twenty years many well-authenticated instances have been placed on record as to the potency of oil as a water-soother, but unfortunately the value of such reports is very much diminished by the ship-masters neglecting to explain the relative position of their vessel in regard to the wind and sea. The British warship *Swiftsure*, when on a voyage from Honolulu to Esquimault, encountered a gale accompanied by tremendous seas. A bag, punctured with the point of a knife, was filled with oil and rigged out on the weather side of the vessel. This had such a marked effect, that the vessel rode bravely through the gale, and reached her destination in perfect safety. On October 8, 1880, a Mr. Fondacaro left Monte Video for Naples in a three-ton boat. He arrived at Malaga on February 4, 1881. On his voyage across the Atlantic, he had repeatedly to lay-to during stress of weather, and reports that he considered his safe arrival entirely due to his use of oil. A gallon of olive-oil would last him, when hove-to, for twenty-four hours. He gives it as his experience that oil does not diminish the size of the waves, but renders them comparatively harmless by preventing their breaking. There is a consensus of opinion among those who have tested the use of oil, that a small quantity is quite as efficacious as a larger one, a consumption of one pint per hour being sufficient. Small as this quantity is, the extreme expansibility of oil when floating upon the water renders it quite adequate. Thus a ship running 10 knots an hour will leave behind her a wake some 10 knots by 40 feet, covered with a thin film of oil.

The Dunkirk Chamber of Commerce, fully alive to the vast importance of the use of oil as materially conducing to safe navigation, have just reported on the results of some tests made at their direction among the French fishing fleet off Iceland. One master reports that by its use he was enabled to ride out successfully a prolonged and severe spell of bad weather, which compelled his *confrères* to run to port until the weather moderated. The Chamber rewarded him with 100 francs. Other captains who have reported in detail the result of their experiments, agree with him in stating that, for small vessels experiencing stress of weather in deep water, the use of oil cannot be too highly recommended.

Nor is the utility of oil confined alone to this branch of marine navigation. Advices just received from New York furnish some interesting particulars relative to the towage of the disabled steamship *Italia* of the Hamburg American Company. The *Italia* broke her shaft whilst proceeding from Havre to New York. In this condition she was taken in tow by the *Gellert*, of the same company. The towing hawsers—6-inch steel wire—were lengthened by heavy chain cables until the distance between the two vessels was increased to 1000 feet. Unfortunately, a heavy gale from the north-west caused a dangerous sea to arise, and it was feared that the *Italia* would have to be abandoned. As a last resort, a can of oil with a small hole in the bottom was set over the stern of the *Gellert*. The effect, according to the master, Captain Kampf, was magical. The seas broke over the bows of the *Italia* with much less fury, merely surging past in a heavy swell, while the tension on the cable was immediately relieved, and the *Gellert* was enabled, in spite of continued bad weather, to reach New York in safety, having towed her charge continuously for the distance of 750 miles. Possibly many cases of abandoned towages in bad weather might be averted did the masters of tugs but try the effect of a little oil prior to casting the vessel adrift.

The true part played by this oleaginous film in diminishing the disturbance of the sea seems to be that of a lubricant. Waves are formed by the friction of wind and water. Any force, therefore, that tends to lessen the friction reduces the violence of the waves. As far as is at present known, animal or the heavier vegetable oils form the best lubricant between the two elements. Mineral or fossil oils, which possess less viscosity and are less oleaginous in their mechanical properties, exert much less influence upon the water. This anti-frictional force of oil can hardly be over-estimated. The Atlantic waves have been calculated to exert an average pressure during the winter months of 2086 pounds per square foot. During a heavy gale this pressure is increased to 6983 pounds; yet the thin oil blanket is sufficient, when applied under certain conditions, to enable a vessel to navigate through them in perfect safety, their oiled summits raising themselves in sullen grandeur, but never breaking aboard. What the exact coefficient of friction between air in motion and water is, and the proportion of its reduction by oil or other lubricants, are questions that open up a most interesting subject of inquiry, the resolution of which will prove highly beneficial to the whole nautical and mercantile world.

Numerous experiments have been made with a view to testing the utility of oil in smoothing the approaches to exposed harbours in rough weather. The tests undertaken at Peterhead have met with unqualified success. The *modus operandi* has been to lay leaden pipes along the bottom of the harbour, taking care to keep the pipes stationary by means of concrete. The pipe is provided with numerous roses for disseminating the oil. When rough weather comes on, oil is forced along the pipes, and it escapes into the water through the apertures provided, and then, its specific gravity being less than that of water, it rises to the surface and quickly renders the sea less turbulent and the passage into the harbour quite safe. Another method employed to render safe ingress into harbours in bad weather is that of firing out to sea an oil-carrying projectile. This consists of a heavy tin tube weighted with lead at one end. The tube is filled with two or three quarts of oil, and the aperture stopped. When the projectile is fired from a gun or mortar, it reverses, and, the time-fuse exploding, the powder blows out the plug, and the liberated oil falls into the sea. A series of experiments, conducted by a Committee appointed by the United States Life-saving Service to inquire into the practical utility of oil-carrying projectiles, goes to confirm the statement made above, viz. that the power of oil to subdue the force of the waves in shoal water, or to prevent the waves breaking in surf, is very small indeed. There is one point, however, upon which all authorities who have tested the use of oil at sea are agreed. As an adjunct to the equipment of ships' boats it is simply invaluable. Many a shipwrecked crew have been enabled to keep their frail craft afloat until land was reached or a rescue effected, solely by its use. Nothing is more common among the records of shipwrecks than to read of the small boats either being swamped while at the vessel's side, or capsizing through stress of weather. In January 1884 the *Cambria* emigrant ship was run into by the *Sultan* in the North Sea, and, out of 522 on board, 416 were drowned. Of the four starboard boats, no less than three capsized, and all their occupants perished. In the collision in the Channel between the *Forest* and *Avalanche*, two out of three boats which left the *Forest* were swamped, and all on board lost their lives. These are but two instances out of many where lives *might* have been saved by the use of a little oil.

The subject of saving endangered life at sea is one that always enlists the deepest sympathies of all sorts and conditions of men. The perusal of the "Annual Wreck Chart," published by the Board of Trade, or of the lamentable records of personal sorrows and destitution consequent upon the disasters around our coasts, suggests the possibility that the loss of life might be considerably reduced by a practical knowledge of the best methods of applying oil during storms at sea. We think that much might be done by its use to facilitate the launching of boats from distressed vessels, and their safe subsequent navigation. Harbours of refuge on exposed coasts might be established at a very small cost.

In one department alone of our maritime industry, deep-sea fishing, many lives might be saved. At present, the mortality among the carriers, *i.e.* those engaged in carrying in small boats the fish from the smacks to the steam despatch-boats, is very great. Their boats might be equipped, at a very low cost, with oil-tanks or oil-bags to be used when trans-shipments are being effected in heavy weather. Already the Governments of the United States and Germany have realized the vast importance of this subject, and have instituted an exhaustive series of experiments with the view of rendering compulsory the carrying of oil for use as a life-saving equipment. When that complex and overburdened instrument of government, the Board of Trade, was asked in Parliament to cause experiments to be made relative to the use of oil at sea, the reply was, that there were no funds available for the purpose; that the Board could not spend money or become investors in such schemes. The Consultative Committee appointed under the Life-saving Appliances Act of last year have, however, suggested oil-bags, among other equipments, to be carried by boats and rafts. At the International Maritime Conference at Washington, U.S., this subject has received the attention its importance merits. Further, the National Life-boat Institution and the National Sea Fisheries Protection Association have amalgamated their forces with a view to testing the efficacy of oil, but as yet the results of their investigations have not been published. While it is very gratifying to know that the man of science and the philanthropist are ready to explore the practical utility of this question, we cannot hope for any satisfying material results until the Board of Trade sees its way to take administrative action in the matter, and to deal in a fitting manner with a question that is so indissolubly connected with the interests of all classes of this great mercantile community.

RICHARD BEYNON.

RECENT OBSERVATIONS OF JUPITER.

OBSERVATIONS of Jupiter have been conducted under great difficulties during the past opposition in consequence of the low altitude of the planet. His elevation, even at meridian passage, has only been about 16°, as observed in this country, so that the study of his surface markings has been much interrupted by the bad definition which usually affects objects not far removed from the haze and vapours on the horizon. It is, however, important that planetary features, especially those which exhibit changes of form and motion, should be watched as persistently as circumstances allow, and with this purpose in view Jupiter has been submitted to telescopic scrutiny whenever the atmosphere offered facilities for such work during the past summer and autumn. Few opportunities occurred, however, during the latter season owing to the great prevalence of clouds, and on the several nights sufficiently clear for the purpose, the atmosphere was unsteady and the definition indifferent; thus the more delicate lineaments of the planet's surface could be rarely observed with satisfactory distinctness.

The great red spot was visible on the night of May 21, 1889, and it was estimated to be on the central meridian at 12h. 31m. Further views of the same object were secured in June, July, and later months. In appearance and form it presented much the same aspect as in preceding years. Its elliptical outline is still preserved, and there seems to have occurred no perceptible change in its size. It is somewhat faint relatively to the very conspicuous belts north of it, and it is only on a good night that it can be well recognized as a complete ellipse with a dusky interior. On the evening of September 12 last, I obtained an excellent view of it with my 10-inch reflector, power 252. The spot was central at 6h. 33m., and its following end was seen to be much the darkest. This has usually been the case, and I have often noticed a very small, black spot at this extremity. Another observation was effected on the early evening of November 26, when the spot crossed the planet's centre at 3h. 54m., but the exact time was a little uncertain, the conditions being far from favourable. Possibly the spot may have effected its passage a little before this time, as from several views of the following end of this object at about 4h. 30m., I concluded my estimate might be a trifle late, but in any case the error would be small.

Comparing the observation on November 26 with that recorded on May 21, it will be found that in the interval of 188·64 days the red spot completed 456 rotations, and that its mean period was 9h. 55m. 40·15s. This is nearly identical with the rotation period I found for the same object in 1888, when it was 9h. 55m. 40·24s. (462 rotations), and in 1887, when the figures were 9h. 55m. 40·5s. It is evident from these several determinations that during the last three oppositions the motion of the spot has been very consistent and equable. There has been a slight acceleration perhaps in velocity, inducing the rotation period to become a little shorter, but the differences are so small that they may well be covered by the observational errors which cannot be altogether eliminated from work of this character, and particularly at a time when the object observed is unfavourably placed. In any case the red spot has rotated with more celerity during the last year or two than in 1886, when its mean period was 9h. 55m. 41·1s., to which it had gradually increased from 9h. 55m. 34·2s. in 1879–80. These variations of motion may be regularly effected in a cycle, and it will be very important if future observations can determine the exact period.

The white spots near the equator of Jupiter are still occasionally visible, but it has not been feasible to secure views of them of a sufficiently exact nature to deduce their rotations. In recent years the apparent velocity of these objects has been decreasing, for while in the autumn of 1880 their period was 9h. 50m. 6s., it was found, from many observations of similar markings by Mr. A. Stanley Williams, of Brighton, in 1887, that it had increased to 9h. 50m. 22·4s.

Since 1884 a number of white spots have been also observed on the northern borders of the great northern equatorial belt. The period of these is but very slightly less than that of the red spot. On September 12, I observed one of these situated in a longitude not far preceding the west end of the red spot, and it appeared to have divided the equatorial belt with a vein of bright material. There was another object of the same kind following the red spot, but in this case the continuity of the belt was not interrupted, the bright matter appearing as a slight indentation in its northern side. These markings are shown in a drawing of Jupiter made by Mr. Keeler with the great Lick refractor, power 315, on September 5 last, but they are not delineated in quite the same characters as seen here. The drawing alluded to is perhaps the best and the most replete with detail of any I have ever seen of this planet, and it furnishes clear testimony that the defining properties of the 36-inch telescope are of the highest order.

The curiously curved belt immediately north of the red spot is still one of the most prominent features on the planet's disk. It forms the southern half of the great south equatorial belt which is double. Under the ends of the red spot it suddenly dips to the north and runs into the other half of the belt. In recent years the curved belt has been very dark and pronounced in the region contiguous to the following end of the red spot, and upon its crest there have been condensations of extremely dark matter. Under the preceding end of the spot this belt is, however, more delicate in tone, and it looks like a mere pencil shading.

During the few ensuing years these interesting features may be studied to greater effect, as the planet will assume a more northerly position, and rise above the vaporous undulations which have recently much interfered with observations of his surface. W. F. DENNING.

NOTES.

DR. ARCHIBALD GEIKIE, F.R.S., has just received a diploma of membership of the Kaiserlich Leopoldinisch-Carolinisch Deutsche Akademie der Naturforscher, the oldest scientific Society of Germany.

SIR JOHN LUBBOCK'S name appears in the list of those who have received New Year's honours and appointments. He has been made a member of the Privy Council. A baronetcy has been conferred on William Scovell Savory, F.R.S., President of the Royal College of Surgeons.

THE Paris municipality proposes to do honour to the memory of Darwin by naming a new street after him.

A COMMITTEE has been formed in Paris for the purpose of preparing the way for the erection of a statue of the late M. Boussingault. His scientific researches were of so much service to industry, especially to agriculture, that the Committee ought to have little difficulty in obtaining the necessary funds.

THE death of Sir Henry Yule, which we regret to have to record, is a great loss to geographical science. He died on Monday, in his seventieth year. His masterpiece was his splendid edition of the "Book of Ser Marco Polo"—a work to the permanent value of which he added largely by his learned and luminous notes.

WE regret to announce the death, after an illness which lasted some months, of M. Eugène Deslongchamps, of the Château Mathieu, Calvados. He was formerly Professor of Zoology and Palæontology at the Faculty of Sciences at Caen, and a member of the committee of the "Palæontologie Française." He was the son of the celebrated French palæontologist, Prof. Eudes-Deslongchamps, and published several memoirs on the palæontological fauna of Normandy, ranging from Brachiopoda to the Crocodilia. His best known memoirs are the "Prodrome des Teléosauriens du Cavaldos" and "Les Brachiopodes des Terrains Jurassiques."

GERMAN papers announce the death of Dr. Karl Edward Venus, an eminent entomologist, and founder of the Entomological Society "Iris," at Dresden. He died on December 13.

THE Congress of Russian men of science and physicians is now holding its eighth meeting. Work began on December 28, and will go on until January 7.

THE general meeting of the Association for the Improvement of Geometrical Teaching will be held in the Botanical Theatre, University College, London, on Friday, January 17. At the morning sitting (11 a.m.) the reports of the Council and the Committees will be read, the new officers will be elected, and various candidates will be proposed for election as members of the Association. After an adjournment for luncheon at 1 p.m., members will reassemble for the afternoon sitting (2 p.m.), at which papers will be read by the Rev. Dr. C. Taylor, on "A New Treatment of the Hyperbola"; by Mr. G. Heppel, on "The Teaching of Trigonometry;" by Mr. E. M. Langley, on "Some Geometrical Theorems"; and by the President (Prof. Minchin), on "Statics and Geometry."

THE Annual Conference of the Principals of the University Colleges was held on Tuesday at the Durham College of Science, Newcastle-upon-Tyne, Principal Garnett occupying the chair. The Principals were subsequently entertained at dinner by the chairman. Several questions affecting the interests of the Colleges collectively were discussed at the meeting, and it was decided on the invitation of Principal Reichel that the next gathering should be held at University College, Bangor.

THE Paris Municipal Council has lately instituted two new scientific chairs in the Hotel de Ville. One of them is devoted to the study of the history of religions. The other is a Chair of Biology, and has been entrusted to Prof. Pouchet, of the Natural History Museum, who delivers a course of general lectures on the fundamental ideas relating to zoology, anatomy, life, &c.

AT a meeting of the Senate of the University of Sydney, on November 4, 1889, a letter from Dr. Haswell was read, intimating his acceptance of the Senate's offer of the Challis Professorship of Biology, to take effect from March 1, 1890.

AT the annual meeting of the Manx Geological Society on December 28, in the Peel Grammar School, Dr. Haviland, the retiring President, referred with pleasure to the fact that early in the summer Mr. Robert Russell had been sent to prosecute the geological survey of the Isle of Man. Dr. Haviland was also able to congratulate Peel on the prospect of a system of technical education being established in Christian's School, under the auspices of the Cloth Workers' Company and Sir Owen Roberts.

MR. A. V. GARRATT, Secretary of the American National Electric Light Association, has sent to the members a circular letter, asking them to state briefly the hardest electrical problems they meet in their investigations or in the conduct of their electrical business. He asks them also to state what feature of their business is the least economical or efficient, and why, and where the greatest economy could be effected if the difficulty could be overcome. The answers to these queries will be digested, and the results submitted to Prof. Henry A. Rowland, of Johns Hopkins University. Prof. Rowland has consented to address the next Electric Light Convention at Kansas City in February, basing his remarks upon the problems suggested by the members, and pointing out the direction in which their solution must be sought.

M. VICTOR GIRAUD, the African explorer, has just published the narrative of his explorations in the African Lake Region from 1883 to 1889. The work contains many illustrations.

THE fourth volume of M. Grandeau's "Études Agronomiques," just issued, contains a review of British and American agriculture, as represented at the Paris Exhibition.

AN historical sketch of the geographical works relating to Russia has been compiled by Baron Kaulbars under the auspices of the Imperial Geographical Society of Russia, in which the author endeavours to show the respective parts played by the army and navy, with various scientific societies, in the exploration and representation of the Empire. Beginning with the map found by Dr. Michof in St. Mark's library, Venice, only five years ago, and dating back to 1525, he traces all the labours, geographic and geodetic, referring to Russia. The astronomer Struve figures well among the latter workers in the measurements of various meridian arcs and the determination of differences of longitude, whilst few can speak with more authority than Colonel Baron Kaulbars himself on the geographical portion. Hydrographical labours began with Peter the Great, and all similar undertakings completed by the Russian navy have been brought together; the bibliographical sketch commencing with the Baltic Sea, as being the most important in the history of the navy. In the chapter chronicling the works of scientific societies, accounts are given of the many explorations into Siberia and Arctic regions. A long and complete list of all maps due to Russian topographers is also given in historical sequence, together with the various scales used.

THE Report of the Kew Committee for the year ending October 31 last contains an interesting account of the experiments carried on at the Kew Observatory; the list of instruments verified, especially clinical thermometers, Navy telescopes and sextants, and of chronometers and watches rated, is a sufficient test of the value set upon the certificates given. The death of Mr. De la Rue, the Chairman of the Committee, will be much felt, as he was one of the most munificent benefactors of the Observatory, and it was at his suggestion that the first photoheliograph was constructed and brought into use there. The complete sets of magnetic, meteorological, and electrical instruments have been kept in perfect working order, and summaries of the results for the year's working are given in the appendices to the Report. Sketches of sun-spots have been made on 173 days, and the collection of solar negatives taken between 1858 and 1872 have been handed over to the Solar Physics Committee, with a view to their utilization. A good whirling machine has been erected, for the purpose of examining the accuracy of small anemometers and of the air-meters employed in measuring air-currents in mine-shafts, &c. In accordance with a resolution of the International Meteorological Committee, a thermometer of very low range has been constructed, to be used as a standard spirit thermometer for temperatures ranging from zero to about -70° C.

MESSRS. SAMPSON LOW have issued, with Mr. Stanley's permission, a shilling volume, containing "The Story of Emin's Rescue as told in Stanley's Letters." It has been edited by Mr. Keltie, who contributes an introduction bringing the narrative of the Emin Pasha Relief Expedition up to the date at which the first of Mr. Stanley's letters was received. A map, showing Mr. Stanley's routes and discoveries, is included in the volume.

AT the meeting of the Photographic Society on December 10, Mr. G. M. Whipple read an interesting and valuable paper on photography in relation to meteorology. There are now 32 observatories—8 in this country, 7 in the colonies, and 17 abroad—in which photographic apparatus is used for meteorological observations.

AT the meeting of the French Meteorological Society of December 3, 1889, M. Wada gave an account of the cyclone which ravaged the southern and eastern part of Japan on September 11 and 12 last. The centre of the storm followed a course towards N. 35° E., progressing at a rate of 30 to 43 miles an hour, the velocity of the wind reaching 65 miles an hour. The barometer fell to 28·23 inches—a reading which is only known to have occurred once before in Japan. This storm raised an enormous wave, said to have been nearly 20 feet above high-water mark, and which carried away 3000 houses. M. Ritter explained his experiments upon the artificial production of clouds in liquids and gases. With regard to the clouds in the atmosphere, the author distinguishes two principal kinds—viz. (1) the "stratus" and semi-transparent mist, and (2) the ordinary forms, such as "cumulus," &c., and he deals with them from two points of view: the diffusion of vapour according to Dalton's law, and the transference of clouds by the movement of the air. He referred to the different results produced from these conditions, with regard to suspension in the atmosphere, &c. The details of the paper will be published in the *Annuaire* of the Society.

THE *Jaarboek* of the Royal Meteorological Institute of the Netherlands for 1888 is the fortieth of the series, and contains, in addition to the daily observations and summaries at various stations a summary of phenological observations for 1879–88, and observations at Parimaribo, Jeddah, and from the Upper Congo. The preface contains an explanation of the conventional signs used in this long series, and of the curious errors which have occurred from time to time; a reference to this volume is therefore necessary to anyone who wishes to make use of the observations of previous years, as the errors are not all typographical; for instance, the wind is given during a year and eight months in kilometres per hour instead of ¼ kilometres. But, notwithstanding certain defects and peculiarities of methods, the Institute has been consistent in keeping to one and the same plan, from a period at which the publication of systematic observations was in its infancy.

The trustees of the Missouri Botanical Garden, in accordance with the intention of its founder, have set a good example by establishing six scholarships for garden pupils, the object being to provide theoretical and practical instruction for young men desirous of becoming gardeners. The course of instruction will extend over six years, and will include thorough training in every department of work in which practical gardeners are interested.

From the latest Report of the School of Mines and Industries at Bendigo, Victoria, we are glad to learn that this institution continues to make steady progress. In 1883–84 it had 324 students. The number in 1888–89 was 799. This shows, as the Council fairly claim, that the efforts of the school to supply scientific and technical education to miners, engineers, assayers, architects, pharmacists, artisans, art students, and others are thoroughly appreciated in Australia. Some of the students hail from Queensland, South Australia, and other distant parts.

The fifth part of the second volume of the *Internationales Archiv für Ethnographie* has been issued. It maintains in all respects the high level reached by previous numbers. Among the contributions are an article in German, by F. Grabowsky, on death, burial, and the funeral festival among the Dajaks; and one in English, by Prof. H. H. Giglioli, on a singular obsidian scraper used at present by some of the Galla tribes in southern Shoa.

At a meeting of the Philosophical Institute of Canterbury, New Zealand, on October 3, Mr. H. O. Forbes, Director of the Canterbury Museum, Christchurch, described an extinct species of swan from osteological remains which he had discovered while excavating a cave recently exposed at Sumner, on the estuary of the Heathcote and Avon Rivers, a few miles distant from Christchurch. The cave had been entirely concealed by the falling in of the basaltic rock overhanging the entrance. This great heap of *débris* had been there since the arrival of the first settlers at Canterbury, and had been quarried from for twenty-five years for the making of roads, without any trace of a cave being exposed till about the beginning of September. When the cave was first entered, there were found on the surface a few Moa bones, and various Maori implements—a well-made paddle, an ornamental baler, numerous greenstone adzes, obsidian flake scrapers, shell-openers, and ornaments carefully polished. In some of the latter, small holes for suspending them round the neck were drilled in the most beautiful manner. It is difficult to conjecture how the Maoris had accomplished this when European workers in greenstone find it a laborious process even with, and impossible without, a diamond drill. Besides these greenstone objects, there was a great quantity of fishing paraphernalia—stone suckers, fish-hooks of all sizes made out of Moa and other bones—all carefully and elaborately fashioned. Some of the larger fish-hooks were carved out of bones which must have belonged to a Dinornis of great size. On the floor of the cave was also found a well-carved representation in wood of a dog, which seems to have formed the terminating ornament of a paddle-handle—evidence that the Maoris were well acquainted with this animal. The femur of the Maori rat and a portion of the skin covered with dense reddish fur in perfect preservation were also obtained. A quantity of human hair was scattered about, both on the floor and in the kitchen midden in front of the cave. This midden was composed chiefly of marine shells of many kinds, and of the remains of fires and feasts. One large lock of long hair—evidently a woman's—was discovered in the midden tied up with great care at both ends with plaited flax, and incased in a plaited flax pocket. Some very fine bone needles also were come upon, but little thicker than steel needles, with an eye exquisitely drilled. There were, besides Moa bones, those of many other species of birds, of dogs, of fish, of seals (both fur and hair), and sea elephants—all of which had been used for food, but no human bones. Of the ornithic remains, some apparently belong to species now extinct in New Zealand, and not yet described. The bones and egg-shells of the Moa show incontestably that the Maori and it were contemporaneous. The geological evidence would seem to indicate that this cave was of considerable antiquity, and was inhabited at intervals for a long period of time. Several fire-places occur interstratified with bands of silt, as if the cave had been inhabited and then flooded many times. Definite conclusions on the geological evidence have not yet been arrived at. The swan bones discovered consist of three complete coracoids, the proximal and distal portions of the humerus sufficient to complete the whole bone. They differ very little from those of the *Chenopis atrata* of Australia, except in their greater size. The new species has been named *Chenopis sumnerensis*. It is smaller, however, than a species of swan discovered—as a complete skeleton—many years ago in Otago, some 18 feet below the surface of the ground, when the foundation for a house was being dug in Dunedin. This Sumner cave has been closed since before the introduction of the *Chenopis atrata* into New Zealand. The extension, therefore, of the Cygnidæ to New Zealand is a very interesting fact in ornithology. A similar cave, but far distant from the present one, was excavated and examined by Sir Julius von Haast (Mr. Forbes's predecessor) many years ago. Of the bones found in it, the Moa remains were fully described by their discoverer, but none belonging to the smaller birds have as yet been described. These with the osteological collections disinterred from the Glenmark and Hamilton swamps, and from the Earnscleugh Cave, will form the subject of a future paper by Mr. Forbes before the Institute.

In a previous paper before the Philosophical Institute of Canterbury, Mr. Forbes pointed out that the bone figured by Prof. Owen on plate ciii. of his "Extinct Birds of New Zealand" as the coracoid of the *Cnemiornis*, belongs with little doubt to *Aptornis*. The coracoid of *Cnemiornis*, of which there are numerous specimens in the Christchurch and Otago Museums, is of the typical anserine form, and closely resembles that of *Cereopsis*. The coraco-clavicular angle in Aptornis approached 130°.

The following curious instance of inheritance of an acquired mental peculiarity is given by Pastor Handtmann, of Seedorf by Lenzen on the Elbe, in the *Korrespondenzblatt* of the German Anthropological Society. When acting as substitute for a few months in 1868, in the parish of Groben, in Brandenburg, he there met a farmer named Löwendorf, who, when he signed his name officially in connection with the school, always wrote his Christian name "Austug" instead of "August." Some years later, the writer was inspecting this school, and heard a little girl read "Leneb" for "Leben," "Naled" for "Nadel," and so on. On inquiry, he found her name was Löwendorf, and she was a daughter of this farmer. The father (then dead) had in talk with his neighbours occasioned much amusement by the peculiar habit, which appeared to be the result of a fall from the upper story of a barn, some time before the birth of this girl. She wrote, as well as spoke, in the peculiar way referred to.

Prof. Leumann is of opinion (*Phil. Studien*) that the influence of blood circulation and breathing, on mind-life, has been too little considered. He notices the parallelism between pulse acceleration and passion, the rush of ideas in fever, and so on. The differences of pulse and breathing in different persons are no less significant, and should be regarded in all psychometric determinations. The author noticed in boys of a Strasburg gymnasium, that in scanning verse, the number of feet spoken in a minute rose with the pulse-frequency. Even in one person, experimented on from midday till evening, the dependence of normal reading of metrical compositions on pulse-frequency was proved ; the rhythmic intervals in scanning corresponded to the pulse-intervals. Leumann supposes that to be the most general and normal song-metre, whose feet correspond to the pulsations, and its lines to respiration. And, in fact, the Indo-Germanic original metre consists of four times four trochees, an arrangement agreeing with that view ; from it arose the Nibelungen strophe and the hexameter.

In the Legislative Council of India recently, Mr. R. J. Crosthwaite in introducing the amended Land Revenue (Central Provinces) Bill, said that many objections had been raised, chiefly by the Malguzars' Association of Nagpore, to the powers given by the Bill to the Chief Commissioner to make rules for the management of forests. To show that such powers were necessary, Mr. Crosthwaite instanced two cases of the wanton destruction of forests which is so common in India. In 1885 the Deputy Commissioner of Nagpore reported that the malguzar of Munsar had given a contract for the cutting and removal of the wood in the forest land of his mahal. The villagers had rights in this forest-land, and those rights were interfered with by the cutting of the wood ; but, in spite of the Chief Commissioner, the malguzar continued the cutting, and the hills were completely stripped of all timber and brushwood. In another case a zemindar had sold the right to collect resin from his forest. The resin is obtained by girdling the trees, and it was found that in about four square miles of particularly fine forest every sab tree was killed outright. That is, four square miles of forest were destroyed to produce about 1200 rupees. Sir Charles Elliott, speaking on the same occasion, said that if some such provision as that now proposed had existed in the past, the forest clearances round Simla and along the southern slopes of the Himalayas abutting the Punjab plain could never have taken place.

Messrs. Dulau and Co. have issued a catalogue of works on chemistry and physics.

In some copies of Nature, last week, the following sentence appeared in the first paragraph of the Duke of Argyll's letter on "Acquired Characters and Congenital Variation": "But it implies the denial of 'congenital' causes." It ought to have been : "But it implies no denial of 'congenital' causes."

The additions to the Zoological Society's Gardens during the past two weeks include a Malbrouck Monkey (*Cercopithecus cynosurus* ♂) from South Africa, presented by Mr. William F. Hughes ; a Lesser White-nosed Monkey (*Cercopithecus petaurista*) from West Africa, presented by Mr. Lawson N. Peregrine ; two Viscachas (*Lagostomus trichodactylus* ♂ ♀) from the Argentine Republic, presented by Mr. Thomas Taylor ; two Crimson-winged Parrakeets (*Aprosmictus erythropterus* ♂ ♀) from Australia, presented by Mrs. G. Byng-Payne ; a Bonnet Monkey (*Macacus sinicus* ♀) from India, presented by Mr. James Entwistle ; a Malabar Parrakeet (*Palæornis columboides*) from Southern India, presented by Mr. J. E. Godfrey ; three Common Bluebirds (*Sialia wilsoni*) from North America, presented by Commander W. M. Latham, R.N., F.Z.S. ; a Black Wallaby (*Halmaturus walabatus* ♂) from New South Wales, two Black and White Geese (*Anseranas melanoleuca*) from Australia, a Ring-tailed Coati (*Nasua rufa*) from South America, deposited.

OUR ASTRONOMICAL COLUMN.

Objects for the Spectroscope.

Sidereal Time at Greenwich at 10 p.m., January 2 = 4h. 49m. 56s.

Name.	Mag.	Colour.	R.A. 1890.	Decl. 1890.
			h. m. s.	° ′
(1) G. C. 1157	—	—	5 27 52	+21 57
(2) 5 Orionis	5	Yellowish-red.	4 47 39	+ 2 20
(3) ι Aurigæ	3	Orange.	4 49 48	+33 0
(4) η Aurigæ	4	White.	4 58 48	+41 5
(5) 51 Schj.	6	Very red.	4 59 43	+ 1 2
(6) S Geminorum ...	Var.	Yellowish-red.	7 36 26	+23 43
(7) S Persei	Var.	Yellowish-red.	2 14 59	+58 5

Remarks.

(1) Described as "very bright, very large, very gradually brighter in the middle ; barely resolvable." The spectrum was observed at Harvard College in 1869. The continuous spectrum extended from about λ 450 to 607. Two bright lines appear to have been observed, less refrangible than those of other nebulæ, but no reliable measures were made, owing to errors in the micrometer (Harvard College Observations, vol. xiii. part i. p. 64). Further observations are required, as all departures from the ordinary spectrum of bright lines are especially interesting in connection with the question of the variation of spectrum with temperature. Comparisons with the carbon flutings seen in the flame of a spirit-lamp, and the brightest flutings of manganese and lead, conveniently obtained by burning the chlorides in the flame, are suggested.

(2) In this star of Group II. the bands are very weak, only 2, 3, 7, 8 being well seen. The star falls in species 3 of the subdivision of the group, the manganese fluting (band 4) being absent because it is masked by the fluting of carbon near λ 564, and 5 and 6 being absent because the temperature is low. The carbon flutings appear to be brightest in the earlier species, and it seems probable that band 9 is also present but has been overlooked. This band is the dark space lying between the bright fluting of carbon 468–474 and the end of the continuous spectrum. Comparisons with the spectrum of the spirit-lamp flame, with special reference to the presence of the carbon fluting 468–474 are suggested. Dunér's mean value for the end of the band in other stars is λ 476.

(3) This is classed by Gothard with stars of the solar type. The usual observations are suggested.

(4) Gothard describes the spectrum of this star as Group IV., but is somewhat doubtful about it. It is probably either a late star of Group III. or Group V., as in either case the hydrogen lines would be moderately thick.

(5) This is a good example of stars of Group VI., in which Dunér records the bands 2, 3, 4, 5, 6, 9, and 10. The last three are carbon absorption flutings, and the only point to be noted in connection with these is the intensity of band 6 (near λ 564), relatively to the other bands. The first four are secondary bands, possibly produced by vapours similar to those which produce the telluric bands in the solar spectrum. Other absorptions may also be looked for.

(6) This is another variable of which no spectrum has been recorded. The range of variation is from about 8·5 at maximum to $<$ 13 at minimum, and the period is 294 days. The maximum occurs on January 2.

(7) This is a variable star of Group II., of the same type as those in which Espin has found bright lines of hydrogen at maximum. The number and character of the bands and the presence or absence of bright lines should be noted. The intensity of the bright carbon flutings and their fading away, if any, as the maximum (January 7) is passed should also be noted. The magnitude at maximum is stated by Gore as 7·6 and that at minimum as $<$ 9·7.

A. Fowler.

Dr. Peters's Star Catalogue.—The case of Dr. Peters against Mr. Borst, with reference to the possession of the Clinton catalogue, containing over 30,000 stars arranged in the order of their right ascension, has been definitely settled. It will be remembered that Mr. Borst claimed the catalogue on the grounds that most of the computations had been made by him outside of his labours at the Observatory, and not under the direction of Dr. Peters, who, however, devised the work, and regarded it all along as his own, since it included his observations extending over very many years. The court held, firstly, that the manuscript could not belong to Hamilton College, of which Dr. Peters is Professor, nor to Litchfield Observatory, of which he is Director, but to the authors and to them alone; and secondly, that the whole of the manuscript, numbering 3572 pages, held by Mr. Borst, had been wrongfully detained, and would have to be delivered to Dr. Peters, with compensation for the detention.

LONGITUDE OF MOUNT HAMILTON.—A telegraphic determination of the longitude of Mount Hamilton has been made by the United States Coast and Geodetic Survey, and the result found for the transit house meridian (Fauth transit instrument) of the Lick Observatory is—

8h. 6m. 34·807s., or 121° 38′ 42″·10 W. of Greenwich,

with an estimated probable error ± 0·1s. or 1″·5.

COMET BORELLY, *g* 1889 (DECEMBER 12).—The following elements and ephemeris have been computed for this comet by Drs. Zelbr and Froebe (*Astr. Nach.*, 2943):—

T = 1890 January 27·7438 Berlin Mean Time.

$$\left.\begin{aligned}\pi &= 211^\circ\ 4'\ 23'' \\ \Omega &= 16\ 59\ 17 \\ \iota &= 59\ 56\ 56\end{aligned}\right\}\text{ Mean Eq. 1889·0.}$$

$$\log q = 9{\cdot}45755$$

$$\Delta\lambda \cos\beta = -\ 4''{\cdot}1$$

$$\Delta\beta = +\ 10{\cdot}7$$

Ephemeris for Berlin Midnight.

1889–90.	R.A. h. m. s.	Decl. ° ′	Brightness.
Jan. 4	18 31 40	+ 21 36·2	3·68
8	35 45	15 22·9	5·02
12	40 25	8 20·5	7·06
16	46 40	+ 0 19·7	10·22
20	56 31	− 8 42·1	14·80

The brightness at discovery has been taken as unity.

COMET BROOKS, *d* 1889 (JULY 6).—The following ephemeris is in continuation of that previously given (NATURE, vol. xli. p. 115):—

1890.	R.A. h. m. s.	Decl. ° ′	Brightness.
Jan. 4	0 45 54	+ 7 52·6	0·6
8	52 5	8 37·6	0·5
12	58 25	9 22·7	0·5
16	1 4 53	10 7·8	0·5
20	11 29	10 52·7	0·4
24	18 12	11 37·4	0·4
28	25 1	12 21·9	0·4

Brightness at discovery = 1.

THE SOLAR ECLIPSE.—Intelligence has been received by Mr. Turner, Secretary of the Eclipse Committee, from Mr. Taylor, stationed at Loanda, announcing that he has obtained no observations.

ACCUMULATIONS OF CAPITAL IN THE UNITED KINGDOM IN 1875–85.

AT a meeting of the Royal Statistical Society on December 17, Mr. Robert Giffen read a paper on accumulations of capital in the United Kingdom. He began by stating that he proposed to continue and expand the paper which he read to the Society ten years ago, on "Recent Accumulations of Capital in the United Kingdom," which dealt specially with the increase of capital between 1865 and 1875. He would now deal with the accumulations between 1875 and 1885, another ten years' period, and 1885 also being practically the present time, there being very little change in the income-tax assessments since 1885, though it appeared likely enough there would be considerable changes in a year or two. His notes had extended so much, as really to become a book, which would be published immediately by Messrs. George Bell and Sons, under the title of "The Growth of Capital," and the paper he now proposed to read consisted of extracts from that book. It must be understood that the computations were necessarily very rough and approximate only, and only designed, in the absence of better figures, to throw light on the growth of societies in wealth, and on the relations of different societies in that respect, with reference to such questions as the relative burden of taxation and national debts, the rate of saving in communities at different times, and the like. Exact figures were impossible, but approximate figures were still useful. The method he followed was to take the income-tax returns, capitalise the different descriptions of income from property there mentioned at so many years' purchase, and make an estimate for property of other kinds not coming into the income-tax returns. Formerly, in comparing 1865 and 1875, he had capitalised at the same number of years' purchase in each year, but between 1875 and 1885 there were changes in capital value irrespective of changes in income which it was important to take notice of, at least as between different descriptions of property, though the results in the aggregate would not be much different from what they are if no change in the number of years' purchase were made. In 1885, then, the total valuation of the property of the United Kingdom, according to the method followed in the paper, came to 10,000 millions sterling in round figures, equal to about £270 per head. The principal items were: Lands, 1691 millions; houses, £1,927,000; railways in United Kingdom, 932 millions; miscellaneous public companies in Schedule D, 696 millions; trades and professions in Schedule D, 542 millions: farmers' profits, &c., in Schedule B, 522 millions; public funds (excluding home funds), 528 millions; gasworks, 126 millions; waterworks, 65 millions; canals, docks, &c., 71 millions; mines and ironworks, 39 millions. These were all based on the method of capitalising income in the income-tax returns, and the principal item of other property, for which an estimate was made in a different way, was that of movable property not yielding income, *e.g.* furniture of houses, works of art, &c., which was taken at about half the value of houses, or 960 millions. Comparing these figures with those of 1875, when the valuation was 8500 millions, the apparent increase was 1500 millions, or about 17½ per cent.; but there were important changes in detail, lands having declined considerably, mines and ironworks having also declined, and there being a great increase in houses and some other items. It appeared also that the increase in the decade 1875–85 was considerably less than in the previous decade dealt with in the former paper. In 1865–75, in fact, the increase was from about 6100 millions to 8500 millions, or no less than 2400 millions, and 40 per cent. in ten years, and 240 millions per annum; whereas in 1875–85 the increase was only 1500 millions, or 17½ per cent. in ten years, and only 150 millions per annum. The difference in the rate of growth was ascribed very largely to a difference in the rate of growth of money values only, reasons being given for the belief that in real prosperity, in the multiplication of useful things, and not merely money values, the improvement in the later period was not less than in the first. The distribution of this great property between England, Scotland, and Ireland, could not be exactly shown, part of the income belonging to the community of the United Kingdom in a way which did not permit of a distinction being made; but upon a rough estimate it appeared that England was considered to have 8617 millions, or 86 per cent. of the total; Scotland, 973 millions, or 9·7 per cent.; and Ireland, 447 millions, or 4·3 per cent. These figures worked out about £308, £243, and £93 per head respectively, as compared with the average of £270 for the United Kingdom. The small relative amount of property in Ireland was commented upon, and the difference between it and Great Britain was ascribed very largely to the political agitation in Ireland, which depreciated property, and the excess of population on the land, which had the same effect; these two causes together making a difference of 200 millions in the apparent capital of Ireland. Measured by property, Ireland was enormously over-represented in the Imperial Parliament. Looking at the subject historically, they found that there had been an enormous and continuous advance in the course of the past three centuries, during which at different times there had been contemporary estimates on the subject. In 1600 the property estimate was for England only 100 millions, or £22 per head; 1680, 250 millions, or £46 per head; 1690, 320 millions, or £58 per head; 1720, 370 millions, or £57 per head; 1750, 500 millions, or £71 per head; and in 1800, 1500 millions, or £167 per head. The estimate for Great Britain in the latter year being about one-eighth more in the aggregate than for England only, and £160 per head. Since 1800 there are figures for the United Kingdom, and these show: 1812, 2700 millions, or £160 per head; 1822, 2500 millions, or £120 per head (a reduction largely due to fall of prices); 1833, 3600 millions, or £144 per head; 1845, 4000 millions, or £143 per head; 1865, 6000 millions, or £200 per head; 1875, 8500 millions, or £260 per head; and finally, the present figures of 10,000 millions, or £270 per head. There was in fact a steady increase, with the exception of the interval between 1812 and 1822, when there was a heavy fall of prices, and this increase, it was believed, represented almost all through a real increase in things, money prices at any rate being at a lower rate now than at the beginning of the century. There had also been a remarkable change all through in the proportions of different descriptions of property. Lands, at the commencement constitute about 60 per cent. of the total; at the beginning of the century they are still about 40 per cent.; at the present time they are 17 per cent. only. Houses, on the other hand, are about 15 per cent. of the total at the beginning, and 19 per cent. at the present time, an increasing percentage of an ever-increasing total; but the main increase after all is in descriptions of property which are neither lands nor houses. After referring to the accumulations of capital in foreign countries, Mr. Giffen concluded by giving illustrations of the mode of using such figures, showing the difference of the burden of taxation and national debts in England, France, and the United States; the preponderance of England in the United Kingdom as compared with England, Scotland, and Ireland; the rapid growth of the United States in recent years as compared with the United Kingdom, and especially as compared with France (the national debt in the United States, from amounting twenty years ago to a sum equal to a fifth of the total property, having come to be only equal to a thirtieth of the property); and the small proportion of the annual savings of the country which comes into the public market for investment, as compared with the savings invested privately as they are made. In passing, a reference was made to the talk of the vast expenditure on military armaments, and the burden they impose on certain communities; and it was suggested that, heavy as the burdens are, yet the vast amount of property relatively indicated that the point of exhaustion was more remote than was commonly supposed. In conclusion, the hope was expressed that the discussion of recent years would lead in time to the production of better figures, especially with regard to the growth of different descriptions of property. Were trouble taken, results might be arrived at which would be of value to the Government practically, as well as to economists in their discussions. The progress of revenue was intimately connected with the progress of national resources, and the progress of money revenue with the progress of the money expression of those resources. The resources themselves, and the money values, must be studied by Chancellors of the Exchequer with almost equal anxiety, and they should both, at any rate, be studied together. Periodical complete valuations of property were in this view as indispensable as the census of population itself.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

University College, Liverpool.—The Sheridan Muspratt Chemical Scholarship, of the value of £50 per annum for two years, has been awarded to Mr. J. T. Conroy, who has been a student in the chemical laboratories during the past two years. Mr. Conroy has recently taken the degree of B.Sc., with honours in chemistry, at the University of London. The Scholarship, which is the gift of Mrs. Sheridan Muspratt, is intended to enable the holder to continue work in the higher branches of chemistry. The Sheridan Muspratt Exhibition of £25 has been awarded to Mr. A. Carey, of Widnes, who has been a student of the College during the last two and a half years, and is now in the final stage of preparation in the honours school of chemistry of Victoria University.

SCIENTIFIC SERIALS.

Rendiconti del Reale Istituto Lombardo, November.—On the antidotes of the virus of tetanus, and on its prophylactic surgical treatment, by Prof. G. Sormani. In continuation of his previous paper on this subject, the author here describes some further experiments with alcohol, chloroform, and various preparations of camphor, chloral, and iodine. He finds that camphor and camphorated alcohol produce no effect on the virus, and that chloroform and hydrated chloral have a more or less attenuating action, checking the development of the artificially cultivated microbe, or even in some cases rendering it absolutely sterile, while camphorated chloral has a decidedly neutralizing effect on the virus. Other experiments show that when tetanus is once developed in the system iodoform is powerless to arrest its progress, but is most efficacious in neutralizing the virus of the injured part. The whole series of experiments fully confirms the author's previous conclusion that iodoform is the specific *disinfectant* of the microbe of tetanus.

Bulletin de l'Académie Royale de Belgique, October 12.—Jupiter's north equatorial band, by M. F. Terby. The author describes in detail the structure of this remarkable phenomenon which he has been carefully studying for the last three years with a Grubb 8-inch telescope.—Determination of the invariant functions or forms comprising several series of variants, by M. Jacques Deruyts. In continuation of his previous communications, the author here extends to forms with several series of variants the results already made known for forms with a series of n variables.—M. C. Vanlair describes the symptoms and treatment of a new case of bothriocephaly in Belgium, due to the presence of *Bothriocephalus latus* in the patient.

SOCIETIES AND ACADEMIES.

London.

Royal Society, December 5, 1889.—"Researches on the Chemistry of the Camphoric Acids." By J. E. Marsh.

An account is given of some experiments leading to the production, in any desired quantity, of a new camphoric acid, and to the mutual conversion of one acid into the other; as well as to a method of quantitatively separating the two acids when mixed. The space at our disposal does not permit us to enter into any details of the experiments, nor into the theoretical considerations involved. For this, reference must be made to the original paper.

December 19, 1889.—"On the Steam Calorimeter." By J. Joly, M.A. Communicated by G. F. Fitzgerald, F.R.S., F.T.C.D.

The theory of the method of condensation has been previously given by the author in the Proceedings of the Royal Society, vol. 41, p. 352.

Since the publication of that paper a much more extended knowledge of the capabilities of the method has been acquired, which has led to the construction of new forms of the apparatus, simple in construction and easily applied. Two of these are described and illustrated, one of which is new in principle, being a differential form of the calorimeter. The accuracy of observation attained by this latter form is so considerable that it has been found possible to estimate directly the specific heats of the gases at constant volume to a close degree of accuracy.

An error incidental to the use of the method arising from the radiation of the substance, when surrounded by steam, to the walls of the calorimeter, is inquired into. It is shown that this affects the accuracy of the result to a very small degree, and is capable of easy estimation and elimination.

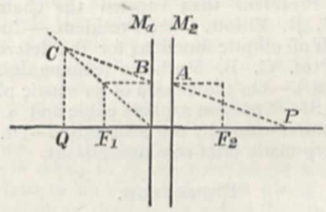
Further confirmation of the accuracy of the method is afforded in a comparison of experiments made in different forms of the steam calorimeter.

Various tables of constants are given to facilitate the use of the method, and the results of experiments on the density of saturated steam at atmospheric pressures, made directly in the calorimeter, are included. These are concordant with the deductions of Zeuner, based on Regnault's observations on the properties of steam, and were undertaken in the hope of affording reliable data on which to calculate the displacement effect on the apparent weight of the substance transferred from air to steam.

The communication is intended to provide a full account of the mode of application of the steam calorimeter.

Royal Meteorological Society, December 18, 1889.—Dr. W. Marcet, F.R.S., President, in the chair.—The following papers were read:—Report of the Wind Force Committee on the factor of the Kew pattern Robinson anemometer. This has been drawn up by Mr. W. H. Dines, who has made a large number of experiments with various anemometers on the whirling machine at Hersham. Twelve of these were made with the friction of the Kew anemometer artificially increased, seven with a variable velocity, and fourteen with the plane of the cups inclined at an angle to the direction of motion. In discussing the results the following points are taken into consideration, viz. the possibility of the existence of induced eddies, the effect of the increased friction due to the centrifugal force and gyroscopic action, and the action of the natural wind. The conclusion that the instrument is greatly affected by the variability of the wind to which it is exposed seems to be irresistible, and if so, the exact value of the factor must depend upon the nature of the wind as well as upon the mean velocity. There is evidence to show that during a gale the variations of velocity are sometimes of great extent and frequency, and there can be but little doubt that in such a case the factor is less than 2·15. The one point which does seem clear is, that for anemometers of the Kew pattern the value 3 is far too high, and consequently that the registered wind velocities are considerably in excess of the true amount.—On testing anemometers, by Mr. W. H. Dines. The author describes the various methods employed in the testing of anemometers, points out the difficulties that have to be encountered, and explains how they can be overcome.—On the rainfall of the Riviera, by Mr. G. J. Symons, F.R.S. The author has collected all the available information respecting rainfall in this district, which is very scanty. He believes that the total annual fall along the Riviera from Cannes to San Remo is about 31 inches, and that any difference between the several towns has yet to be proved.—Report on the phenological observations for 1889, by Mr. E. Mawley. This is a discussion of observations on the flowering of plants, the appearance of insects, the song and nesting of birds, &c. Taken as a whole, 1889 was an unusually gay and bountiful year.

Physical Society, Dec. 6, 1889.—Prof. Reinold, President, in the chair.—The following communications were read:—On the electrification of a steam jet, by Shelford Bidwell, F.R.S. The author showed that the opacity of steam issuing from a nozzle is greatly increased by bringing electrified points near it, and that its colour is changed to orange-brown. Electrified balls and disks when placed in the steam produce similar effects, and when these are connected with an influence machine at work, the decoloration of the jet rapidly responds to each spark. On examining the absorption spectrum of the unelectrified jet, little or no selective absorption was detected, but on electrification, the violet disappeared, the blue and green were diminished, and the orange and red remained unchanged. From these results the author concludes that electrification causes an increase in the size of the water particles in the steam, from something small compared with the wave-length of light, to about 1/50000 of an inch in diameter. Allied phenomena with water jets have been observed by Lord Rayleigh, who found that a straggling water jet is rendered much more coherent by bringing a rubbed stick of sealing wax near it. These observations are of considerable meteorological interest, for the steam jet phenomena go far towards explaining the cause of the intense darkness of thunderclouds, and of the lurid yellow light with which that darkness is frequently tempered. After making his experiments the author learnt that similar observations had recently been made by the late Robert Helmholtz, who viewed the steam jets by reflected light against a dark background. On electrification the jets became much better defined, and presented diffraction colours. Luminous flames also produced similar effects, and Mr. Bidwell has found that glowing touch paper is equally efficient. Helmholtz conjectures that the sudden condensation may be due to molecular tremors or shock imparted by the electrification upsetting the unstable equilibrium of the supersaturated vapour, just as a supersaturated saline solution is suddenly crystallized when disturbed. Another hypothesis suggests that condensation is caused by the introduction of solid matter into the jet by the exciting cause, thus producing nuclei upon which the vapour may condense. On reading Helmholtz's paper, the author tried the effect of gas-flames on water jets, and found that when luminous they influenced the jet considerably, whereas non-luminous flames had no appreciable effect. He also found that luminous flames are positively electrified, and demonstrated this before the meeting. Prof. Rücker thought the surface tension of the films surrounding the water jets might be lowered by the presence of a burning substance, and that the smoke from the touch paper used in some of the experiments on steam jets would introduce solid particles and facilitate condensation. Mr. Richardson inquired whether a red-hot iron had any effect. Dr. Fison said he had made experiments on the electrification of flame, and found that potentials varying from + 2 volts to − 1½ volts could be obtained in the region within and surrounding a Bunsen flame. Prof. S. P. Thompson commented on the contrast between Mr. Bidwell's experiments and those of Dr. Lodge on the dissipation of fogs by electricity, and also asked whether the colour of the jet depended on the length of the spark produced by the machine. Prof. Forbes thought a crucial test between the two hypotheses of Helmholtz could be obtained by trying the experiment in a germless globe. The President said he had recently noticed that gas flames were electrified. Mr. Bidwell in reply said he ought to have mentioned that the effect of flames on jets may be due to dirt, for if soap or milk be added to the water in the steam generator, no effect is produced by electrification or flame. As to change of colour with spark-length, little (if any) variation is caused thereby. He had not tried whether a red-hot iron produced any effect on a steam jet.—Notes on geometrical optics, Part 2, by Prof. S. P. Thompson. Three notes were presented, the first of which dealt with the geometrical use of "focal circles" in problems relating to lenses and mirrors, and to single refracting surfaces. By "focal circles" the author means the circles having the principal foci as centres, and whose radii are equal to the focal lengths. By their use the point conjugate to any point on the principal axis is readily determined. One construction for a mirror is to draw a tangent to the focal circle from a point P on the axis; the foot of the perpendicular to the axis drawn through the point of contact gives the point conjugate to P. When applied to a thin lens, a tangent is drawn as above to one focal circle, and the line joining the point of contact with the centre of the lens is produced to meet the other focal circle; a perpendicular to the axis from the remote point of intersection gives the conjugate point. Modifications applicable to thick lenses and single refracting surfaces were also given. In his second note the author treated similar problems by the aid of squares drawn on the principal focal distances, the constructions being remarkably simple, as will be seen from the figure, in



which M_1 M_2 represent the principal planes of a thick lens, F_1, F_2, its principal foci, and P and Q are conjugate points. The line BC is drawn parallel to PA. In the third note, the paths of rays through prisms are determined by the aid of imaginary planes representing the apparent position of the plane bisecting the dihedral angle of the prism when viewed through its two faces. Just as in problems on thick lenses in which the part between the principal planes may be supposed removed, so when dealing with prisms, the part between the imaginary planes above referred to may be supposed non-existent. In another method of treatment, the apparent positions of points outside the prism when viewed from inside the prism are made use of, and their application to illustrate dispersion was pointed out. Mr. C. V. Boys asked whether the latter construction could be used to show why the slit of a spectroscope appears curved.—On the behaviour of steel under mechanical stress, by Mr. C. H. Carus-Wilson. This is an inquiry into the properties of steel as illustrated by the *stress-strain* curves given in automatic diagrams from testing machines, and by magnetic changes which take place during testing. After pointing out that the permanent elongation of a bar under longitudinal stress consists of a sliding combined with an increase of volume, the author showed that the "yield" is caused by the limit of elastic resistance (ρ) parallel to one particular direction in the bar (generally at 45° to the axis) being less than along any other direction. When this lower limit is reached, sliding takes place in this direction until the hardening of the bar caused thereby raises the limit of elastic resistance (in the direction referred to) to that of the rest of the bar, after which the stress must be increased to produce further permanent set. From considerations based on the stress-strain curves of the same material when hardened to different degrees by heating and immersion, &c., it was concluded that the increase of (ρ) during "yield" is the same for all the specimens, and that the "yield" is a measure of the "hardness." The question of discontinuity of the curves about the "yield point" was next discussed, and evidence to the contrary given by specimens which show conclusively that the yield does not take place simultaneously at all parts of the bar, but travels along the bar as a strain wave. In these specimens the load had been removed before the wave had traversed the whole length; and the line between the strained and unstrained portions could be easily recognized. As additional evidence of continuity, the close analogy between the *stress-strain* curves of steel of various degrees of hardness, and the isothermals of condensible gases at different temperatures when near their point of liquefaction, was pointed out; the apparent discontinuity in the latter probably being due to the change from gas to liquid taking place piece-meal throughout the substance (see Prof. J. Thomson, Proc. Roy. Soc., 71, No. 130). In seeking for an explanation of the hardening of steel by permanent strain, the author was led to believe this due to the displacement of the atoms within the molecules of the substance. To test this hypothesis, experiments on magnetization by stretching a bar in a magnetic field were made; these show that the magnetization increases with the stress up to the "yield point," and is wholly permanent when approaching that point. On comparing his results with Joule's experiments on the elongation of loaded wires produced by magnetization, the author infers that there are two kinds of elongation—firstly, that produced by relative motion of the molecules, and secondly, an elongation resulting from a straining of the molecules themselves. To this latter straining the hardening by permanent strain is attributed, and this view seems compatible with the results of Osmond's researches on the hardening of steel.—Mr. F. C. Hawe's paper was postponed.

Mathematical Society, Dec. 12, 1889.—Mr. J. J. Walker, F.R.S., President, in the chair.—The following papers were read:—On the radial vibrations of a cylindrical elastic shell, by A. B. Basset, F.R.S.—Note on the 51840 group, Dr. G. G. Morrice.—The President then vacated the chair, which was taken by Mr. E. B. Elliott, Vice-President.—Complex multiplication moduli of elliptic functions for the determinants − 53 and − 61, by Prof. G. B. Mathews (communicated by Prof. Greenhill, F.R.S.).—On the flexure of an elastic plate, by Prof. H. Lamb, F.R.S.—Notes on a plane cubic and a conic, by R. A. Roberts (communicated by the Secretary).—Dr. Larmor and Mr. Curran Sharp made brief communications.

EDINBURGH.

Royal Society, December 16, 1889.—Sir Arthur Mitchell, Vice-President, in the chair.—Dr. Thomas Muir read a note on Cayley's demonstration of Pascal's theorem. He has succeeded in simplifying the proof.—Dr. Muir also read a paper on self-conjugate permutations, and one on a rapidly converging series for the extraction of the square root.—Prof. Tait read a note on some quaternion integrals, and also a note on the glissette of a hyperbola. When a given ellipse slides on rectangular axes, any point in its plane traces out a definite curve, and the same curve can be similarly obtained as the trace of a definite point in the plane of a certain hyperbola sliding between axes in general inclined to the former.—Dr. Woodhead communicated a paper, written by Dr. Herbert Ashdown, on certain substances, formed in the urine, which reduce the oxide of copper upon boiling in the presence of an alkali. Dr. Ashdown was led to search for these substances in the human subject as the result of observations made upon lower animals.—Dr. G. E. Cartwright Wood discussed enzyme action in the lower organisms.—Dr. Woodhead communicated a paper, by Mr. Frank E. Beddard, on the structure of a genus of Oligochætæ belonging to the Limnicoline section.

PARIS.

Academy of Sciences, December 16, 1889.—M. Hermite in the chair.—Note on the eclipse of December 22, by M. J. Janssen. The arrangements are described which were made at the Observatory of Meudon for observing this event.—On the effects of a new hydraulic engine used for irrigation purposes, by M. Anatole de Caligny. The general disposition of this apparatus was fully described in the *Comptes rendus*, November 19, 1887. The present note has reference to an improvement introduced for the purpose of remedying a serious defect in the original design. It has now the advantage of giving as good results as any of the systems in general use, while superior to them in simplicity and economy.—On the production of films of ice on the surface of the alburnum of certain species of plants, by M. D. Clos. Early in December, after a hard frost, when the glass fell to − 6° C. at night, *Verbesina virginica*, *Helianthus orgyalis*, and several other plants exhibited the same phenomenon of glaciation at the Toulouse Botanical Garden as was observed and described by Dunal at Montpellier in 1848. An explanation is here given of the phenomenon, which occurred on a much larger scale on the present than on the previous occasion.—Observations of Borrelly's new comet (*g* 1889), made at the Paris Observatory with the equatorial of the west tower, by M. G. Bigourdan. The observations were taken on December 15, when the comet presented the appearance of a nebulosity indistinctly round, of 2′ diameter, slightly more brilliant in the central region, but without notable condensation. In its expanse were clearly visible two stellar points, and the presence of several others suspected.—On the series $\sum\frac{1}{k^2}$, $\sum\frac{1}{k^3}$, by M. André Markoff. From the nature of these series the author establishes a formula which yields the equation—

$$1 + \frac{1}{2^3} + \frac{1}{3^3} + \frac{1}{4^3} + \ldots = 1{\cdot}202\ 056\ 903\ 159\ 594\ 285\ 40,$$

correct to 20 decimals. M. Markoff's paper forms a sequel to Stirling's memoir "De Summatione et Interpolatione Serierum Infinitarum."—On magnetic potential energy and the measurement of the coefficients of magnetization, by M. Gouy. The mechanical action of magnets on isotropous substances diamagnetic or feebly magnetic isotropous bodies has often been utilized for measuring or comparing the coefficients of magnetization assumed to be constants. On this hypothesis has been established the expression of the potential energy which serves to calculate the mechanical action in question. Here M. Gouy proposes to supply a somewhat more complete theory by regarding these coefficients, not as constants, but as variable with the magnetizing force, and utilizing the experimental data for measuring the variations.—On the colour and spectrum of fluorine, by M. Henri Moissan. The colour of fluorine as here determined is a greenish-yellow, much fainter than that of chlorine under like conditions, and inclining more to the yellow tint. Thirteen rays have been determined in the red region of the spectrum. With hydrofluoric acid several bands have been obtained in the yellow and violet, but very wide and not sufficiently distinct to fix their position with accuracy.—Action of ammonia on the combinations of the cyanide with the chlorides of mercury, by M. Raoul Varet. The paper deals severally with the action of ammonia on the cyanochloride of mercury; the action of absolute ammoniacal alcohol; the action of ammoniac gas; the cyanochloride of mercury and zinc; and the cyanochloride of mercury and copper.—On an adulteration of the essence of French turpentine, by M. A. Aignan. This fraud, which consists in the addition of a small quantity of the oil of resin, is not easily detected, but may be discovered by studying the rotatory power of the liquid, as is here shown.—Papers were submitted by M. Besson, on the temperature of solidification of the chlorides of tin and arsenic, and on their faculty of absorbing chlorine at a low temperature; by M. Seyewitz, on the synthesis of dioxidiphenylamine and of a red-brown colouring substance; by M. Pierre Mercier, on a general method of colouring photographic proofs with the salts of silver, platinum, and the metals of the platinum group; and by MM. G. Pouchet and Biétrix, on the egg and first development of the alose, a fish allied to the sardine.

December 23.—M. Hermite in the chair.—On the discovery of a fossil ape, by M. Albert Gaudry. On presenting to the Academy the skull of an ape recently discovered by Dr. Donnezan at Serrat d'en Vaquer, M. Gaudry remarked that, except those from Pikermi in Greece, these are the only cranial remains of a fossil Simian hitherto brought to light. Many other fossils have been found in the same place, which evidently contains large accumulations, especially of extinct vertebrate animals.—Observations of the comet discovered by M. Borrelly at the Observatory of Marseilles, on December 12, by M. Stephan. The observations are for December 12, 13, and 14, during which period the comet steadily increased in brightness, and assumed more distinct outlines. On the 12th it was obscured for a few minutes by a star of the tenth or eleventh magnitude.—Determination of the difference of longitude between Paris and Leyden, by M. Bassot. This international operation, executed by MM. Van de Sande Bakhuyzen and Bassot, presents a special geodetic interest, Leyden being the northernmost station of the meridian of Sedan which now passes through Belgium far into the Netherlands. From the observations the difference of longitude between Paris and Leyden appears to be 8m. 35·602s., with probable error ± 0·011s., which, reduced to the official meridians, gives 8m. 35·213s.—On the degree of accuracy attained by thermometers in the measurement of temperatures, by M. Ch. Ed. Guillaume. On presenting to the Academy his "Traité pratique de la Thermométrie de précision," the author took occasion to reply to M. Renou's recent remarks on the accuracy of the mercury thermometer. Reviewing the whole question, and comparing the opinions and experiences of the most distinguished physicists during late years, M. Guillaume considers it placed beyond doubt that mercury thermometers with glass of varying qualities yield varying results. But these differences, formerly supposed to be fortuitous, are now known to be systematic, so that any number of instruments giving identical results may be constructed by a judicious selection of glass and careful manipulation.—On β-inosite, by M. Maquenne. In a previous note (*Comptes rendus*, vol. cix. p. 812) the author showed that pinite may be decomposed into a molecule of methyl iodide and a molecule of a new sugar called by him β-inosite. The analysis of these two bodies leading to identical results, he inferred that they were isomerous, presenting relations of the same order as those existing between the two known hexachlorides of benzine. This hypothesis has been fully confirmed by his further study of β-inosite, communicated in the present memoir.—On a new class of diacetones, by MM. A. Béhal and V. Auger. The authors have already shown that the chlorides of malonyl, methylmalonyl, and ethylmalonyl react on the aromatic carburets, yielding diacetones, β,R—CO—CHX—CO—R. They have also determined the formation of compounds having the characteristic property of yielding with the alkalies and alkaline carbonates blood-red solutions. A further series of researches has now enabled them to prepare several of these compounds in large quantities, and thus study their constitution as here described. The best results were yielded by metaxylene and the chloride of ethylmalonyl.—Optical properties of the polychroic aureolas present in certain minerals, by M. A. Michel Lévy. This curious phenomenon is traced mainly to the presence of small crystals of zircon widely disseminated throughout granitic and other rocks. In some cases it may also be due to the presence of dumortierite and allanite. These aureoles offer an interesting example of a simultaneous modification of birefraction and polychroism, a modification, however, which is not permanent, or at least which may disappear, without involving any change in the properties of the mineral itself.—Analysis of the Mighei meteorite, by M. Stanislas Meunier. This meteorite, which fell on June 9, 1889, at Migheï, in Russia, yielded besides the usual constituents, a new element, which M. Meunier has not yet succeeded in identifying.—Papers were contributed by M. Y. Wada, on the earthquake of July 28 at Kiushu Island, Japan; by M. Ch. Contejean, on the circulation of the blood in mammals at the moment of birth; by M. Ferré, on the semeiologic and pathologic study of rabies; and by Messrs. Woodhead and Cartwright Wood, on the antidotic action exercised by the pyocyanic liquids on the development of the anthracite disease.

BERLIN.

Meteorological Society, Dec. 3, 1889.—Dr. Vettin, President, in the chair.—Dr. Kremser spoke on the frequency of occurrence of mist, a subject whose investigation he had recently undertaken. Up to the present time the material derived from observation is extremely scanty, as shown by the extremely divergent mean values obtained for different places in close proximity to each other, as, for instance, Hamburg and Altona, or even different parts of the one city, Berlin. It seems scarcely possible to attribute the differences to local conditions in all cases, for the mean annual values resulting from the observations of different observers in one and the same place show an equally striking discordancy. This is undoubtedly due to the want of suitable units for estimating and measuring mists. From the above it follows that it is impossible to determine any secular changes on the basis of existing observations, although the yearly variations may be. By comparisons based on a long series of observations, it appeared that a series extending over ten years suffices to give a reliable monthly mean. From this it appears that at most stations the maximal amount of mist occurs in the months of November and December, the maximum occurring in November in the eastern provinces of Prussia, and falling progressively later the further the stations lie towards the west. On the coasts of the North Sea and on the adjacent islands the maximum is observed in January, while it occurs on mountains as early as September and October. At the latter stations the minimum is met with as early as May, and is progressively later (June and July) at the other stations according to the lateness of the maximum. On the islands, as, for instance, Heligoland, the minimum does not occur before September or October. As a general rule, 70 per cent. falls in autumn and winter, 20 per cent. in spring, and 10 per cent. in summer. The amplitude of the yearly differences is greatest on the plains and least on mountains. The number of days on which mist occurs is greatest at mountain stations, amounting on the average to 200 per annum, falling in the low lands to as few as 40 or less. The material at hand for determining the variations in the amount of mist per diem was extremely scanty; still it was possible to make out that, in winter, mist is most frequent in the morning, diminishing considerably towards midday, and being in the evening at times as frequent as at midday, at times somewhat more frequent. In summer, mist is observed only in the morning, and then disappears completely. In the discussion which followed the above communication it was pointed out how essential it is to distinguish between clouds and mist, as also many other factors, such as the frequency of purely local mists, the absence of wind, the difficulty of determining the density of mists, the differences of altitude, &c.—Dr. Sprung spoke on some new self-recording apparatus of various kinds made by Richard of Paris, and described fully his actinometer and anemocinometer.

Physical Society, Dec. 6, 1889.—Prof. Kundt, President, in the chair.—Prof. Planck spoke on the development of electricity and heat in dilute electrolytic solutions. From the experiments of Kohlrausch and Hittorf, and the theoretical considerations of Van t' Hoff, Arrhenius, and Nernst, all that takes place in dilute electrolytic solutions during the passage of a current is very accurately known, especially in the cases where the solution is very dilute and the electrolyte is very uniformly distributed in it. It has become possible to subject the occurrences in electrolytic solutions to mathematical investigation, owing to the existing conceptions of the osmotic pressure in such solutions, of the more or less complete dissociation of the electrolyte when in dilute solution, of the applicability of the gaseous laws to such solutions, and owing to the experimental determination of the rate at which the *ions* travel. The speaker had submitted the general case, in which the solution is not quite uniform, to a mathematical analysis, and deduced the formulæ which represent that which is taking place in each unit of volume of the highly diluted solutions in which dissociation is complete. These formulæ correspond exactly to those arrived at by Nernst for the development of electricity. Up to the present time the thermal phenomena in dilute electrolytic solutions have not been fully dealt with. The speaker showed that heat is the most important form of energy existing in the solution. It is only possible to arrive at a complete understanding of the heat production if, when drawing parallels between dilute solutions and gases, a further step is taken, and it is assumed that just as gases become warmer by compression and colder by a fall of pressure, so also heat is developed in electrolytic solutions when the *ions* are increased in number, and disappears when they are diminished per unit of volume. Hence the mere diffusive processes in an electrolytic solution whose composition is not uniform must develop an osmotic heat, which makes its appearance, and can be calculated in the absence of any electrical current. This osmotic heat must be taken into account, along with the two already known sources of heat production, during the passage of an electric current through a solution, before it is possible to calculate all the relationships of energy in a dilute, non-uniform, electrolytic solution during the passage of a current through it.—The President exhibited the air-pump constructed by Otto von Guericke in 1675, which had recently been acquired by the Physical Society. This pump is still in a thoroughly workable condition, with the exception of the glass vessel, which has been renewed. The pressure in this receiver could be reduced to 20 mm. of mercury, by means of the pump. The celebrated Magdeburg hemispheres have also come into the possession of the Society, and were exhibited at the same time; they are perfect except in the want of the leather packing.

AMSTERDAM.

Royal Academy of Sciences, November 30, 1889.—Dr. Hoek read a paper on the Zuyder Zee herring, showing that it belongs to a race of spring herrings (herrings spawning in spring) closely related to the spring herrings of the Baltic, as described by Heincke. But whereas, in the Baltic, two races of herrings—an autumn or winter herring, and a spring herring—can be distinguished, all the herrings which enter the Zuyder Zee—both those which enter it in autumn and those which are caught in spring—belong to one variety: they all spawn in the spring months only; they are reproduced only in water that is rather brackish (nearly fresh); and their fry is very small in comparison with that of open-sea herrings. Considering that the Zuyder Zee herring is a variety which has sprung from the open North Sea herring, it furnishes a striking instance of the formation of a variety under changed conditions in the course of a few centuries.—Prof. van de Sanden Bakhuyzen gave an account of the meeting of the Committee for the Construction of the Photographic Map of the Heavens, held at Paris in September last, and spoke about the share of the Dutch astronomers in that undertaking.

DIARY OF SOCIETIES.

LONDON.

THURSDAY, JANUARY 2.

ROYAL INSTITUTION, at 3.—Electricity (adapted to a Juvenile Auditory): Prof. A. W. Rücker, F.R.S.

FRIDAY, JANUARY 3.

GEOLOGISTS' ASSOCIATION, at 8.—On the Fossil Fishes of the English Lower Oolites (illustrated by Specimens from the Collection of Thos. Jesson): A. Smith Woodward.—A Short Account of the Excursion to the Volcanic Regions of Southern Italy (illustrated by Photographic Views): Dr. H. J. Johnston Lavis.

SATURDAY, JANUARY 4.

ROYAL INSTITUTION, at 3.—Electricity (adapted to a Juvenile Auditory): Prof. A. W. Rücker, F.R.S.

SUNDAY, JANUARY 5.

SUNDAY LECTURE SOCIETY, at 4.—Ballooning in the Service of Science (with Oxyhydrogen Lantern Illustrations): Eric S. Bruce.

MONDAY, JANUARY 6.

VICTORIA INSTITUTE, at 8.—Iceland: Rev. Dr. F. A. Walker.
SOCIETY OF CHEMICAL INDUSTRY, at 8.—Peroxide of Hydrogen, its Preservation and Commercial Uses: C. T. Kingzett.
ARISTOTELIAN SOCIETY, at 8.—Practical Certainty the Highest Certainty: R. E. Mitcheson.

TUESDAY, JANUARY 7.

ANTHROPOLOGICAL INSTITUTE, at 8.30.
ROYAL INSTITUTION, at 3.—Electricity (adapted to a Juvenile Auditory): Prof. A. W. Rücker, F.R.S.

WEDNESDAY, JANUARY 8.

GEOLOGICAL SOCIETY, at 8.—On some British Jurassic Fish-remains referable to the Genera Eurycormus and Hypsocormus: A. Smith Woodward.—On the Pebidian Volcanic Series of St. Davids: Prof. C. Lloyd Morgan. The Variolitic Rocks of Mount Genèvre: Grenville A. J. Cole and J. W. Gregory.
ROYAL MICROSCOPICAL SOCIETY, at 8.—On the Variations of the Female Reproductive Organs, especially the Vestibule, in Different Species of Uropoda: A. D. Michael.
SOCIETY OF ARTS, at 7.

THURSDAY, JANUARY 9.

ROYAL SOCIETY, at 4.30.
MATHEMATICAL SOCIETY, at 8.—On the Deformation of an Elastic Shell: Prof. H. Lamb, F.R.S.—On the Relation between the Logical Theory of Classes and the Geometrical Theory of Points: A. B. Kempe, F.R.S.
ROYAL INSTITUTION, at 3.—Electricity (adapted to a Juvenile Auditory): Prof. A. W. Rücker, F.R.S.

FRIDAY, JANUARY 10.

ROYAL ASTRONOMICAL SOCIETY, at 8.
INSTITUTION OF CIVIL ENGINEERS, at 7.30.—The Irrigation Works on the Cauvery Delta: Alfred Chatterton.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

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