THURSDAY, NOVEMBER 10, 1892.

EXPERIMENTAL BIOLOGY.

Experimental Evolution. By Henry de Varigny, D.Sc. (London : Macmillan, 1892.)

DR. HENRY DE VARIGNY has enriched the literature of biology by publishing in the "Nature Series" the lectures on "Experimental Evolution" delivered by him in 1891 to the Summer School of Art and Science in Edinburgh. This school, as is well known, has been doing good work on Extension lines in Edinburgh, and Prof. Geddes is to be congratulated on having secured the co-operation of so able a biologist and so lucid an exponent of the special aspects of biology with which he has identified himself as M. de Varigny. The lectures are well worthy of publication, for they contain a rich, well-ordered, and, for the most part, well-sifted body of facts collected from many sources, and especially from the publications of French naturalists. But the author is more than a collector of facts recorded by other workers; he is himself a worker in this special field of biological science. And some of the most valuable of the observations contained in the work are the result of his own careful and exact investigations.

Experimental biology is still in its infancy. It is true that our domesticated animals and plants are the result of much experimental work in the past; but the experiments were not planned with the object of explaining organic nature, and were therefore not biological in their aim. There is pressing need at the present time for experiments with such definite scientific aim; for experiments, that is to say, carried out with the express object of testing the truth of biological principles. And that this work be well done there is pressing need for organization. We have only to look at the results which have been reached by well-planned and well-directed marine stations in extending our biological knowledge, faunal, morphological, and embryological, to see what may be done by organization of research. What Dr. de Varigny eloquently pleads for, and what our own countryman, Dr. Romanes, is also pleading for, is an experimental institute, well planned and adequately supported, the purpose of which shall be to carry out extensive experiments for testing evolution hypotheses in all their bearings.

"It appears to me," says Dr. de Varigny, "that this institution should comprise the following essential elements :—Rather extensive grounds, a farm with men experienced in breeding, agriculture, and horticulture; some greenhouses, and a laboratory with the common appliances of chemistry, physiology, and histology. Of course this must be located in the country. It is very important to have experienced farm hands, and a good chemist and histologist are necessary in the staff of the institution. As to the general management, it seems advisable to have a director with a board of competent men, whose functions would be to decide, after careful investigation and exchange of views, what are the fundamental experiments to be performed. These experiments, when once decided upon, should be pursued during a long period of years, and nothing should be altered in their execution unless considered advisable by the board, or unless the experiment should be found useless, or devoid of chance of success. The main thing should be to provide for the duration of the experiment, whether the originators were living or dead, and to follow it out for a long time. Time is an indispensable element in such investigations, and experiments of this sort will surely exceed the normal duration of human lifetime."

A special branch of the work of such an institute should be experimental investigations in comparative psychology. Of this there is nowadays some need. Speaking of the transmission of acquired characters, Dr. de Varigny says, "Psychology affords similar instances. A kitten which has never seen a dog is afraid from the first moment it perceives one; young birds of many species instinctively fear the hawk and other birds of prey, while remaining unaffected by the presence of other birds. Are not these psychological 'attitudes' due to environment (acting on the *mens* of ancestors) which have been transmitted by inheritance; are these not *acquired characters?*" From observations of my own I am prepared to say that it is by no means universally true that a kitten which has never seen a dog is afraid from the first moment it perceives one. Mr. Spalding does indeed describe how the smell of his hand with which he had been fondling a dog set four blind kittens puffing and spitting in a most comical fashion. But a careful observer, Mr. Mann Jones, writes to me that a young kitten with which he experimented "took eight days to connect the smell or odour of his hand with the thing—dog." And my own observations are confirmatory of those of Mr. Mann Jones. Mr. Hudson, in a very interesting chapter of the "Naturalist in La Plata," gives observations which tend to show that young birds afford little evidence of instinctive fear of particular enemies; and my own experiments with young chicks lead me to believe that they have no instinctive knowledge of the things of this world. Any unusual and sharp sound (*e.g.*, a chord on the violin), any large approaching object (*e.g.*, a ball rolled towards them), causes alarm. There is no evidence of instinctive particularization of alarming objects. Such observations lead me to look with suspicion on any arguments for the transmission of acquired characters based on supposed instinctive knowledge of things. And they show the need of further research in comparative psychology such as could be carried out at the Institute of Experimental Biology.

It may be said that the central hypothesis of modern evolution, that of natural selection, stands in no need of experimental verification. But it will presumably be admitted, even by those who are firm in their belief, among whom I count myself, that further experimental support will be of the utmost value. There are many who assume a sceptical attitude, and who say—We grant the inexorable logic of your conclusions if your premisses be established. More individuals are born than can or do survive; the devil devours the hindmost; and a beneficent selection rewards the survivors with the privilege of procreation : hence, progress towards increased adaptation. A very pretty piece of logic. But now, they say, show us the devil at work. We pretend to no particular knowledge of these matters, but we are quite ready to be convinced by proven facts. Prove to us this devil's work, and we acquiesce in your conclusion. But do not put us off with a logical "must be," the recognized symbol of an assumption. Do not tell us that since a hundred were born and only two survive, the ninety-eight must be in some way and for some reason unfit. This is just the very fact of which we require definite and indubitable evidence.

Now what solid and umimpeachable body of evidence have we wherewith to conclusively refute this scepticism? If animals or plants removed to a new environment assume a new habit, in how many cases is it clearly *proved* that this is due to the elimination of all those who failed to vary in the direction of this habit? It behoves us to be careful that the very strength of the natural selection hypothesis be not a source of weakness, by leading us to neglect the duty of experimental verification. That there should be a central institute or institutes for the purpose of such experimental verification, is what Dr. de Varigny and Dr. Romanes are pleading for. It would produce a salutary organization of research; for the institute would have carefully selected correspondents in all parts of the world who would carry out their experiments in concert. It would bring scattered energies to a focus. It would by its journal show individual workers where research is specially needed. It is bound to come sooner or later. We hope to see it an established fact before the close of the present century.

C. LL. M.

BRITISH FUNGUS FLORA.

British Fungus-Flora, a Classified Text-Book of Mycology. By George Massee. In 3 vols. Vol. I. (London and New York: George Bell and Sons, 1892.)

IT was in 1836 that Berkeley published his "British Fungi" as a part of Hooker's "British Flora," and for about a quarter of a century this was the standard work. In 1860 appeared Berkeley's "Outlines of British Fungology," which from the first was disappointing, inasmuch as it was only a barren catalogue for all except the large and conspicuous species; and even the latter were so compressed in description, by the exigencies of confining the book within narrow and definite limits, that it did not wholly supersede the use of the old "British Fungi." In 1871 an effort was made to repair the error by the publication of Cooke's "Handbook of British Fungi," which brought the whole subject up to date, and gave a new impetus to British mycology. On account of the considerable acquisition of species, new to the British flora, it was deemed fitting in 1871 to produce a new work which should include these additions, and then Stevenson's "British Fungi" appeared. This new work only included the "Hymenomycetes," or, in effect, part of the first volume of Cooke's "Handbook," leaving all the rest untouched. In order to remedy this deficiency in part, Cooke's "Myxomycetes" was issued in 1877, and Phillips' "Manual of British Discomycetes" in 1887. Meanwhile a second edition of a portion of Cooke's "Handbook" was being issued as a supplement to "Grevillea," but confined exclusively to the *Agaricini*. With the exception of Plowright's "British Uredineæ" published in 1889, all the rest of the orders contained in the "Handbook" remained as they were in 1871. The unrevised portions included the *Pyrenomycetes*, or Sphæriaceous fungi; the *Sphæropsideæ*, or imperfect Pyrenomycetes; and the *Hyphomycetes*, or moulds. Hence the announcement of a complete work which should include *all* the British fungi, of whatever denomination, brought up to date, did not come as a surprise.

The volume before us consists of 430 pages, and professes to be the first of three volumes, which are to contain the whole "British Fungus Flora" in full, and upon the same plan as this first volume. We have heard of wonderful feats of "strong men," but these will be nothing in comparison to the feat which is ostensibly promised on the title-page, *when* it is accomplished. In our simplicity we should have calculated *six* volumes as nearer the minimum. If the result proves to be *less*, we shall be content to bear the odium of a false prophet. We may premise that the author who has undertaken the present work is eminently fitted to carry it out successfully, inasmuch as he is a practical field naturalist, with independent views, and by no means afraid of hard work.

To return to the volume in question, we must recognize clearness of typography, and distinctness in the isolation of species, which will facilitate reference and increase its practical utility. The illustrations are rather rough outlines, but quite sufficient for practical purposes, and will exhibit the distinctions between the several genera as far as illustrations can do it. Of the systematic arrangement we are not prepared to speak so highly, but perhaps some may consider this a matter of detail. The contents may be summarized thus, in the order of their appearance. The *Gastromycetes*, or puff-ball fungi, commencing with the subterranean species, followed by the *Sclerodermeæ* and the *Nidularieæ*, then the *Lycoperdeæ*, concluding with the *Phalloideæ*. These are succeeded by the *Hymenomycetes*, in like manner inverted, commencing with the *Tremellineæ*, and backwards through the other families to the *Agaricini*, which are commenced in the last 120 pages, but not half completed. We imagine that half another volume will be required to complete the *Basidiomycetes*.

Under ordinary circumstances, when we take up a flora, we are accustomed to meet with the adoption of either one of two methods. The one consists of a regular sequence, from what the author regards as the highest developments in his congeries to the lowest; the other an equally regular sequence from the lowest to the highest. This is conventional, but the present book is not conventional. In one sense there undoubtedly is a regular sequence from the lowest forms to the highest in the *Basidiomycetes*, which this volume contains; but we must not infer that Mr. Massee regards the *Basidiomycetes* as the lowest order of Fungi, or that he commences with the simplest organisms, proceeding upwards by regular gradations to the most complex, when he starts with the *Gastromycetes*. Undoubtedly our author has not made a special study of the puff balls in order to degrade them to the lowest rank. Hence we can only arrive at one conclusion, and that is, that such portions of the work have now been printed as were ready for the press, and no conclusions are to be drawn from the sequence adopted as a convenience, as if it were adopted by premeditation.

Continental mycologists have now for some time accepted the genera of the *Agaricini* as defined by Fries, with the exception of the large genus *Agaricus*, which Fries himself subdivided into numerous smaller groups as subgenera; but they have elevated all these smaller groups to the rank of genera, and placed them upon an equality with the other veritable genera of *Agaricini*. Against this metamorphosis we feel bound to contend, on the ground that the distinctions, although sufficient for the subdivision of a genus, are not of generic value, and that the genera so constituted are unnecessary, and of unequal value, with the old genera beside which they are placed. For instance, *Amanitopsis* differs only from *Amanitæ* in the absence of a ring; and *Annellaria* differs only from *Panæolus* in the presence of a ring. Let any one of practice and experience compare these pseudo-genera with *Coprinus*, *Cantharellus*, or *Schizophyllum*, and judge of what we say. For the first time these pseudo-genera now find a place in a British flora, and, although not of overwhelming importance, we cannot permit them to pass without protest.

Spore measurements are a recent addition to the diagnoses of *Hymenomycetes*, and, although we contend that they should be employed with caution and discrimination, it is very satisfactory that so much attention should have been given to them in this work. Not only does the spore vary in size in a given species in different seasons, but at different periods in the same year. This is certainly true in some species which have been tested, and should lead us to accept spore measurements as approximate rather than absolute.

In conclusion, we are bound to remark that this is a student's book, written with a full appreciation of the wants of a student, and giving all the information which a student might require. In all cases, whether under families, genera, or species, will be found just the details which the novice will be most anxious to obtain, and, although the study of these interesting but rather difficult plants has been of late somewhat upon the decline, we doubt not that it will revive and prosper by the aid of the new "British Fungus Flora," which will become the "text-book of British mycology." M. C. C.

SOUTH AFRICAN SHELLS.

Marine Shells of South Africa: A Catalogue of all the Known Species, with References to Figures in Various Works, Descriptions of New Species, and Figures of such as are new, little known, or hitherto unfigured. By G. B. Sowerby, F.L.S., F.Z.S. Pp. 89, 5 pls. [drawn by the author]. (London, 1892.)

SINCE 1848, when Krauss published his well-known work, entitled "Die Südafrikanischen Mollusken," no such list as the one before us dealing with the Molluscan Fauna of this interesting and important marine province has appeared.

Krauss, who included the non-marine forms of the South African region in his work, recorded 403 marine species, of which 213 were considered to be peculiar to the province. Many other species have been subsequently cited or described as coming from that quarter, notably by E. von Martens and by our present author.

Conchologists undoubtedly owe much to Mr. Sowerby for thus bringing together within the small compass of this single volume, the scope and aim of which are sufficiently indicated in its title, the scattered records of the various species as known to him; but they will equally regret that the author did not include the whole molluscan fauna instead of confining himself to the testaceous forms, and thereby raise the work from the level of a mere shell-collector's catalogue to the rank of a work of reference of real scientific value.

Mr. Sowerby enumerates 740 species, and estimates that 323 of these are confined to South Africa, whilst 67 also occur in European seas, and 340 have been found on other coasts. Unfortunately, it is our disagreeable duty to point out that this record does not include "all the known species," and hence is not what the author fully intended it to be, viz., "as complete as possible." An important paper by Von Martens[1] appears to have been overlooked, for there are about thirty species named in it, including some which were then new, not mentioned by Mr. Sowerby. Still more remarkable is the omission of the new forms described by Mr. Watson in his report upon the Scaphopoda and Gastropoda, obtained during the voyage of the *Challenger*. Davidson's "Monograph of recent Brachiopoda," had it been more closely scanned, would have yielded not only two species reputed to have come from the Cape, but also *Terebratulina Davidsoni*, King, the type specimens of which, dredged on the Agulhas Bank, were passed on to their describer by Mr. G. B. Sowerby (the elder, we presume) in 1871.

A number of species have been recorded by Mr. E. A. Smith in an appendix to a "Report on the Marine Molluscan Fauna of the Island of St. Helena,"[2] as found there on what is locally known as "Sea-horn." This substance appears to consist of portions of a large species of Tangle, probably *Echlonia buccinalis*, which occurs at the Cape, whence it drifts to St. Helena. Some allusion should have been made to these forms. Hints might also have been gleaned from the same report, which deserves to be more widely known than seemingly it is, of undoubted South African species whose names do not appear in Mr. Sowerby's catalogue.

The presence of a good index, while it obviates the necessity, does not abolish the desirability of a good classification, and, in the present state of our knowledge in matters conchological, that of Woodward's Manual is hardly up to date; it is somewhat late in the day to find *Dentalium* still in its old place in the Gastropoda.

Some few changes in nomenclature are made in deference to the law of priority, and these are set forth at the end of the preface. Amongst them is *Ovula*, Bruguière, 1789 = *Ovulum*, Sowerby, &c., though, according to some, *Ovula* is itself a synonym for *Amphiperas*, Gronovius, 1781; *Calliostoma* is erroneously attributed to Bruguière instead of Swainson.

There are also some oversights in the text, as, for instance, "*Columbella cerealis*, Menke (Buccinum), Krauss ... = *C. Kraussii*, Sowerby," where, since Menke's name was given merely in MS., Sowerby's name stands, having four years' priority over Krauss's; *Triforis* is treated as though of the masculine gender; whilst the references to "figures in various works" require careful checking.

[1] "Ueber einige südafrikanische Mollusken nach der Sammlung von Dr. G. Fritsch." Jahrb. Deutsch. Malak. Gesell. 1874, pp. 119-146.

[2] Proc. Zool. Soc. 1890, pp. 247-317.

As regards the figures that accompany the work itself, it is a matter for regret that they cannot be commended. Few objects are more difficult to draw or require more skill in their delineation than do the shells of mollusca, and the amateur is rarely able to do them justice. The want of finish in the present instance is all the more noticeable from the contrast they afford to the rest of the "get up" of the work, which is admirable.

These shortcomings are not thus dwelt on in any captious spirit, but are pointed out in the friendly hope that a future edition of the work may shortly be forthcoming, in which the defects of the present one, compiled under great difficulties and at much disadvantage, may be made good and a really complete catalogue result.

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OUR BOOK SHELF.

The Framework of Chemistry. Part I. By W. M. Williams, M.A. (London: George Bell and Sons, 1892.)

THIS is the first part of a book which has been specially written as a supplement to the oral lessons and experimental demonstrations given by a teacher. It is intended to contain nothing but what is absolutely necessary to give definite and precise impressions regarding the salient points of the lessons, all details relating to laboratory manipulation being omitted. The more important introductory facts, divested of theoretical considerations, are first discussed, then come "atoms and molecules," treated in an elementary fashion and leading the way to the explanation of the use of symbols and formulæ.

How the system adopted by the author will work out can only be ascertained when the other parts are to hand. So far as the information in the present volume goes, it is to a great extent useful and clearly stated.

Objection may be taken to the classification of solutions as mechanical and chemical, for, were it for no other reason, it is still a disputed point whether any solution may be considered a mixture.

The concise style of the book lends itself to incomplete statements. For instance, to say that one of the oxides of carbon "contains exactly twice as much oxygen as the other," is hardly accurate; a constant quantity of carbon is essential to the accurate conception of the facts. The most serious blunder made by the author lies in the confusion of force and energy. This is manifest in statements involving the conversion of "chemical force" into an "equivalent amount of heat" or of "electrical force," and culminates in the assertion that "Force, like matter, cannot be destroyed."

The Beauties of Nature, and the Wonders of the World we Live In. By the Right Hon. Sir John Lubbock, Bart. M.P., F.R.S. (London: Macmillan and Co., 1892.)

SO many writers of the present day adopt a pessimistic tone that a pleasant impression is always produced by Sir John Lubbock's genial and imperturbable optimism. In the present volume he undertakes to show how many sources of interest men might find in the world around them, if they would only take the trouble to train themselves to appreciate the scientific significance of ordinary facts. He begins with a study of animal life, and has much that is fresh and suggestive to say about various aspects of the subject. Then there are chapters on plant life, woods and fields, mountains, water, rivers and lakes, the sea, and the starry heavens. The volume is written in the clear, frank style with which all readers of Sir John Lubbock's books are familiar, and it ought to do much to foster among the class to which he appeals habits of careful and exact observation. His readers have the satisfaction of knowing that of the many things they may learn from him none will afterwards have to be unlearned.

Algebra for Beginners. By H. S. Hall and S. R. Knight. (London: Macmillan & Co. 1892.)

THIS work is intended as an "easy introduction" to the author's "Elementary Algebra for Schools," and, besides being treated on lines similar to those of the last-mentioned book, is published in a cheaper form. The idea throughout seems to have been to present the beginner with the practical side of the subject, and with this intention the examples are made as interesting as such examples can be. The usual sequence has not here been strictly adhered to; but a beginner will find that he will still be able to reach the "as far as quadratic equations" limit. It is needless to say that the explanations are stated in clear and simple language, while the examples are all new. That this book will be widely used is undoubted, for it will form an excellent forerunner to the more advanced one referred to above.

Introduction to Physiological Psychology. By Dr. Theodor Ziehen. Translated by C. C. van Liew and Dr. Otto Beyer. (London: Swan Sonnenschein and Co. 1892.)

IN reviewing the book of which this is a translation (NATURE, vol. xliv. p. 145), we pointed out that such a book was badly wanted in English. We are glad, therefore, to welcome a translation of Dr. Ziehen's work, which will serve well as an introduction to the new science of physiological psychology.

LETTERS TO THE EDITOR.

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

The *Volucellæ* as Examples of Aggressive Mimicry.

AN interesting point in the *Volucellæ* as examples of aggressive mimicry is the fact that they were first used to support the teleological theories of an earlier day, and were subsequently claimed by natural selection. Thus Messrs. Kirby and Spence speak of them (Second Edition, 1817, vol. ii., p. 223) as affording "a beautiful instance of the wisdom of Providence in adapting means to their end;" and after describing the resemblance of the flies to the bees, they continue, "Thus has the Author of nature provided that they may enter these nests and deposit their eggs undiscovered. Did these intruders venture themselves amongst the humble-bees in a less kindred form, their lives would probably pay the forfeit of their presumption." In this theory of Providence it is hard to see where the bees come in. In 1867, A. R. Wallace published an article on "Mimicry and other Protective Resemblances among Animals," which was in 1875 republished in his "Essays on Natural Selection." In this essay (p. 75 of the volume) he spoke of this interpretation as the only case in which an example of mimicry had been "thought to be useful, and to have been designed as a means to a definite and intelligible purpose." He accepts it as a product of natural selection, and since that time it has been constantly used as a well-known example of this principle, so well known, indeed, that the history of it became unnecessary in any publication where space was an object.

I neither originated the principle of aggressive mimicry nor the *Volucellæ* as examples of it, although I accepted, and still accept, both. Under these circumstances I must, in justice to Kirby and Spence and A. R. Wallace, repudiate the discovery of a significance I should have been proud to have made, but which was made, as a matter of fact, about half a century before I was born. It is only fair to these writers to say this, for Mr. Bateson, although mentioning Kirby and Spence, seems throughout to give me the sole, or, at any rate, the chief, responsibility for both hypothesis and examples.

In writing my book I made great use of a very interesting series of specimens in the Museum of the Royal College of Surgeons, lately brought together by Prof. Stewart. The aggressive mimicry of the *Volucellæ* was illustrated in one of these cases, and I briefly described the contents of the case in the passage Mr. Bateson quotes. I was glad to give a few more details than those supplied by Mr. Wallace, and at the same time to mention examples which could be actually seen by readers; for I referred to the collection more than once. I was, however, anxious to obtain confirmation from one who had studied the Hymenoptera and their parasites much more minutely than I had, so I referred the proofs to Mr. R. C. L. Perkins, a most observant naturalist, specially interested in these insects. He made some valuable suggestions, but did not modify the account of the case in the Royal College of Surgeons. I think I may claim, therefore, that I took all reasonable precautions to avoid error in a part of the subject which had not then come under my own personal observation. Prof. Lloyd Morgan, in his interesting "Animal Life and Intelligence," has also mentioned this example, and figures the *Volucella* and *Bombus muscorum*. He tells me that his figures were copied from a case in the Natural History Museum, so that my selection appears to be supported by the two great biological museums of London.

Within a few weeks of the appearance of my book, I had found out the omission of the other banded humble-bees also mimicked by the *mystacea* variety of *Volucella bombylans*, and I showed one of these (I think *B. hortorum*) at a lecture given to the British Association at Leeds in 1890. I had intended, and intend, to repair the omission in any reprint that may be required.

There is, however, nothing inaccurate in the statement that *B. muscorum* is mimicked. We require something more than dogmatic assertions and question-begging metaphor of tabby-cat and fox to establish this as an error of the two museums and the two volumes which have followed them in this respect. Mr. Bateson appears to have been studying the literature of *Volucellæ* rather carefully: if he now extends his investigations to the perfect insects themselves, and compares the individuals in a series of moderate length, he will find that the *mystacea* variety differs much in the demarcation of its rings or zones, and also that the appearance of each individual varies with the direction from which it is observed. The less sharply-marked appearances resemble *B. muscorum*, the likeness being increased by a slight indication of zoning to be seen in the latter.

On July 7 of the present year I captured, in a wood near Newbury, a pair of the variety *mystacea* in copula. The male, the larger insect, was unusually indistinctly zoned. I have submitted the specimens to Mr. Verrall, who kindly tells me that the large male is certainly the variety *mystacea*, and he evidently thinks there is nothing remarkable about it. On the other hand, the female, which was unusually small, is more interesting, being somewhat an intermediate variety. As, Mr. Verrall informs me, Rondani has made about a score of intermediate species, this little capture of mine may turn out to be of interest, and it is comforting in a controversy of this kind to be able to add one fresh observation which may be of some use, if only in the way of confirmation.

Now as to the statement, in which no ambiguity was intended, that the two varieties lay in the nests of the bees they respectively mimic. This was, as Mr. Bateson says, a very general impression, the impression of naturalists who knew these insects far better than I did, an impression which had already been expressed in the case at the College of Surgeons. If I was mistaken in adopting it, was it not well that I made the mistake, if by its means the general impression should be corrected, having in my book assumed a tangible shape? What man who cares for the advance of science more than for his own advancement would regret to have made a mistake under such circumstances?

But I am not yet satisfied that the impression is not substantially correct. I do not regard the dimorphism of *V. bombylans* as the unique phenomenon it appears to be in the opinion of Mr. Bateson. I fail to see any essential biological difference between it and the dimorphism of many Lepidopterous larvæ—a dimorphism which extends into the pupal stage of most species of the genus *Ephyra*—or between it and the distinct types into which certain butterflies of the genus *Kallima* can be divided according to the colouring of the under sides of the wings, or certain moths of the genus *Triphæna* according to that of the upper sides of the upper wings. But we know that in those cases which have been tested, while the majority of the offspring resemble the variety to which the parents belonged, a certain proportion follow the other variety, and when the parents belong to different varieties the offspring are more equally divided. It is therefore only to be expected, so far as our present knowledge goes, that both varieties should emerge from the same nest. The important thing to be ascertained, from the point of view of the theory of aggressive mimicry, is not the colour of the offspring which emerge, although this is of high interest on other accounts, *but the colour of the parents which enter*. It might be supposed that Mr. Bateson would have understood this, but it is perhaps too much to expect from a critic who is so aggressively uninterested.

It would be interesting to know the grounds upon which Mr. Bateson considers the dimorphism of *V. bombylans* to be almost unique. At present he contents himself with assertions. If we were ever to return to the *régime* of authority and dogmatism in place of reason and experiment, Mr. Bateson's scientific position would be indeed assured.

Years ago I was satisfied that the evidence for the statement in my book was insufficient, and this, too, I had intended to modify when the opportunity occurred. In lecturing I have often alluded to the investigation as an interesting one, and only a fortnight ago suggested it to the members of the Natural History Society at Marlborough College. Two years ago I endeavoured to breed *Volucellæ* in the manner described by Mr. Bateson, I am sorry to say without success. I may therefore claim that the statement quoted by Mr. Bateson had produced no paralysis of effort on my part either as regards my own work or that which I have been able to suggest to others.

I may add that the upshot of this inquiry—even if it lead to the conclusion that both varieties lay indiscriminately in the nests of all the species they resemble—would not, in my opinion, remove the *Volucellæ* from their place as examples of aggressive mimicry, but the working of the principle would be more complex. I do not, however, propose to render myself liable to further sneers about "ingenuity" by discussing it on the present occasion.

Mr. Bateson's letter appropriately ends by putting into my mouth a defence I should never have advanced—a defence which was obviously inserted in order to impute discredit—and then proceeding to the easy task of demolishing it. Let me therefore say that a mistake is to me a mistake, whether in a volume intended for the public or a paper presented to a scientific society. Indeed, I regret the former more than the latter. Unfortunately, too, mistakes are more liable to occur in the volume, because the ground is wider, and passes in some directions into less familiar regions. But I can honestly say that I have always done my best to avoid mistakes, and that I correct them as the opportunity arises, in fresh papers or in reprints of volumes. And I derive much comfort from Mr. Phelps' dictum, which I am sure appeals to every one who works, that "people who never make mistakes never make anything." EDWARD B. POULTON.

Oxford, October 24.

P.S.—I wish to take this opportunity of correcting certain mistakes in my book ("Colours of Animals," Internat. Sci. Ser.), as it may be some time before the book can be reprinted, owing to the number of copies struck off.

Pages 49, 50.—Dr. Hurst informs me that my abstract of Weismann's work on seasonal dimorphism is wrong. This will be carefully reconsidered in any reprint.

Page 73.—I wish to withdraw the account of *Phrynocephalus*. Although the structures alluded to are probably alluring, there is not sufficient evidence as to the manner in which they are used.

Page 85.—Professor Howes calls my attention to the description of the nerve-terminations in pigment-cells.

Page 94, *et seq.*—Sir J. Ross should be Captain James Ross.

Page 105.—I ought to have added that Mr. Sharpe's conclusions are not accepted by Professor Newton.

Pages 142-146.—Mr. Bateson has shown that the white cocoons of *Saturnia* and *Eriogaster* are not due to the white backgrounds employed, but to disturbance of the larvæ. It is still probable that the principle holds in *Halias prasinana*.

Page 156.—For the above reason I withdraw the argument about the cocoons of *Rumia*, although I believe that it still holds if *H. prasinana* be substituted.

Chapters x., xi. should be read in connection with the experiments on Warning Colours since made by Mr. Beddard and published in his volume, "Animal Coloration."

Page 161.—The cockroach is not a good example. As Prof. Weldon pointed out to me, there is no evidence that its unpleasant smell renders it unfit for food. The hive-bee would be a better instance.

Page 193, line 7 from bottom.—*Fibrous* should be *fulvous*.

Page 203, line 6 from bottom.—For *suited for* read *bearing*.

Page 208, line 13 from top.—*Divert* should be *direct*.

Page 224.—I have since heard from Mr. Skertchly that he did not intend the argument which I quote at the bottom of the page to be taken seriously.

Page 236.—*Diadema bolina* should be *D. misippus*, and it and the *Danais* it mimics occur in *three* varieties, not in *two*. I owe this to Col. Swinhoe; the error was copied from Trimen. E. B. P.

The Geology of the Asiatic Loess.

IN the spring and early summer of this year I had the opportunity, in company with Mr. S. B. J. Skertchly, of examining closely the loess deposits of Shantung, stretching from Chefoo to Tsinan, the provincial capital.

The investigation convinced us both that the original loess of China must be regarded as a marine deposit. Subsequent to the time of Mr. Skertchly's leaving the province, on June 17, I was able to supplement these conclusions by the discovery of a band of limestone rocks bored by pholades and crustaceans up to a height of about 1100 feet, above which line no indications of late marine action were visible. The rocks in the locality near Tsinan-fu are carboniferous limestones interbedded with dioritic porphyries, and are still horizontal and unbroken for some thousands of square miles, having received their present contour in pre-loess ages. The dip for hundreds of square miles in this locality seldom exceeds from 2° to 8°. These facts we hope to make the subject of a joint memoir.

The loess of China has, however, been traced almost continuously beyond the limits of the eighteen provinces to the foot of the Pamîrs. West of the Pamîrs loess occurs in the valley of the upper Oxus, probably in the Kizil Kum, and up to the Caspian, and its marine origin requires us to believe in the submergence within late geologic time of the greater part of Central Asia. Most geologists recoil at such a suggestion, and I am in a small minority in accepting the view that the present distribution of ocean and continent is of very recent date. I may, however, in condonation of heterodox views, refer to the position of the argument with regard to the alleged shifting of the terrestrial axis of rotation, which has within the last few years entered on a new phase. When some years ago I presented these views to the Council of the Geological Society of London they were scouted as utterly untenable. Since that time, while English astronomers have held the view that practically the axis of rotation has undergone, within the limits of observation, no change, American astronomers have come to the conclusion that a secular movement is actually in progress. My own geological observations in Europe, North America, and Asia have led me to infer that the North Pole has within recent geological time shifted, and that a shift is in all probability in progress at the present time along a line following approximately the direction of the 70th meridian of west longitude. This shift is not to be taken to involve a change in the direction in celestial space, but is rather a rolling of the earth over its axis, the latter remaining practically stationary.

Dynamical causes sufficient to account for the change of position of the terrestrial poles, and in consequence of the parallels of latitude, seem to me to be at work. Prof. G. Darwin has calculated the probable change in the position of the pole due to an elevation of the bed of the Pacific Ocean, but no one has touched the converse effect of the change of the pole on the relative levels of the oceans and continents. In addition to the cause suggested in the possible elevation of large tracts of continental land, there are other influences at work tending in the same direction. The different distribution of the large masses of ice around the poles, which probably varies within somewhat large limits, and the slow disturbance of equilibrium resulting from the growth of deltas and deep sea deposits, have frequently been adduced. More important still is perhaps the differential influence of tidal friction in retarding the rotation, the effect of which must be sensibly unequal in the two hemispheres north and south of the equator; another cause may be looked for in the action of aerial currents, the effect of which in the northern hemisphere as containing greater masses of elevated land must be greater.

Another potential cause of shifting has never, that I am aware of, been formulated. Although at present of comparatively small influence, it must at various geological periods have been of great importance. It leads on to dynamic considerations of tidal energy beyond the compass of a letter to explain. The relative part played by the sun and moon, as deduced from gravitational formulæ, does not quite agree with the observed phenomena of our daily tides. It is believed by many that the ordinary lunar tide, affecting mainly the oceanic envelope, is complicated by the presence of a terrene tide largely influenced by the sun, and that the earth does to an appreciable extent yield twice in the twenty-four hours to the deforming force of solar gravitation. So long as this oscillation takes place at regularly recurrent intervals no energy is wasted. Should, however, a sudden snap occur, breaking the rhythm of the oscillation, some energy is evidently spent, and this can only be made up from the *vis viva* of rotation. Such snaps do occur occasionally; the regular oscillation is momentarily suspended, and the waters of the ocean rush in to restore the equilibrium. This is the well-known "tidal" wave that so frequently occurs in connection with earthquakes.

Such a snap on the equatorial line would simply retard the rotational period generally. North or south of this line, as the moments of rotation would be instantly unequal, the sphere would roll over its axis of rotation, and a shift in the position of the poles occur. The earth is not a perfectly rigid mass. Were it as rigid as steel, the interior within a depth of 200 miles would yet, under the pressure of gravitation, behave as a liquid; a shift in the pole would then be met either by a corresponding shift in the equatorial protuberance, or a change in the ocean level; or, more probably, by a compound action of both. In the latter case, to fulfil the conditions of equilibrium, the ocean surface in the neighbourhood of the new equator would rise, and if the shift were sufficiently great, would overflow the lowlands. If the equator, in the longitude of Central Asia, had at any former time passed north of its present position, and the rock masses of the Continent had not been elevated, a mid-Asian sea must have resulted. The undisturbed position of the carboniferous rocks, and the plain evidence that the surface sculpturing of the rocks was of pre-loess age, show that the process was unaccompanied by violent movements.

The theory of the shift of the earth over its momentary axis accounts better than any other for the geological condition of polar lands, and I venture to state it again in brief, as on this occasion the initiative has come from the astronomers, not the geologists. THOS. W. KINGSMILL.

Shanghai, China, August 20.

Note on Mr. Kingsmill's paper.

I think it will be difficult for Mr. Kingsmill to adduce evidence of geological changes large enough to produce any considerable shifting of the position of the principal axes of the earth, and accordingly I should feel sceptical as to a theory which postulates that such change has been sufficient to explain considerable changes of climate.

With respect to a later part of the paper, I am entirely at variance with his views. As far as I know "the relative part played by the sun and moon" in producing oceanic tides is in exact accordance with gravitational formulæ.

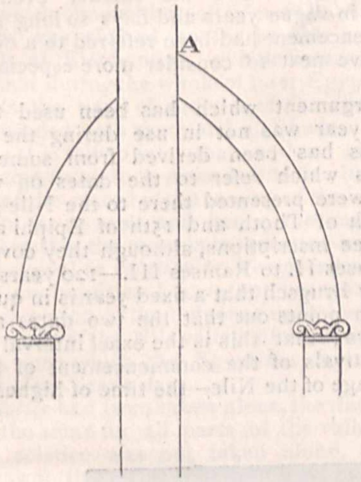
The existence of a terrene tide is a matter of speculation, but, as the earth cannot be perfectly rigid, it must exist to some extent. The amplitude of the lunar terrene tide must certainly bear to that of the solar the same ratio that holds in the case of oceanic tides, and there is no reason, that I know of, for attributing a greater efficiency to solar action in the case of the deformation of the solid portion of the earth.

I am quite unable to follow the argument by which the so-called "tidal" wave produced by earthquake shock is supposed to produce a retardation of the earth's rotation.

October 21. G. H. DARWIN.

Optical Illusions.

REFERRING to the article in NATURE for October 20, may I mention a rather common optical illusion which I do not remember to have yet seen in print. If a gothic arch is unequally divided by a space between two vertical parallel lines, these lines will not only seem to diverge slightly where they intersect the lines of the arch, but the arch itself is caused to appear as if one half had slipped bodily down from the other to an extent



equal to its own thickness. In the figure given above it is impossible to believe that but for the intervention of the vertical interlinear space the two halves would be seen to meet perfectly with the apex at A. This illusion is worth the notice of architects who desire to avoid the disquieting effect upon the eyes of observant persons which is produced by the intersection of the chancel arch of a church by an intervening pillar.

28 Mount Park Crescent, Ealing, W. R. T. LEWIS.

A Remarkable Rainfall.

THE rainfall here of October has been so remarkable that it seems worth while to place it on record in your columns. Rain fell on twenty-five days during the month, making a total fall of 10·32 inches. As the annual rainfall on an average of eleven years is 31·10 inches, it will be seen that very nearly one-third of this amount fell in one month. This is by far the highest amount I have recorded since I began to make records in January, 1878, the next highest month being August, 1879. On that occasion five inches fell in thirty hours on the 17th and 18th, and many bridges were carried away in Flintshire and Denbighshire, but the total fall for the month was only 7·89 inches. Dr. Nicol, of Llandudno (six miles from here), who has registered the rainfall since, and including 1861, informs me that it amounted last month to 8·56 inches there, this also being the highest month he has ever recorded.

In September rain fell on twenty-three days, and though the total fall was only 3·77 inches, yet the constant rain, combined with an unusually low temperature (the mean maximum being only 56°·6, and the highest shade temperature 67°·4, against 64°·6 and 81°·2 respectively in 1891), made it almost impossible to get in the harvest. ALFRED O. WALKER.

Nant-y-Glyn, Colwyn Bay, November 5.

On a Supposed New Species of Earthworm and on the Nomenclature of Earthworms.

IN yesterday's NATURE I find that the Rev. Hilderic Friend has again given the name *L. rubescens* (Friend) to a supposed new species of earthworm. This worm appears to me to be identical with *Enterion festivum* (Savigny), described under the name *Lumbricus festivus* by Rosa. Though comparatively rare, it is by no means new, nor even new to Britain, though I know of no published record of its occurrence here. I met with two or three specimens among the worms supplied to me when I was working at the chapter on Lumbricus in "Marshall and Hurst," and identified them subsequently by the help of Rosa's table. At the time I took them for mere varieties, and put them into a bottle for future study. I believe the specimens are now in the possession of Dr. Benham, who has entirely overlooked the species in his "Attempt to Classify Earthworms" (*Quart. Journ. Micr. Sci.* xxxi.).

The specific name *terrestris* must also, it appears to me, be dropped. Linnæus did not define a species under that name, but applied it to what are now universally regarded as several distinct species. The species so called by Mr. Friend was, I believe, first defined by Savigny under the name *Enterion herculeum*. The diagnostic characters of the species are given by Rosa in his useful table of the species ("I Lumbricidi dei Piemonte," p. 25), and he calls it *Lumbricus herculeus*, to which name the usual rules of nomenclature bind us.

I would therefore suggest the following alterations in Mr. Friend's "Chart of the Genus Lumbricus":—

1. For "Terrestris (Linn.)" read "herculeus (Sav.)"
2. For "Rubescens (Friend)" read "festivus (Sav.)"

Owens College, October 28. C. HERBERT HURST.

Ice Crystals.

DURING the cutting of the formation for a railway I observed on Tuesday morning, the 18th inst., a peculiar series of ice crystals. The ground is composed of arenaceous clay largely mixed with sand and small gravel, and is of a very open nature, the surface being covered with moorland grass, rushes, and coarse ferns. These crystals were only found in a length of about nine feet, the ground on both sides of the patch being hard frozen.

These crystals were acicular, and sprang from a base of very porous opaque ice, but every needle was entirely free and distinct throughout its height, and at first sight appeared to be bound together with two bands, one at one-third and the other at two-thirds of the height. A closer examination proved that the band appearance was due to a slight enlargement of the crystals at these points, the ice being opaque, whilst the needles were perfectly translucent.

The average height of these crystals was about one inch, the needles having a diameter of about $\frac{1}{64}$th part of an inch, and were grouped together in clusters of forty or fifty, forming an irregular square of about $\frac{1}{4}$-inch on the side. Some of these crystals were growing vertically from the ground, others springing out horizontally from the side of the cutting, and were either straight, curved, or bent round forming a half circle. This morning the same form of crystals existed, but were much larger, being fully two inches long. On both occasions the air was calm and clear, the min. ther. reading 30° on the 18th, and 24° to-day.

Lesmahagow, October 25. C. M. IRVINE.

Lunar Craters.

THE letter and illustration offering a suggestion as to the formation of lunar craters remind me of an experiment I once saw during a chemical lecture, bringing out the same point very clearly.

A shallow dish containing a layer of damp sand, $\frac{1}{2}'$, was flooded with 1-inch coating of Paris plaister, of the consistence of cream, and the dish set to dry over a Bunsen flame.

As the plaister set, the surface was pitted with crater-like holes, formed by the escape of steam from the sand at the bottom of the dish, giving a perfect representation of a lunar surface.

As some of your readers might care to try this experiment, I take the liberty of sending you this "recollection."

M. H. MAW.

Walk House, Barrow-on-Humber, Hull, Nov. 7.

A Fork-tailed Petrel.

THE occurrence of a Fork-tailed Petrel as far inland as Macclesfield may perhaps interest some of the readers of NATURE.

It was picked up by a man on the 11th ult., two days after the stranding of the *Sirene* in a gale at Blackpool, and being unacquainted with the species he sent it to me as a curiosity. I identified it as a Fork-tailed Petrel, and Mr. J. H. Salter, of Aberystwyth College, has kindly confirmed this decision.

Some of the feathers on the forehead are tipped with white. Does this indicate a young bird, as I can find no mention of it in any of the plumage descriptions that I have seen?

NEWMAN NEAVE.

Rainow, near Macclesfield, November 5.

THE ORIGIN OF THE YEAR.[1]

III.

IN the previous articles I have endeavoured to show that the Egyptians had the Sirius year and the vague year so related to each other that the successive coincidences of the 1st Thoth in both years took place after intervals of 1460 Sirian years. With a real year, the length of which would be brought home to them by the regular recurrence of the solstices and Nile flood (to say nothing of the equinoxes) and the year of 360 days which they would soon find to be quite artificial and unreal; they would be much more likely to refer the dates in the artificial year to the real one, than to take the opposite course, and, as I have shown, the artificial dates would sweep backwards through the real ones. Such a method of reckoning, however, would be useless for calendar purposes, as they not only wanted to define the days of the year but the years themselves, and I pointed out that something more was necessary, and that an easy way of defining *years* would be to conceive a great year, or *annus magnus*, consisting of 1460 years, each "day" of which would represent four years in actual time; and further to consider every event, the year of which had to be chronicled in relation to others to take place on the day of the heliacal rising of Sirius or the nearly coincident Nile flood, which, as we shall see, occurred, at different periods of Egyptian history, on the 1st Thoth and 1st Pachons.

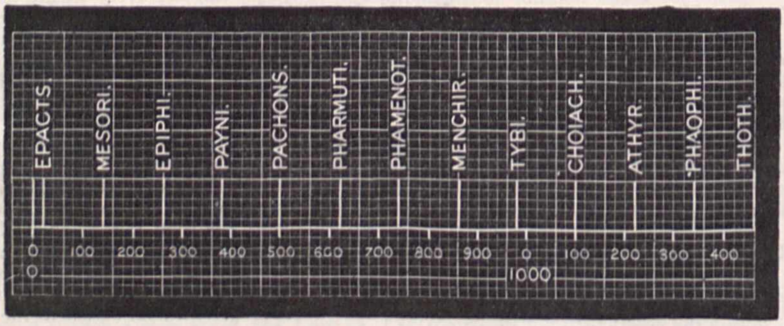


FIG. 5.—The distribution of the 1st of Thoth (representing the rising of Sirius) among the Egyptian months in the 1460 year Sothic cycle.

A diagram, which may here be repeated, was given to show how such a system would work. From any coincidence of 1st Thoth (or 1st Pachons) in both the Sirian and the vague year, since the vague year is the shorter, the 1st Thoth (to deal only with Thoth) of the vague year would recede; so that in such a cycle it would fall first among the Epacts, then in Mesori, and so on through the months, till the next coincidence was reached.

The diagram will show how readily the cycle year can be determined for any vague year. If for instance the 1st Thoth in the vague year falls on 1 Tybi of the cycle, we see that 980 years must have elapsed since the beginning of the cycle, and so on.

Here, then, we have a true calendar system; if the Egyptians had not this, what had they?

Such a calendar system as this it will be seen, however, is good only for groups of four years. Thus during the first four years of a cycle the 1st Thoth vague would happen on 1st Thoth of the cycle, during the next four years on the 5th Epact, and so on.

Now a system which went no further than this would be a very coarse one. We find, however, that special precautions were taken to define which year of the four was in question. Brugsch[2] shows that a special sign was employed to mark the first year of each series of four.

Now as a matter of fact it is known (I have the high authority of Dr. Krall for the statement) that each king was supposed to begin his reign on the 1st Thoth (or 1st Pachons) of the particular year in which that event took place, and the fact that this was so supports the suggestion we are considering. During the reign its length and the smaller events might be recorded in vague years and days so long as the date of its commencement had been referred to a cycle.

We have next to consider more especially the vague year.

One argument which has been used to show that a vague year was not in use during the time of the Ramessids has been derived from some inscriptions at Silsilis which refer to the dates on which sacred offerings were presented there to the Nile-god. As the dates 15th of Thoth and 15th of Epiphi are the same in all three inscriptions, although they cover the period from Ramses II. to Ramses III.—120 years—it has been argued by Brugsch that a fixed year is in question.

Brugsch points out that the two dates are separated by 65 days; that this is the exact interval between the Coptic festivals of the commencement of the flow and the marriage of the Nile—the time of highest water; and that, therefore, in all probability these are the two natural phenomena to commemorate which the offerings on the dates in question were made.

But Brugsch does not give the whole of the inscription. A part of it, translated by De Rougé,[1] runs thus:—

"I (the king) know what is said in the depot of the writings which are in the House of the Books. The Nile emerges from its fountains to give the fullness of life-necessaries to the gods," &c.

De Rougé justly remarks: "Le langage singulier que tient le Pharaon dédicateur pourrait même faire soupçonner *qu'il ne s'agit pas de la venue effective de l'eau sainte du Nil à l'une des deux dates précitées*."

Krall (*loc. cit.* p. 51) adds the following interesting remarks:—"Consider, now, what these 'Scriptures of the House of Life' were like. In a catalogue of books from the temple of Edfu, we find, besides a series of purely religious writings, 'The knowledge of the periodical recurrence of the double stars (sun and moon),' and the 'Law of the periodical recurrence of the stars.'

"... The knowledge embodied in these writings dated from the oldest times of the Egyptian empire, in which the priests placed, rightly or wrongly, the origin of all their sacred rolls" (cf. Manetho's 'History," p. 130).

Now to investigate this question we have to approach some considerations which at first sight may seem to be

[1] Continued from vol. xlvi. p. 107.
[2] "Matériaux pour servir à la reconstruction du calendrier," p. 29.

[1] "Aeg. Zeit," 1886, p. 5, quoted by Krall.

foreign to our subject. I shall be able to show, however, that this is not so.

Imprimis we must remember that it is a question of Silsilis, where we know both from tradition and geological evidence, in ancient times the first cataract was encountered. The phrase "The Nile emerges from its fountains" would be much more applicable to Silsilis, the seat of a cataract than as it is at present. We do not know when the river made its way through this impediment, but we do know that after it took place and the Nile stream was cleared as far as the cataract that still remains at Elephantine, a Nilometer was erected there, and that during the whole of later Egyptian history at all events the time of the rise of the river has been carefully recorded both there and at Rhoda.

From this it is fair to infer that in those more ancient times the same thing took place at Silsilis; if this were so the reason of the record of the coming of the inundation at Silsilis is not far to seek, and hence the suggestion lies on the surface that the records in question may state the date of the arrival *in relation to Memphis time*.

So far in my inquiries I have not been able to find a complete discussion of the influence upon local calendars, in different parts of the Nile valley, of the variations of the phenomena upon which the Egyptians depended for the marking of New Year's day.

If the *solstice* had been taken alone, the date of it would have been the same for all parts of the valley; but certainly the solstice was not taken alone, and for the obvious reason that they wanted something to warn them of the Nile rise, and in the lower reaches of the river the rise precedes the solstice.

Nor was the heliacal rising of Sirius taken alone.

As we have seen, according to Biot the heliacal rising of Sirius *at the solstice* took place on July 20 (Julian) in the year 3285 B.C.; and according to Oppolzer, it took place on July 18 (Julian) in the year 3000 ± B.C.

But this is too general a statement, and it must be modified here. There was a difference of 7 days in the date of the heliacal rising, according to the latitude, from southern Elephantine and Philæ, where the heliacal rising at the solstice was noted first, to northern Bubastis. There was a difference of four days between Memphis and Thebes, so that the connection between the heliacal rising and the solstice depended simply upon the latitude of the place. The further south, the earlier the coincidence occurred.

Here we have an *astronomical* reason for the variation in the date of New Year's day.

But it was chiefly a question of the arrival of the Nile flood, and the date of the commencement of the Nile flood was by no means common to all parts of Egypt!

I cannot find any statement of the dates of the arrival of any one Nile flood at places between Elephantine and Cairo. Dr. Wallis Budge[1] states: "The indications of the rise of the river may be seen at the cataracts as early as the end of May."

Now if we take the 1st cataract to be here meant, and deal with May 31; since the average day of arrival of the inundation at Cairo is 3 days after the solstice—that is June 20 (Greg.)—we have 24 days for the flood-travel for the 600 miles between Elephantine and Cairo, four-fifths of a month elapsing between the times at which the Green Nile colours the pool at Syene below the Cataracts, and the river at Memphis; so that the further south, the earlier the flood was noted. This gives us about a mile an hour. This certainly seems too slow.

But if we assume 16 days, this would give us about 15 days between Silsilis and Cairo, and 12 days between Thebes and Cairo, taking Cairo to represent the ancient Memphis. Now this represented a difference in the new year's days of different places, compared to which our modern differences of local time sink into insignificance, for they only touch hours of the day; and the reason that I have referred to them here is to point out that if the assumption made is anything like accurate, if, for instance, in Pepi's time a Nile rise were observed at Silsilis, there might easily be a difference of 15 days between the rise of the Nile at Silsilis and the Memphic 1st of Thoth. If both at Silsilis and Memphis the Nile rise marked 1st Thoth, the day of the rise at Memphis would correspond to 15th Thoth at Silsilis, so that a king reaching Silsilis with Memphis local time, would be struck with this difference, and anxious to record it, may not this then have been the important datum recorded in the sacred books? If so, it would not touch the question of the fixed or vague year at all.

Let it, then, be for the present conceded that there was a vague year, and that at least some of the inscriptions which suggest the use of only a fixed year in these early times may be explained in another way. I do not say the above explanation is the correct one, for the assumption of 16 days may be wrong, even if difference in the dates of the heliacal rising at the two places be taken into account.

The dates we have found—trying to take the very simplest way of writing a calendar in pre-temple times, and using the calendar inscriptions in the most natural way—are for the coincidence of the heliacal rising of Sirius at, or near, the solstice—

270 B.C.
1728 B.C.
3192 B.C.

Now here we meet with a difficulty which, if it cannot be explained, evidently proves that the Egyptians did not

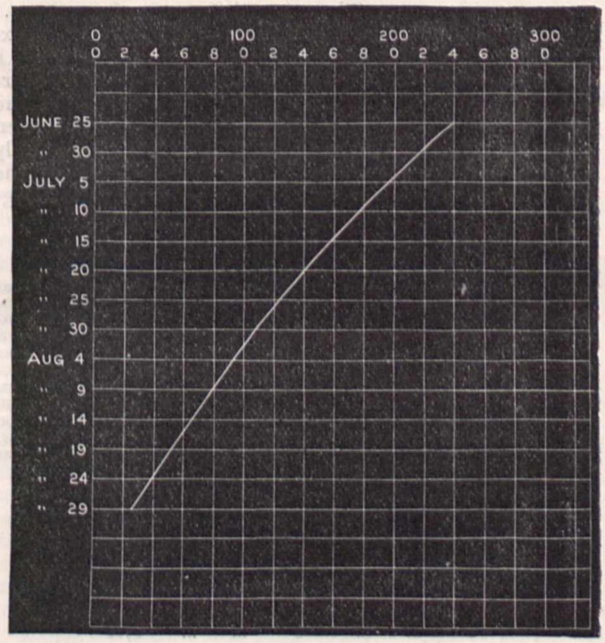


FIG. 6.—Julian dates of the 1st of Thoth (vague) from 23 A.D. to 240 A.D.

construct and use their calendar in the way we have supposed.

We have it on the authority of Censorinus that a Sothic period was completed in 139 A.D., and that there was then a vague year in partial use. It is here that the work of Oppolzer is of such high value to us. He discussed all the statements made by Censorinus, and comes to the conclusion that his account is to be depended upon. It

1 "The Nile," p. 46

has followed from the inquiries of chronologists that in this year the 1st of Thoth took place on July 20 (Julian), the date originally of the heliacal rising of Sirius, the beginning of the year.

This being so, then, in the year 23 A.D.—in which the Alexandrine reform of the calendar, of which more presently, was introduced—the 1st of Thoth would take place on August 29, a very important date. Censorinus also said that in his own time (A.D. 238) the 1st of Thoth of the vague year fell on June 25. Fig. 5 will show the connection of these three dates in reference to the vague year. The relations of the statements made as to the years 139 and 238 are very clearly discussed by Dr. Oppolzer.

Oppolzer, then, being satisfied as to the justice of taking the year 139 A.D. as a time of coincidence of the fixed and vague years—the latter being determined alone by the heliacal rising of Sirius, and, be it remembered, not by the solstices—calculated with great fulness, using Leverrier's modern values, the years in which, in the various Egyptian latitudes, chiefly taking Memphis (lat. 30°) and Thebes (lat. 25°), the coincidence between the two Thoths occurred in the previous periods of Egyptian history. He finds these dates for latitude 30° as follow:—

	Julian year.	Historical year.[1]
0	−4235	4236
1	−2774	2775
2	−1316	1317
3	+139	139
4	+1591	1591
5	+3039	3039

Now the date which Oppolzer gives for the coincidence which is nearest the date we had previously determined at 270 B.C. is 139 A.D. There is a difference of 409 years.

The question is, Can this fundamental difference be explained? I think it can.

In the first place, it is beyond doubt that, in the interval between the Ramessids and the Ptolemies, the calendar, even supposing the vague year to have been used and to have been retained, had been fundamentally altered, and the meanings of the hieroglyphics of the tetramenes had been changed—in other words, the designations of the three seasons had been changed.

On this point I quote Krall in a note.[2]

The three hieroglyphic signs used for the tetramenes are supposed to represent water, flowers, and a barn, and the natural order would be that the first should represent the inundation, the second the sowing which succeeds it, and the last harvest time. If this be conceded, the initial system would have had the month Thoth connected with the water sign, as Thoth in early Egyptian times was the first inundation month. But in the times of the Ramessids even this is not so. Thoth has the sowing sign assigned to it. In the time of the Ptolemies the flood is no longer in Thoth, but in Pachons, and Pachons has the barn sign attached to it, while the month Thoth is marked by the water sign, thereby bringing back the hypothetical relation *between the name of the month and the sign*, although, as we have seen, Thoth is no longer the flood month.

Egyptologists declare that all or at least part of this change took place between the periods named; they are undoubtedly justified as regards a part.

At one point in this interval we are fortunately supplied with some precise information. In the year 238 B.C. a famous decree was published, variously called the decree of Canopus and the decree of Tanis, since it was inscribed on a stone found there.

It is perfectly clear that one of the functions of this decree was to change, or to approve an already made change in, the designation of the season or tetramene in which the inundation commenced, from Thoth to Pachons.

Another function was to establish a fixed year, as we shall see presently. We must assume then that a vague year was in vogue prior to the decree. Now the decree tells us that at its date the heliacal rising of Sirius took place on 1 Payni. Assuming that this date had any relation to the system we have been considering, the cycle to which it belonged must have begun

Days.
5 Epacts
30 Mesori
30 Epiphi
30 Payni
——
95 × 4 = 380 years previously; that is, in the year 618 B.C.

Now here at first sight it would seem that the Sothic cycles we have been considering have no relation to the one now in question; for, according to my view, the last Sothic cycle began in 1728 B.C.

A little consideration, however, will lead to the contrary view, and show that the time about 600 B.C. was very convenient for a revision of the calendar.

In the first place nearly a month now elapsed between the coming of the flood and the heliacal rising; and in the second, by making the year for the future *to begin with the flood*, a change might be made involving tetramenes only.

Thus, commencement of cycle		... 1728 B.C.
Epacts	5	
Two tetramenes ...	240	
Month between flood and rising of Sirius ...	30[1]	
	275 × 4 = 1100	
		628 B.C.

Nor is this all. A very simple diagrammatic statement will show what might also have happened about 618 B.C.

[1] It should be observed that a distinction is made between the Julian and the historical year. This comes from the fact that when astronomical phenomena are calculated for dates B.C., it must be remembered that chronologists are in the habit of designating by 1, or rather by −1, the first year which precedes the instant of time at which the chronological year commenced, while astronomers mark this year in their tables by 0. It follows, therefore, that the rank of any year B.C. is always marked by an additional unit in the chronological dates. For the Christian era, of course, chronologists and astronomers work in the same way. The following table, given by Biot, exhibits the connection between these two methods. In the latter Biot shows the leap-years marked B, and the corresponding years in the Scaligerian chronological period are also given.

Dates of Julian Years commencing on January 1.

According to Chronologists.	According to Astronomers.	Corresponding years of the period of Scaliger.
−6	−5	4708
−5B	−4B	4709
−4	−3	4710
−3	−2	4711
−2	−1	4712
−1B	−0B	4713B
Physical instant when the era commenced.		
+1	+1	4714
+2	+2	4715
+3	+3	4716
+4B	+4B	4717B
+5	+5	4718

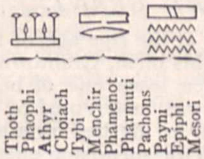
[2] *Loc. cit.* p. 29. "It is well known that the interpretation of the seasons and the months given by Champollion was opposed by Brugsch, who propounded another, which is now universally adopted by experts. Something has happened here which is often repeated in the course of Egyptian history—the signs have changed their meaning. Under the circumstance that the vague year during 1461 years wanders through the seasons in a great cycle, it is natural that the signs for the tetramenes should have changed their significations in the course of millenniums.

"While Thoth was the first month of the inundation in the documents of the Thutmosids and Ramessids, we have in the time of the Ptolemies the month Pachons as the first month of the flood season. Whilst Brugsch's explanation is valid for the time of the Ramessids, it is not so for that of the Ptolemies, to which Champollion's view is applicable."

[1] Probably too great a value by 2 or 3 days.

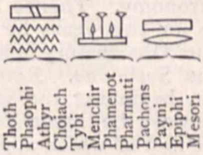
if a reformer of the calendar (and one especially of conservative tendencies) appeared upon the scene, who believed that the ancient sign for the inundation-tetramene was the water sign, and that the ancient name was Thoth. Finding the cycle beginning in 1728 with the signs as shown—

1728 B.C.



when starting fresh, he would seize the opportunity of effecting a change, not only by dealing with a tetramene, but he would change the names of the tetramenes allocated to the signs.

B.C. 618



As Krall remarks, it was almost merely a question of a change of the sign! It really was more, because the new tetramene began with the flood.

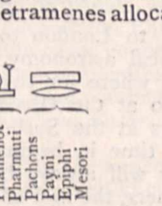
Assuming this, we can see exactly what was done in 238 B.C., *i.e.* about 380 years later. We have seen that the 380 years is made up of

5 Epacts
30 Mesori
30 Epiphi
30 Payni

$95 \times 4 = 380$

the heliacal rising of Sirius occurring on 1 Payni, having swept backwards along the months in the manner already explained. We had then—

B.C. 238



To sum up, so far as we have gone we have the three inscriptions at Philæ, Elephantine, and the still more ancient one of Pepi, indicating on the simple system we have suggested beginnings of Sothic cycles on the 1st Thoth about the years

270, 1728, 3192 } B.C.

On the other hand, we have the decree of Canopus, giving us by exactly the same system a local revision of the Calendar about 600 B.C. I say *about* 600 B.C. because it must be remembered that a difference of 2½ days in the phenomena observed will make a difference of 10 years in the date, and we do not know in what part of the valley the revision took place, and therefore at what precise time in relation to the heliacal rising the Nile-rise was observed.

Whenever presumably it took place, New Year's day was reckoned by the Flood, and the rising of Sirius followed nearly, if not quite, a month afterwards. The equivalent of the old 1st Thoth was therefore 1 Payni. In months, then, the old 1st Thoth was separated from the new one (= 1 Payni) by 3 months (Payni, Mesori, Epiphi) and the Epacts.

In this way, then, we can exactly account for the difference of 409 years referred to above as the dates assigned by Censorinus and myself for the beginning of the Sirius cycle.

Difference between 270 and 239	=	31 years.
3 months = 90 days × 4	=	360 ,,
5 epacts × 4	=	20 ,,
		411 ,,

The difference of two years is equal only to half a day!

It seems, then, pretty clear from this that the suggestion I have ventured to make on astronomical grounds may be worth consideration on the part of Egyptologists. If our inquiries have really led us to the true beginnings of the Sothic periods, it is clear that those who informed Censorinus that the year 139 A.D. was the end of a cycle omitted to tell him what we now can learn from the decree of Tanis.

J. NORMAN LOCKYER.

(*To be continued.*)

TECHNOLOGICAL EXAMINATIONS.

THE report of the results of the Technological Examinations, held this year under the direction of the City and Guilds of London Institute, has a special interest, seeing that after this year the system of payment on results in connection with all classes outside the Metropolis will be discontinued. There is no doubt that the offer of payment to teachers helped very greatly in 1879 to stimulate the formation of technical, as distinct from science, classes, and the great extension of this work of the Institute is largely due to the offer then wisely made of contributing towards the cost of instruction. The tables furnished in the report, and the diagram of results, are very interesting as showing the great development of these trade classes. Since 1880 the number of candidates for examination has increased more than tenfold, the numbers being 816 in 1880 and 8,534 in 1892. In 1885 there were 263 technological classes in different parts of the country, and in the session 1891–2 this number had increased to 610. There is, of course, a corresponding increase in the number of students in attendance at these classes. In 1881 the number of students was 2,500, this year it was 16,565. This record of progress is certainly satisfactory, and particularly so, seeing that prior to 1891 there was no sort of organization to carry on the work of directing and assisting technical classes for artisans in different parts of the country. As a pioneer movement, the work of the City Guilds Institute has been eminently successful, and many of the Technical Schools which have now been brought under the control of County Councils undoubtedly owe their origin to the technological classes promoted by the City Guilds. The question now demanding attention is the future of these classes. Much is to be said in favour of associating them more closely with the science classes, which are held in the same schools; but what is wanted for the permanent improvement of such classes is a system of efficient inspection by persons competent to advise County Councils with respect to the important work now under their control.

From the report and programme it appears that year by year the Institute adds to the extent and efficiency of its examinations by the introduction of new subjects and of practical tests. Practical examinations were held this year for the first time in photography, goldsmiths' work, boot and shoe manufacture, and in wood-working in connection with the examination in manual training for teachers of public elementary schools. This last examination is somewhat different in kind from the other examinations of the Institute. It is not a trade examination. Its purpose seems to be to encourage instruction of a distinctly educational character. Moreover, it is a close examination. None but teachers of public elementary schools are eligible, and these must have regularly attended a course of practical lessons in a registered class under a teacher approved by the Institute. Notwithstanding these restrictions, 615 candidates presented themselves at the first examination held by the Institute, and of these 350 passed, 195 obtaining the Teacher's Certificate.

The report contains full statistics of the results of the examinations in each of the 61 subjects included in the programme, and it also shows the results in each of the 210 towns where the examinations were held. Of the centres outside London, Manchester sent up the largest number of successful candidates, whilst Glasgow, Dundee, and Leeds come next in order. The report calls attention to the fact that the proportion of candidates to the population is far less in London than in Manchester, whilst the hope is expressed that the larger facilities for technical instruction which will be available within the next few years will lead to an increase in the number of students and of candidates for examination. This increase will no doubt take place with the opening of new polytechnic institutions; but we venture to think that the real improvement in technical education cannot be correctly measured by any mere increase in the number of candidates for examination. It depends much more upon the character and quality of the instruction which the candidates receive. The great defect of our present organization is the poverty in knowledge and practical experience of the teachers of our science and technical classes. Some improvement in the qualifications of teachers, and in the conditions of their training, is needed before progress can be measured by the increase in the number of students in attendance, or of candidates for examination.

We notice that in future the Institute proposes to award two kinds of certificates—the one kind to students who have regularly attended a course of instruction under an approved teacher, and the other to candidates who may present themselves for examination without giving any evidence as to their training. In this way the Institute proposes to combine the functions of a teaching and an examining body. The certificate indicating that the candidate has received some training at a school of recognized position will doubtless acquire a distinct value; but much will depend upon the ability and the reputation of the teacher under whom the candidate may have studied.

Of the many alterations in the new programme the most important is the addition of a practical part to the examination in mechanical engineering. This examination of the Institute has never seemed to us wholly satisfactory, as overlapping, to too great an extent, the examinations of the Science and Art Department in applied mechanics, machine construction, and steam. But in future the examination will consist of two parts, one of which will be distinctly specialized with a view to the candidate's occupation. Moreover, in the honours grade, candidates will be required to undergo a practical examination in either machine designing or workshop practice. At the last examination in this subject 966 candidates presented themselves, of whom 536 passed. It is satisfactory to note the continuous increase in the number of candidates in plumbers' work, a trade in the successful practice of which every householder is interested. In this subject a high standard for passing is wisely maintained. Of the 816 candidates who presented themselves, 235 came up for the practical part of the examination, and of these only 85 succeeded in passing in both parts of the examination, and are qualified for certificates.

There is little doubt that the statistics furnished in this report go far to show that a high value is attached by artizans and their employers to the Institute's certificates, and that the progress of technical education has been advanced by the cautious and judicious manner in which the Institute has conducted this department of its operations.

ROBERT GRANT.

IN Robert Grant, who at the ripe age of seventy-eight died at the place of his birth, Grantown-on-Spey, on October 24, 1892, science loses one of her ablest historians. His education was interrupted by a serious illness, which confined him to his bed from his fourteenth to his twentieth year. With surprising energy, however, on his recovery he set about the study of mathematics and the acquisition of ancient and modern languages. After studying for a time at King's College, Aberdeen, he went to London to collect materials for a history of physical astronomy. Thence he proceeded to Paris in 1845, where for two years he attended the lectures of Arago at the Observatory, and those of Leverrier and others at the Sorbonne. Returning to London, he lost little time in beginning the great work with which his name will always be associated. It was published in numbers, the first of which appeared in September, 1848, but it was not until March, 1852, that the whole work was issued. It bears the title "History of Physical Astronomy from the Earliest Ages to the Middle of the Nineteenth Century, comprehending a detailed account of the establishment of the Theory of Gravitation by Newton, and its development by his successors; with an exposition of the progress of research in all the other subjects of Celestial Physics." Most completely do the contents of the volume fulfil every expectation raised by this comprehensive programme. The fame of its author was at once established. Four years later he received from the hands of the late Mr. Manuel J. Johnson, President of the Royal Astronomical Society, the gold medal, then for the first time awarded for literary service to astronomical science. One paragraph of the address delivered on that occasion may here be quoted as characterizing most justly the work as well as its author: "Throughout the book no one can fail to be struck with the rare skill, integrity, and discernment the author has displayed in tracing the successive stages of progress; or with the scrupulous care he has taken to assign to each of the great men whom he reviews their proper share in the common labour. Nowhere is this more conspicuous than in the discussion relative to the discovery of the planet Neptune. By a simple narration of facts he has placed the history of that great event in so clear and so true a light, that I believe I am not wrong in saying he has gained an author's highest praise under such circumstances—the approval of both the eminent persons concerned." Even now, forty years after its publication, the "History" has lost none of its value as a mine of information, and as a delightful guide to those who desire to make a closer acquaintance with the astronomers of the past, as well as their works.

For some time Mr. Grant edited the "Monthly Notices" of the Royal Astronomical Society, and was a member of their Council. In conjunction with the late Admiral Smyth, he translated and edited Arago's "Popular Astronomy" (2 vols. 1855 and 1858). Meanwhile his health had so far improved that in 1858 he was able to go through a course of observational astronomy at Greenwich Observatory. In the following year, on the death of Prof. J. Pringle Nichol, he was appointed Professor of Astronomy, and director of the Observatory in the University of Glasgow.

As a member of the party that went to Spain in the troop-ship *Himalaya*, to observe the total solar eclipse of July 18, 1860, Prof. Grant, from his station near Vittoria, had the satisfaction of seeing a portion of the chromosphere, the existence of which as a thin layer enveloping the photosphere he had abundantly demonstrated in the winter of 1850-51, from a discussion of all the observations extant ("History," pp. 395, 396). It can excite no surprise that Prof. Grant assumed the red layer and also the prominences to shine by reflected light, when it is recollected that the sun's light and heat were then supposed to originate wholly in the photosphere while the nucleus was thought to be so cool as possibly to be habitable. When Prof. Grant took charge of the Glasgow Observatory the only useful instrument he found was the transit-circle by Ertel and Son, of Munich, but through the liberality of a few friends, chiefly in Glasgow, a nine-inch Cooke Equatorial was added to the Observatory some years afterwards. After thoroughly testing the transit-circle the new director commenced a series of observations of Mercury, Neptune, the minor planets, and a selection of stars from the British Association Catalogue. Gradually, however, his attention was concentrated entirely on the stars, the list being correspondingly expanded. The observations of planets were communicated from time to time to the *Astronomische Nachrichten* or to the "Monthly Notices."

The stellar observations were published at the expense of her Majesty's Government in 1883 in the well-known "Catalogue of 6415 Stars for the epoch 1870, deduced from Observations made at the Glasgow University Observatory during the years 1860 to 1881, preceded by a Synopsis of the Annual Results of each Star arranged in the order of Right Ascension."

In the introduction will be found a discussion of the Proper Motions of 99 stars. A very complete and appreciative review of this work from the pen of Prof. Auwers of Berlin appeared in the *Vierteljahrsschrift der Astronomischen Gesellschaft* (19 Jahrgang). The Glasgow star places were at once looked on with confidence by the numerous observers of comets and minor planets. One point connected with the Catalogue deserves special mention, viz. that, although the observations from which it is derived extend over a space of twenty-one years, the work appeared within two years of the close of the series. This promptitude excites the greater admiration when we learn that, exclusive of Prof. Grant's personal share in the work, no less than thirteen young assistants at various times took part in the observations, and two others in the computations. Many of these personal changes, each of which brought its quota of extra work to Prof. Grant, were no doubt in some measure due to the smallness of the allowance provided for assistance, viz. £100 per annum. Prof. Grant, however, was the last man to waste his energies in useless complaint, and dismisses this point with the remark that "in recent years the work of scrutinizing, reducing to a common epoch, and combining together the vast mass of the observations of the catalogue, extending over a period of more than twenty-one years, has pressed very heavily upon the slender resources of the observatory." The important time service of the City of Glasgow was originated by Prof. Grant some thirty years ago, and continues in operation up to the present moment. In 1855 he received from the University of Aberdeen the degree of M.A., followed by that of the honorary LL.D. in 1865, in which latter year he was elected a Fellow of the Royal Society of London. For three years he presided over the Philosophical Society of Glasgow, to whose proceedings he made various contributions. It may also be noted that among his writings are two remarkable letters proving beyond a shadow of a doubt the spurious character of the pretended Pascal correspondence. These letters were printed in the *Comptes Rendus* by special permission of the French Academy.

In manner Prof. Grant was singularly vivacious, and to the last he greeted with the warmest enthusiasm every fresh discovery in the science to which his life was devoted.

R. C.

NOTES.

THE following is the list of names recommended by the President and Council of the Royal Society for election into the Council for the year 1893. The ballot will take place at the anniversary meeting on November 30:—President, The Lord Kelvin, D.C.L., LL.D.; treasurer, Sir John Evans, K.C.B., D.C.L., LL.D.; secretaries, Prof. Michael Foster, The Lord Rayleigh, D.C.L.; foreign secretary, Sir Archibald Geikie, LL.D.; other members of the Council, Captain William de Wiveleslie Abney, C.B., Sir Benjamin Baker, K.C.M.G., LL.D., Prof. Isaac Bayley Balfour, William Thomas Blanford, Prof. George Carey Foster, Richard Tetley Glazebrook, Frederick Ducane Godman, John Hopkinson, Prof. Joseph Norman Lockyer, F.R.A.S., Prof. John Gray McKendrick, William Davidson Niven, William Henry Perkin, LL.D., Rev. Prof. B. Price, The Marquess of Salisbury, K.G., Adam Sedgwick, Prof. William Augustus Tilden.

AN international subscription for a testimonial to M. Pasteur on the occasion of his seventieth birthday on December 27 is to be opened by the French Academy of Science. Many men of science in all parts of the world will be glad to have this opportunity of expressing their high appreciation of M. Pasteur's labours.

SOME time ago we announced that Baron Nordenskiöld proposed to edit a number of very remarkable letters and memoirs of Carl Wilhelm Scheele, who died in 1786. It has now been decided that the one hundred-and-fiftieth anniversary of the birth of this great Swedish chemist, on December 9, shall be made the occasion of a brilliant celebration in his native country. A monument to Scheele is to be unveiled in Stockholm.

THE Naturforschende Gesellschaft of Danzig are issuing invitations to the celebration of the 150th anniversary of their foundation on January 2 and 3, 1893. The meetings will take place on the Monday evening in the Friedrich-Wilhelm-Schützenhaus, and on the Tuesday morning in the large hall of the Landeshaus, and the proceedings will wind up on the latter day with a dinner at 4 p.m. in the Schützenhaus.

PROF. EDWARD PRINCE, of Glasgow, has been offered the important post of Commissioner and General Inspector of Fisheries for Canada by the Dominion Government, and has accepted the office. Prof. Prince is well known as an authority in Fishery Science. He holds the chair of Zoology in St Mungo's College, Glasgow, and is President of the Anderson's College Scientific Society, and Vice-President of the Glasgow Natural History Society.

IT is announced that the King of Italy will open in person the International Medical Congress, which is to be held in Rome next year. An English committee is being formed to do what it can to secure the success of the Congress.

THE New York Academy of Sciences has organized a Biological Section, which is to hold monthly meetings. The opening meeting, at which Prof. H. F. Osborn presided, was held on October 17.

THE Victoria University has issued a list of University Extension lectures which are to be delivered in the course of the session 1892–93. They are to be given at many different centres, and include a wide range of subjects, among which various departments of physical and natural science hold a prominent place.

LIVERPOOL has sustained a real loss by the death of Mr. T. J. Moore, the late curator of the Liverpool Derby Museum. Mr. Moore had a wide knowledge of various branches of science, and did much to foster popular interest in the results of scientific inquiry. He died on October 31.

DURING the latter part of last week the weather continued very unsettled, the depressions which advanced from the Atlantic causing strong southerly winds or gales in many places, with frequent and heavy rain, while the temperature was uniformly high for the time of year, the daily maxima reaching nearly 60° in the southern parts, and exceeding 50° in the northern parts of the kingdom. On Saturday night a considerable decrease of temperature occurred, owing to the advance of an anti-cyclone which subsequently spread over most of the country; the southerly winds gradually disappeared, and were succeeded by calm and variable airs. In the early part of the present week fog became prevalent in many parts of England, but the weather was generally fair with frosts over the inland districts. On Tuesday, however, fresh depressions were passing along our north-west coasts, and rain squalls became general over Ireland and Scotland, while southerly winds again became prevalent. The *Weekly Weather Report*, issued on the 5th instant, showed that the rainfall greatly exceeded the mean in the east and south of England, while in Scotland and the northern parts of England the fall was below the average. Since the beginning of the year, the eastern, Midland, and north-west districts of England have had three inches of rainfall in excess of the normal amount, while in the south-west of England there is a deficiency of 7·6 inches.

THE U.S. Hydrographic Office has issued a chart showing the submarine cables of the world, with their principal land connections. The chart is described by *Goldthwaite's Geographical Magazine* as a necessity to foreign commerce. It contains tables for the computation of rates to any part of the world.

THE November number of the *Kew Bulletin* contains sections on coffee cultivation in British Honduras, the prune industry of California, sugar cane borers in the West Indies, sisal hemp industry in Yucatan, Liberian coffee in the Malay native states, and Bombay aloe fibre. There are also miscellaneous notes, from one of which botanists will be glad to learn that after many unsuccessful attempts to introduce living examples of the interesting plant, *Dischidia rafflesiana*, Kew has at last succeeded, thanks mainly to the generosity of Dr. Treub, the distinguished director of the Botanic Gardens, Java, who sent a plant of it in a Wardian case two years ago. This plant is now established and growing freely, producing numerous large pitcher-like leaves as well as the small normal hoya-like foliage. The morphological meaning of these pitchers has not yet been thoroughly worked out. "The species of dischidia all want a careful study. They cannot be described satisfactorily from dried specimens. The leaves change in form, and it is not ascertained in respect of many species whether they may or may not be converted into pitchers (ascidia)" (Hooker in "Flora of British India"). The plant at Kew is now under the special observation of Dr. Scott, hon. keeper of the Jodrell Laboratory. *D. bengalensis* is an old garden plant. It is cultivated at Kew in the Palm House. *D. rafflesiana* is for the present kept in one of the propagating pits.

AT the opening meeting of the twelfth session of the Junior Engineering Society on November 4, an excellent address was delivered by the president, Dr. John Hopkinson, F.R.S., on the cost of electric supply. His general conclusion on the subject is that to be ready to supply a customer with electricity at any moment he wants it, will cost those giving the supply not much less than £11 per annum for every kilowatt, that is for every unit per hour; and afterwards to give the supply will not cost very much more than ½d. per unit. The clear apprehension of this point Dr. Hopkinson believes to be essential to the commercial success of electric supply. It is hopeless, he thinks, for electricity to compete with gas in this country all along the line, if price is the only consideration. But with selected customers, electricity is cheaper than gas. Surely, he adds, it is the interest of those who supply electricity to secure such customers by charging them a rate having some sort of relation to the cost of supplying them.

AN address delivered by Prof. Virchow at the opening of the recent International Congress of Archæology at Moscow is printed in the current number of the *Revue Scientifique*. Prof. Virchow repeats in this address what he has often said before—that no trace of "the missing link" between man and the lower animals has been discovered either in the human skulls which are believed to be most ancient or in the physical organization of modern savages. He urges that the immediate task for anthropologists is to explain the origin of the existing human races, and to determine the causes by which these races, while retaining the power of hereditary transmission, have acquired their distinctive characteristics. At first sight, he says, it is easy to suppose that a dolichocephalic skull may be transformed into one of brachycephalic form; but it has not yet been shown that any dolichocephalic race has been actually transformed into a brachycephalic one, or *vice versâ*. Prehistoric anthropology ought, he thinks, to find methods which would facilitate the recognition of the types of ancient races and peoples, and enable us to find them again among the races and peoples of the present day. It ought also, as occasion offers, to collect data with regard to those strange individual cases about which theories, as Dr. Virchow holds, have been prematurely formed, and which should be kept in "the scientific baggage" until we have secured intermediate links which will render it possible for us to unite them in a series.

ACCORDING to an official report of Captain von François, the dromedaries which have been introduced into the German territories in South-west Africa in connection with the parcel post service have more than fulfilled the expectations that had been formed about them. The climate suits them, and they are not affected by any of the prevalent cattle diseases. On the road between Lehuititang and Geinab they were six days without water, and on the seventh day, at Geinab, they did not seem to be very thirsty. In stony regions their feet do not, like those of unshod horses or oxen, suffer any injury. When loaded with a weight of 250 pounds, a dromedary advances at much the same rate as an ox-waggon. The only drawback connected with these useful creatures is that they are rather costly.

MR. A. E. DOUGLASS, first assistant at the Boydun station of the Harvard College Observatory, Arequipa, contributes an interesting paper to *Science*, October 21, on indications of a rainy period in Southern Peru. There is evidence to show, he thinks, that for many thousands of years, going back far beyond the recognized period of human habitation, the climate of Peru has been very much as it is at present. That was preceded by a slow rise of the land out of the sea, which caused the climate to change from wet to dry. But under the wet climate the elevation of the land was still too great, and perhaps the duration of the epoch was too short, to produce a luxuriant tropical vegetation; otherwise there would be to-day extensive coal-fields. The wet climate, however, was sufficient greatly to alter the face of the country. Lake Titicaca was of enormous area, fed perhaps by the melting glaciers. In the almost continuous rainy season, huge turbid rivers roared and tumbled down these western slopes of the Cordillera, while on each mountain summit vast quantities of snow fell, only to pursue its way down the steep slopes, carving out valleys, building up ridges, and by its melting wearing out deep ravines, which grow smaller as they become lost in the broad level plain below. Under such luxuriance of moisture the valley of Arequipa must have teemed with animal and vegetable life, the barren hills to the south were clothed in green, and the desert of La Joya blossomed like a garden.

A CAPITAL annotated catalogue of the mammals collected by Dr. W. L. Abbott in the Kilima-Njaro region, East Africa, has been prepared by Mr. F. W. True, and printed in the Proceedings of the fifteenth volume of the U.S. National Museum, with several plates. Dr. Abbott has presented to the National Museum many African collections; but none of them, according to Mr. True, is of more interest than the collection of mammals. The specimens have been prepared with much care, the skins being almost invariably accompanied by the skulls and furnished with labels giving the locality and date of capture, sex, and other data. In determining the species Mr. True has found it necessary to depend almost exclusively on the literature, on account of the lack of specimens for comparison, but the identifications have been made with much care, and may, he thinks, on the whole, be relied upon. Several species apparently new are represented in the collection: *Dendrohyrax validus*, *Mus aquilus*, *Dendromys nigrifrons*, *Sciurus undulatus*, *Cephalophus spadix*. On one who has studied the North American mammalian fauna in detail, Mr. True says, the thought impresses itself that the condition of species, as regards variation, is different in the Ethiopian and Nearctic regions. In North America individual variation seems far less extensive than in Africa, while geographical variation appears to be more extensive and constant. In Dr. Abbott's collection great individual variation is especially apparent in the genera *Galago*, *Genetta*, and *Canis*. It is true that the species of the last-named genus everywhere present much individual variation, but in North America its chief variations appear to be geographical in character. The known range of several species is considerably extended by Dr. Abbott's labours.

AN important contribution to spectroscopy appears in No. 10 of Wiedemann's *Annalen* in the shape of a paper on the infrared emission spectrum of the alkali metals, by Benjamin W. Snow. The method is distinguished by the adoption of a modified form of the bolometer and a very delicate galvanometer with quartz fibre suspension. The fibre, supplied by Prof. Boys, was 40 cm. long. With a scale at a distance of 3m., a deflection of 1mm. corresponded to a current of $1{\cdot}5 \times 10^{-11}$ amp. The spectra were obtained by means of a silicate-flint prism, so as to avoid the overlapping of the infra-red spectra which seems to be inevitable where gratings are used. Since no infra-red lines could be traced in the spectrum produced in the Bunsen or the oxy-hydrogen flame, the electric arc was used, the current being derived from the very uniform Berlin Central supply. The best arrangement for the arc was found to be a hole bored through the centre of the carbon, containing a "wick" of the compressed salt. The bolometer consisted of two platinum-thread resistances. A platinum wire embedded in silver was hammered flat, so as to have a breadth of 0·05mm. and a thickness of 0·00036mm. Two such threads were fastened side by side with shellac on a mica frame. One of them was blackened in a turpentine flame and exposed to the light, the other being covered. The difference of resistance produced by the incident rays was measured by a Wheatstone bridge arrangement, with a shunt contrivance for enlarging the scale of the bridge wire. The resistance of each of the platinum ribbons under ordinary conditions was 75 ohms. The other branches of the bridge were made of German silver wire. The slit of the spectrometer was adjusted to 0·1mm., corresponding to an angle of 1·68 minutes of arc in the spectrum, whilst the breadth of the platinum thread corresponded to an arc of 1''·6. The current through the bridge was maintained at one-fortieth ampere. In the measurement of the intensity of the lines, the energy of radiation was taken as proportional to the first throw. It was found that a standard candle at 1m. distance gave a throw of 150mm. A preliminary investigation of the carbon spectrum revealed a large number of bands reaching up to λ 20620, the principal less refrangible bands being between

7000 and 7700
7850 and 8600
9000 and 10000
10750 and 11600
13700 and 15000

These were made up of innumerable fine lines. It was also observed that the carbon spectrum vanished in comparison with the metallic spectrum as soon as the latter was brought into play. Of the five metals investigated, viz., sodium, potassium, rubidium, lithium, and cæsium, the two rarest were found to be specially rich in infra-red lines. Sodium showed maxima at 8180, 11270, 12400, and 18360, potassium at 7670, 10820, 11580, 12250, and 14610, lithium at 8070, rubidium at 7910, 9980, 13120, and 14760, and cæsium at 8380, a large one at 8820, and others at 9980, 13270, and 14530. Kayser and Runge's empirical law for the alkalies was confirmed for the infra-red of lithium and sodium, but not for the other three metals.

MR. ELLIOTT COUES, of the Smithsonian Institution, defends in *Science* the rule, in biological nomenclature, "once a synonym, always a synonym," for the form of which he believes himself to be in some degree responsible. He illustrates the real meaning of the aphorism in the following way. Let there be a genus *Smithia* in botany. Let a genus *Jonesia* then be named. Let *Jonesia* then be found to be the same genus as *Smithia*. Then the name *Jonesia* "lapses into synonomy," and cannot be thereafter applied to any other genus in botany. That is all that is meant by the saying "once a synonym always a synonym." In other words, if *Jonesia* is not good for what it originally meant, it is good for nothing; it is to be deleted absolutely, and cannot come into re-existence by transfer to any other genus. Mr. Coues shows that the same principle holds for all specific names within their respective genera. Example: Let there be a *Rosa Smithi*. Let some one then name a *Rosa Jonesi*. Let *R. Jonesi* be considered to be the same species as *R. Smithi*. Then there can never be a *R. Jonesi*; that is to say, no other species of *Rosa* can be specified as *Jonesi*. But, of course, if any one discovers, after this reduction of *Jonesi* to a synonym of *Smithi*, that what had been called *R. Jonesi* is a good species, then *Jonesi* revives as the name of *that* species; and the fact that it had been (erroneously) regarded as a synonym of *Smithi* is no bar to its use in its original sense.

THE Geological Survey of America has published a paper, by Mr. J. S. Diller, on the Geology of the Taylorville region in the Sierra Nevada, California, immediately north of the fortieth parallel. In this region there are eighteen sedimentary formations and seventeen eruptive masses. The former have a total thickness of 24,500 feet; 17,500 feet are probably Palæozoic, and 7000 feet are Mesozoic. Among the sedimentary rocks, one horizon in the Silurian, two in the Carboniferous, three or more in the Trias, and five in the Jura have been definitely recognized by fossils. Among the eruptives there is great variety. Their extravasation, beginning early in the Palæozoic, recurred vigorously in the Triassic and at the close of the Jurassic, and, finally, also in the Neocene and Pleistocene. The dioritic rocks of the region are a portion of the great granitoid mass of the upper Sierra Nevada, and are evidently eruptive, with well-defined contact phenomena in Triassic formations. Their eruption is certainly post-Triassic, and may have taken place immediately at its close or after the deposition of the Jurassic. There are at least four unconformities in the geologic column of the Taylorville region. During the greater part, if not the whole, of the Palæozoic, the sea covered the region now occupied by the northern portion of the Sierra Nevada. The great disturbance at the close of the Carboniferous may have been accompanied by an uplift, forming land during the early Triassic; but if so, it subsided and was ready to receive the deposits of the upper Triassic. The disturbance at the close of the Triassic formed no land in the northern Sierra region, but that which closed the Jurassic was accompanied by a great upheaval, excluding the sea to the western base of the Sierras. The general structure of the Taylorville region involves a synclinal and two limiting anticlinals. After the folds were overturned toward the north-east, the Grizzly anticlinal was affected by an overthrust fault in the same direction. The throw along this fault in the older strata is so much greater than in those of Jurassic age as to suggest that a large part of the displacement took place at the close of the Triassic, and was followed by movement on the same plane at the close of the Jurassic.

MR. STANFORD has issued an interesting and valuable contoured map of the county of London. The scale is three inches to a mile. The contour lines or lines of equal altitude are drawn at 25 feet intervals. The lowest contour is 25 feet above the level of the sea, ordnance datum, which is 12 feet 6 inches below Trinity high water. The whole of the alluvial flat lying below the lowest contour, or at a less altitude than 12 feet 6 inches above the river Thames (Trinity high-water mark), is covered by a dark brown tint.

THE third volume of reports upon the fauna of Liverpool Bay and the neighbouring seas has been issued. The reports have been written by members of the Liverpool Marine Biology committee and other naturalists, and edited by Prof. W. A. Herdman, F.R.S.

MESSRS. GURNEY AND JACKSON have published the *Zoological Record* for 1891. It is the twenty-eighth volume of the series. Mr. D. Sharp, F.R.S., has acted as editor, and has had the co-operation of many able zoologists. It is intended that in future the volume shall be published in August or September.

PHOTOGRAPHERS will read with great interest an admirable paper by Captain Abney, in the November number of the *Journal of the Camera Club*, on "shutters," which he describes as "a piece of apparatus which is the very joy and toy of the photographer's existence." The paper is fully illustrated.

THE Rev. L. A. Walker sends to the current number of the *Entomologist* some statistics of the entomology of the Hague, where he acted as chaplain during July. The entomology of Holland seemed to him very disappointing in number of species, and also in individuals in the great majority of cases; less productive, in fact, than the ordinary run of country places at home.

AT the meeting of the Linnean Society of New South Wales on September 28, Mr. R. Etheridge, junior, exhibited seeds of the "Bean-tree," possibly an *Erythrina*, from Macdonald ranges, Central Australia. The seeds are strung and used as necklaces by the aborigines, who use the wood of the same tree for producing fire by friction, and also for shields, on account of its lightness.

A COMPOUND of gold and cadmium of the composition AuCd has been isolated by Messrs. Heycock and Neville, and is described by them in the November number of the Journal of the Chemical Society. During the course of a series of experiments last year upon solutions of gold and cadmium in melted tin, it was observed that the amount of lowering of the freezing-point of the tin by the simultaneous introduction of gold and cadmium was considerably less than the sum of the effects which each of the two latter metals would produce alone. It was surmised that this difference must be due to combination between the gold and the cadmium. Moreover, the product o this combination appeared to be only sparingly soluble in tin, for a considerable quantity of a crystalline precipitate was produced, but owing to the difficulty of freeing it from the tin which solidified over it upon removal, the compound was not obtained in a state of sufficient purity to enable a definite conclusion concerning its composition to be arrived at. Messrs. Heycock and Neville now announce that they have succeeded in preparing the compound in an entirely different manner, and in isolating it in a state of comparative purity. The following is the best mode of procedure:—A piece of the hardest combustion tubing is sealed at one end and slightly bent in the middle so as to form a V-tube of very large angle. A quantity of pure gold is placed in the sealed limb, together with three or four times its equivalent of cadmium. The open end is then drawn off so as to enable the tube to be exhausted by means of the Sprengel pump. As high a vacuum as possible should be obtained, and the tube subsequently sealed. The apparatus is then arranged upon a combustion furnace in such a manner that the excess of cadmium when liquefied may run away from the alloy. When the cadmium first melts it is advisable to vigorously shake the tube so as to diffuse the gold well among the cadmium. The combination then occurs suddenly, accompanied by bright incandescence of the gold. When the larger excess of cadmium has been allowed to run away from the compound, the end of the tube containing the latter is heated for about five hours to a temperature about that of the softening of glass, when the remainder of the excess of cadmium distils regularly off, until towards the expiration of the five hours no further condensation occurs. The product thus left behind was found in three successive experiments to contain about 63·7 per cent. of gold, the percentage required for a compound of the composition AuCd. The compound of gold and cadmium thus obtained presents a silvery greyish-white appearance, is very brittle, and exhibits a crystalline fracture. The action of acids upon it is somewhat singular. Cold acids appear to be without material action upon it, but hot nitric or hydrochloric acid attacks it with great energy, the cadmium passing into solution and the gold being left in the shape of the original ingot.

THE additions to the Zoological Society's Gardens during the past week include a Purple-faced Monkey (*Semnopithecus leucoprymnus*) from Ceylon, presented by Mrs. Elgee; six Short-tailed Voles (*Arvicola agrestis*) from Scotland, presented by Mr. J. E. Harting, F.Z.S.; two Laughing Kingfishers (*Dacelo gigantea*) from Australia, presented by Mr. J. W. Hornsby; a Golden Eagle (*Aquila chrysaëtus*) from Labrador, presented by Mr. J. G. Baxter; a Jackdaw (*Corvus monedula*) British, presented by the Rev. H. W. Reynolds; three —— Geckos (*Gecko verticillatus*) from Burmah, presented by Mr. W. G. Bligh; two American Darters (*Plotus anhinga*), a Common Boa (*Boa constrictor*) from South America, four Bar-tailed Pheasants (*Phasianus reevesi* ♂ ♂ ♀ ♀) from China, purchased.

OUR ASTRONOMICAL COLUMN.

A BRIGHT COMET is announced in Andromeda, seventy seconds preceding Struve 72.

COMET BARNARD (OCTOBER 12).—The following is a continuation of the ephemeris we gave last week of Comet Barnard taken from *Astronomische Nachrichten*, No. 3125.

Ephemeris for 12h. Berlin M.T.

1892.	R.A. h. m. s.		Decl. ° ′		Log *r*.		Log Δ.		Br.
Nov. 11...	20 46 49	...	+2 33·3						
12...	49 40	...	2 15·7						
13...	52 32	...	1 58·3	...	0·2262	...	0·1648	...	0·97
14...	55 25	...	1 41·2						
15...	20 58 19	...	1 24·4						
16...	21 1 14	...	1 7·9						
17...	21 4 9	...	+0 51·6	...	0·2250	...	0·1713	...	0·94

It may be mentioned that an *Astronomische Nachrichten* circular note contains rather a modified edition of the above places deduced from observations made on October 16, 20, and 25.

Thus for the 13th, the R.A. is given as 20h. 54m. 24s. (app.), and declination (app.) + 1° 54'.5; and for the 17th, R.A. (app.) 21h. 6m. 39s, and declination (app.) + 0° 46'.4.

COMET BROOKS (AUGUST 28).—Owing to the rapid brightening of Comet Brooks, we give the following ephemeris continued from the same source as mentioned last week (*Astronomische Nachrichten*, No. 3125).

12*h*. *Berlin M.T.*

1892.	R.A. app. h. m. s.	Decl. app. ° '	Log *r*.	Log Δ.	Br.
Nov. 11...	9 56 50 ...	+3 18.7			
12...	10 1 8 ...	2 24.6 ...	0.0985 ...	9.9861 ...	15.61
13...	5 29 ...	1 29.6			
14...	9 52 ...	+0 33.8			
15...	14 17 ...	−0 22.9			
16...	18 45 ...	1 20.3 ...	0.0847 ...	9.9712 ..	17.81
17...	23 15 ...	2 18.4			

OCCULTATION OF MARS AND JUPITER BY THE MOON.—Prof. Barnard communicates his observations of the occultation of Mars and Jupiter by the moon, which occurred in one week during last September, to the *Astronomical Journal*, No. 276. The instrument used was the 12-inch equatorial and the seeing was defined as being very fine on both occasions. At the disappearance of the former planet, which took place at the dark limb of the moon, nothing very striking was noticed, the moon's limb at that point being sharp and not dusky, as had been previously seen in an occultation of Jupiter. The times of disappearance and appearance (Mount Hamilton mean time) were :—

	Disappearance. h. m. s.		Reappearance. h. m. s.
1st contact ...	9 9 35.8	...	10 45 56.0 (1s. late ?)
Half obscured ...	9 10 4	...	10 26 17
2nd contact ...	9 10 37.1	...	10 26 52.2

In the case of Jupiter, which disappeared at the bright limb, a narrow shadow band was noticed fringing the limb where the planet appeared to cut it. This is due, as Prof. Barnard thinks, to the effect of contrast. The times of contacts were as follows :—

	Disappearance. h. m. s.		Reappearance. h. m. s.
1st contact ...	17 28 10.4	...	18 33 17.5 (2s. late ?)
Half obscured ...	17 28 55.0	...	18 33 50
2nd contact ...	17 29 45.7	...	18 34 33.7

MOTION OF THE SOLAR SYSTEM.—The question of the exact position of the point in the heavens to which the sun with his system is travelling has been the object of much research and computation, and the present co-ordinates are now considered as being about R.A. 267° and declination + 31°.

The determination under consideration (*Astronomical Journal*, No. 276) has been undertaken by Prof. J. G. Porter, and is based on the proper motions of 1340 stars, contained in the Publication of the Cincinnati Observatory, No. 12. The method employed for computing the co-ordinates of the apex of the sun's way is that of Prof. Schönfeld ; the stars were grouped in four divisions, Division I. including those whose yearly proper motion was less than 0".30 and contained 576 stars ; Division II., motion from 0".30 to 0".60, containing 533 stars ; Division III., motion from 0".60 to 1".20, containing 142 stars ; and lastly, Division IV., the motion exceeding 1".20, 70 stars being included. From these four groups the following values have been deduced, where σ and τ represent the co-ordinates of the apex of the sun's course and $\frac{c}{\rho}$ the velocity of the sun's motion :—

	σ	τ	$\frac{c}{\rho}$
	°	°	"
I. ...	281.9 ...	+53.7 ...	0.16
II. ...	280.7 ...	+40.1 ...	0.30
III. ...	285.2 ...	+34.0 ...	0.55
IV. ...	277.0 ...	+34.9 ...	0.66

The last determination of these co-ordinates was made, if we are not mistaken, by Prof. Stumpe, and were given in *Astronomische Nachrichten*, Nos. 2999–3000. The values there deduced agree very well with those in question, with the exception of τ in Group I. and σ in Group IV., which consequently throw the mean values rather out. Adopting the same notation, he obtained—

	σ	τ	$\frac{c}{\rho}$
	°	°	"
I. Group ...	287.4 ...	+42.0 ...	0.140
II. ,, ...	279.7 ...	40.5 ...	0.295
III. ,, ...	287.9 ...	32.1 ...	0.608
IV. ,, ...	285.2 ...	30.4 ...	2.057

Summing up the values obtained by some previous workers, the following table gives the co-ordinates obtained :—

Name.	R.A.	Decl.	No. of stars used in reduction.
Gauss	259.2 ...	+30.8 ...	—
Argelander ...	259.9 ...	32.5 ...	390
O. Struve ...	261.5 ...	37.6 ...	392
Mädler	261.6 ...	39.9 ...	2163
Airy	261.5 ...	24.7 ...	113
Dunkin	263.7 ...	25.0 ...	1167
Rancken ...	284.6 ...	31.9 ...	106
Birchoff	285.2 ...	48.5 ...	480
L. Struve ...	273.3 ...	27.3 ...	2509
Stumpe	285.1 ...	36.2 ..	1054
Porter	281.2 ...	40.7 ...	1340

SOME REMINISCENCES OF THE MAORIS.

MR. W. COLENSO, F.R.S., has often been asked to record some of his reminiscences of the Maoris, whom he has for very many years had opportunities of studying. This he has now done in a paper printed in the Transactions of the New Zealand Institute (vol. xxiv.), some extracts from which may be of interest for various classes of readers. He says :—

Of the Mako Shark.—Fifty years ago (to go no further back) a Maori chief would be known by wearing certain emblems or insignia indicative of rank, one of which was the tooth of the *mako* as an ear-pendant ; and, as such were plentiful, though distributed, the thought often occurred to me in my early travelling days, What a number of the fish *mako* there must have been captured or obtained by the Maoris to yield such a large number of teeth ! Moreover, on inquiry I invariably found that all the teeth I saw were prized heirlooms, and had descended to the present possessor through several generations, and (as far as I could learn) none had been recently acquired. And while, when travelling along the sea-coasts for many a league on both sides of the North Island during several years, and always on foot, I had both seen and heard of a number of large sea-animals (fishes and mammals) that were driven on shore on the sandy beaches in severe gales from the sea, I never knew of a single *mako* shark, nor had the Maoris resident on those shores ever heard of one being cast up.

In replying to my numerous inquiries by letter respecting the *mako*, made many years ago, an intelligent aged Maori chief living on the east coast wrote as follows (or, rather, he being of the old school, and unable himself to write, a young adherent did so at his dictation). I give a literal translation of portions of his letter :—

"You ask, did I ever see a *mako* fish ? Yes ; and it is a very large creature, the biggest of all the sharks (*mango*)—in length 2 fathoms measured (*erua maro whanganga nei*), and in thickness 1 foot. It is a true shark, but called by us a *mako* on account of its teeth. You also inquire concerning its fat or oil, and the edible qualities of its flesh, whether considered choice by us Maoris. Now, there are many kinds of shark, as the *mako*, the *karaerae*, the *pioke*, the *ururoa*, the *uatini*, the *tahapounamu*, the *taiari*, the *tatere*, and the *mangotara*, and I have not eaten of them all, and therefore I do not know how nice or how fat they all are ; and so of this one, the *mako*. But, my friend, this fish was never desired as an article of food—never so used by us Maoris. The only part of it that we sought and greatly desired to have was its head, and this solely on account of its teeth. When caught out at the deep-sea fishing-grounds its body was never hauled into the canoe, but the head was cut off while it was still in the sea and alongside of the canoe (*ka tapahia moanatia te upoko*) : this done, and the head secured, the body was left to drift away on the sea. The head was also immediately wrapped up securely in a clothing-mat (*kahu*), lest it should be noisily wondered at by those who were strangers or unacquainted with it (*koi umeretia e nga tangata tauhou*). You also ask what instrument was used for cutting off the head of the *mako*. What, indeed! Why, the saw made of the teeth of the *tatere* shark firmly fixed on to a wooden blade (*he niho tatere, he mea hohou ki runga ki te rakau*). You further inquire respecting the number of its teeth. There are eight—that is, large ones from within—and also eight smaller ones of them outside. Besides those there were several much smaller ones in front or outside (*o waho rawa*), but these I never counted, and therefore cannot give their exact number."

He also wrote (in another and subsequent letter) in answer to my further inquiries: "There are four very large teeth from the beginning, or within. These are called *rei*, and are kept for ear-pendants. Altogether there are eight teeth—that is, four very large ones, and four smaller, making eight in all. The outside teeth resemble those of the *tatere* shark, and are only termed teeth (*niho*); these have no other name, but those that are kept for ear-pendants are called *au rei*. Then, you wish to know how the *mako* was captured by us Maoris in the olden times. Listen. This fish was never taken as other sharks (*mango*) were, with hook and bait: none of our fish-hooks would be strong enough to hold it, they would soon be broken. Now, when the fishing-canoe was out fishing, and had been a long time there catching fishes of various kinds, suddenly a *mako* would be seen coming leisurely along on the surface of the water (*e hara mai noa ana i te kiri o te wai, ara i te kare o te wai*). Then the man who saw it would shout out to his companions in the canoe, 'Haul up our land' (*Hutia mai to tatou whenua*), not naming the fish; and when the *mako* was pretty near to the canoe, about three yards off, then the big tempting bait was let low down before it, and on the *mako* seeing the bait it would bend down its head to seize it (*ka tupou te upoko*), when its tail would be upraised above water. Then a noosed rope would be flung over its tail (lasso-fashion) and quickly hauled tight, which would secure the tail within the noose hard and fast. And away would speed the canoe at a fleet rate towards all sides of the sea and sky, being continually turned about in all directions by the fish, the man who had noosed it always holding on to the rope. At last, being exhausted, the *mako* died; then it floated, when its head would be cut off, as I said before. This was our common manner of catching the *mako* fish (*ko tona hii tonu tenei o tenei ika o te mako*), often also called by us a monster (*taniwha*); and hence arose the term of monster-binding (*heretaniwha*), owing to it being securely noosed and bound with a rope flung over its tail." Here ends the interesting narration of my worthy old Maori correspondent, who died soon after.

I have never seen a *mako* fish, and I am in doubt whether it is yet fully known to science. It is evidently one of the deep-water fishes. The first mention of it by skilled scientific observers that I have noticed is in Sir James Ross's "Voyage to the South Seas," wherein it is stated that on nearing the Chatham Islands, in November, 1841 (within a week after leaving their winter quarters and anchorage in the Bay of Islands), "the long-snouted porpoises were particularly numerous. One of these creatures was struck with a harpoon, and in its formidable jaws we found the teeth which the New-Zealanders value highly as ornaments, and which had puzzled us greatly to ascertain to what animal they belonged" (vol. ii., p. 134). Those Antarctic Expedition ships had spent several months in the Bay of Islands, and the officers had frequent opportunities of seeing and examining the teeth of the *mako*, and very likely had purchased some from the Maoris, as they were diligent in acquiring natural specimens, and curios and ornaments of all kinds.

Professor Hutton, in his "Catalogue of the Fishes of New Zealand" (published by the Government in 1872), considered the *mako* to be the "*Lamna glauca* = tiger-shark;" but he says, "The shark from which the Maoris obtain the teeth with which they decorate their ears is probably this species, but I have seen teeth only" (*l.c.*, p. 77).

Subsequently Professor Julius von Haast (in 1874) read a paper before the Philosophical Institute of Canterbury (Trans. N.Z. Inst., vol. vii., p. 237) on the *mako* of the Maoris, which, he says, is *Lamna cornubica*, the porbeagle shark, and not *L. glauca* as had been supposed by Professor Hutton. But Professor von Haast had only a small young specimen (or, rather, its skin) to examine, which two North Island Maoris, then engaged at Christchurch Museum, pronounced to belong to a young *mako*, and informed him that this fish in its adult state was about 12ft. long. The animal to which the skin belonged was 4ft. 10in. long. Professor von Haast also gives much information relative to the teeth of his small specimen (differing widely from my Maori friend's description given above), their number, form, and size, the colour of its skin, &c. Still, as I take it, there are reasonable doubts as to that specimen being a true *mako*; I think it is highly probable that his two Maori informants had never seen a real *mako* shark.

Couch, in his celebrated work on "British Fishes," in his account of the porbeagle shark, gives a drawing of it from nature, and also others of its teeth and jaws, which appear to be different from those of the *mako*, being much more slender, and semi-terete, undulate, and sharply pointed (vol. i., pp. 41–44).

My object in writing this notice of the *mako* shark is mainly to relate the ancient Maori mode of capturing it.

Of the Preparation of Black Pigment for Tattooing.—The ancient Maoris had more ways than one of obtaining the black substance used in tattooing, which colouring-matter also varied in quality, partly owing to what it was made from; that for the countenance being superior to that used for the lower parts of the body. One way of obtaining the best kind was as follows:—

First, two proper careful men were selected for the work. This, too, was done with ceremony, they being (for the time) *tapu* (*i.e.*, under the laws of *taboo*)—rigidly set apart. A small kiln-like furnace (*ruangarehu*) was excavated in the side of a hill suitably situated. The substances to be used in burning for their soot—*kauri*-resin (*kapia*) and the resinous veins of white pine wood (*kapara*)—were got ready; a net made from the *wharanui* flax leaves finely split, composed of very small and close meshes, and beaten well, so as to be rough and scabrous from long broken fibres, in order the better to catch and retain the soot (*awe*), which was intended to adhere only to the network: this net was fixed properly and securely over the top opening or chimney of the kiln, and above it were placed thick mats and such like, to prevent the escape of the burning soot and smoke. All being ready, a very calm fine night was chosen for the firing of the kiln—a night in which there should not be the least breath of moving air; and, the kiln being fired, those two men remained all night at their post, attending to their work, carefully feeding the fire. When all the resinous substances were burnt up, and the kiln cold—the calm weather still continuing—the soot was carefully collected and mixed up with the fat of birds, and then given to a Maori dog to eat, which dog had also been early set apart for this work—tied up, made to fast, and kept hungry, that it might perform its part and eat the prepared morsels with avidity. After devouring the mixed food the dog was still kept tied up, and not allowed to eat any other aliment until it had voided the former. When the fæces were evacuated they were carefully gathered, and mixed up and kneaded with bird's oil and a little water, and, when this mixture became dry and hard, it was put up securely into a large shell, or into a hollowed pumice or soft stone, and laid by carefully, buried in the earth, for future use. It is said to have possessed no disagreeable odour when dry (though it had while fresh), and, though long kept, it did not become bad nor spoil through keeping, which, on the contrary, was said to improve it, and it was very much prized.

It was this pigment, so put up and kept, that was the origin of one of their proverbs, "*Puritia to ngarahu kauri*" = Keep to thyself thy kauri-resin-soot pigment. This saying was used when a person was unwilling to give what was asked, the same being some common thing, and not at all needed by the avaricious owner. But there is a double meaning here in this simple sentence (proverb)—namely, "You may never require it, or live to use it." (See Trans. N.Z. Inst., vol. xii., p. 145.)

Of the Manufacture of their Long Spears.—Some of their spears were very long. Of these there were two kinds. One kind was made of hardwood, *rimu* (*Dacrydium cupressinum*). This was used in defending their forts and stockades before the introduction of firearms, being thrust through the palisades at close quarters against the legs and bodies of the invaders. The other kind was much lighter, though longer, being made of the light wood of the *tawa*-tree (*Beilschmiedia tawa*), and used only for the spearing of pigeons when they were sitting on the top of a high tree. This spear was tipped with a flattish serrated bone 3 inches—5 inches long, usually coarsely barbed on one lateral edge, and sharply pointed; the bone being human, and a portion of that of the arm or leg, and, of course, of their deadly enemies. Seeing that these long spears were always made from heartwood of their tallest trees, it was a mystery to me how they managed to manufacture them, the hardwood ones being from 16 feet to 20 feet and the others from 20 feet to 35 feet long; and it was not until my first visit to the Urewera Tribe, at Ruatahuna, in the interior beyond Waikare Moana, in 1841, that I discovered how it was effected. This patient performance has ever seemed to me a notable example of one of their many laborious and persevering works. For it must never be forgotten, in considering their ancient laborious and heavy works, especially in hard substances, as wood, bone, and stone, that they accomplished all without the use or knowledge of iron or any other metal.

First, a straight, tall, and sound *tawa*-tree was selected in the forest. This was felled with their stone axes. Its head and branches having been lopped off, it was dragged out into the open ground, and split down the middle into two halves. If it split easily and straight, then it would probably serve for two spears, if each half turned out well in the working. The next thing was to prepare a long raised bed of hard tramped and beaten clay, 35ft.-40ft. long—longer than the intended spear—the surface to be made quite regular and smooth (like a good asphalte kerb town walk of the present day). On to this clay bed the half of the *tawa*-tree was dragged, and carefully adzed down by degrees, and at various times, to the required size and thickness of the spear. It was not constantly worked, but it was continually being turned and fixed by pegs in the ground, to keep it lest it should warp and so become crooked. It took a considerable time—about two years—to finish a spear. The last operation was that of scraping with a broken shell or fragment of obsidian, and rubbing smooth with pumice-stone. When quite finished and ready for use a suitable tall and straight tree was found in, or on the edge of, the forest; its trunk was trimmed of branchlets, &c.; the long spear was loosely fixed vertically to it, so as to run easily through small round horizontal loops girt to the tree, and placed at some distance from each other; the tip of the spear concealed, yet protruding near the topmost branches of the tree; and, as the pigeon is a very thirsty bird (especially, I should think, after feeding on the large fruits of the *tawa* and of the *miro—Podocarpus ferruginea*—trees, which are hot and piquant), the Maoris made small corrugated vessels of the green bark of the *totara* tree that would hold water, and fixed such on the top of the tree to which the long spear had been lashed, and by-and-by, when the bird was settled above after drinking (for it is a very quiet bird, sitting long after feeding), the spear was gently pulled down by its owner below on the ground, and sent up with a jerk into the body of the pigeon. I have seen the fixed spear thus used in the forests, and have eaten the bird so captured.

I may here mention that I have also seen those totara-bark dishes, with water in them, fixed high up on the big branches of trees in the woods in the Urewera country, having flax nooses so set over the water as to catch and hold fast the pigeon in its drinking. I have seen pigeons so caught, the Maoris climbing the trees naked with the agility of monkeys to secure their prizes.

From the large amount of labour and the time consumed in the making of a long spear, and its great beneficial use when made, arose a good proverb among them relative to industry in tillage, &c., and to being prepared—"*Kahore he taraingu tahere i te ara*" = You cannot hew a bird-spear by the way. Meaning: Without timely preparation you may die from want of food, though the pigeons are plentiful in the forests near you.

Of the Fine Smelling-sense and Taste of the Ancient Maoris for Perfumes.—I have already more than once, and in former papers read here before the Institute, touched on the superior powers of sight of the ancient Maoris;[1] and it has often occurred to my mind that they also possessed a very keenly developed sense of smell, which was largely and quickly shown whenever anything sweetly odoriferous, however fine and subtle, had been used—as eau de Cologne, essence of lavender, &c. Indeed, this sense was the more clearly exhibited in the use of their own native perfumes, all highly odorous and collected with labour. Yet this sensitive organization always appeared to be the more strange when the horribly stinking smells of two of their common articles of food—often, in the olden times, in daily use—are considered: rotten corn (maize, dry and hard, in the cob) long steeped in water to soften it; and dried shark. The former,

[1] Trans. N. Z. Inst. vol. xiv. p. 67, &c.

however, has long been abandoned; yet at one period every village at the North had its steeping-pit.

In a paper I read here at our June meeting I mentioned some of the very small Hepaticæ (*Lophocolea* and *Chiloscyphus* species) as being used for perfume by the Maoris, who called them *piripiri*. Their scent was pleasant, powerful, and lasting. Hooker, in describing those plants, has mentioned it from dried and old specimens. Of one species, *Lophocolea pallida*, he says, "odour sweet;" of another, *L. novæzealandiæ*, "often fragrant;" of another, *L. allodonta*, "odour strong, aromatic;" of another, *Chiloscyphus fissistipus*, "a handsome strongly-scented species:" and he has further preserved it to one of them in its specific name, *C. piperitus*, "odour of black pepper."

There were also two or three ferns—viz., *Hymenophyllum sanguinolentum*, a very strong-smelling species, hence too its specific name; dried specimens not only retain their powerful odour, but impart it to the drying papers: *Polypodium pustulatum*, having an agreeable delicate scent: and *Doodia fragrans*, a neat little species; this last was so far esteemed as sometimes to give name to the locality where it grew, as *Puke mokimoki*,[1] the little isolated hill which once stood where the Recreation-ground now is in Napier; that hill having been levelled to fill in the deep middle swamp in Monroe Street.

One of the *Pittosporum* trees, *tawhiri* (*P. tenuifolium*), also yielded a fragrant gum; but the choicest and the rarest was obtained from the peculiar plant *taramea* (*Aciphylla colensoi*), which inhabits the alpine zone, and which I have only met with near the summits of the Ruahine Mountain-range, where it is very common and very troublesome to the traveller that way. The gum of this plant was only collected through much labour, toil, and difficulty, accompanied, too, with certain ceremonial (*taboo*) observances. An old *tohunga* (skilled man, and priest) once informed me that the *taramea* gum could only be got by very young women—virgins; and by them only after certain prayers, charms, &c., duly said by the *tohunga*.

There is a sweet little nursery song of endearment, expressive of much love, containing the names of all four of their perfumes, which I have not unfrequently heard affectionately and soothingly sung by a Maori mother to her child while nursing and fondling it:—

Taku hei piripiri,
Taku hei mokimoki,
Taku hei tawhiri,
Taku kati-taramea.

My little neck-satchel of sweet-scented moss,
My little neck-satchel of fragrant fern,
My little neck-satchel of odoriferous gum,
My sweet-smelling neck-locket of sharp-pointed *taramea*.[2]

Here I may observe that to the last one of the four the word *kati* is prefixed: this word—meaning, to sting, to bite, to puncture, to wound sharply and painfully—is added to indicate the excessive sharpness of the numerous leaves and leaflets of the *taramea* plant (hence judiciously generically named by its early discoverer, Forster, *Aciphylla* = needle-pointed leaf), and the consequent pains, with loss of blood, attending the collecting of its prized gum, thus enhancing its value.

This natural and agreeable little stanza, one of the olden time, has proved so generally taking to the Maori people that it has passed into a proverbial saying, and is often used, hummed, to express delight and satisfaction—pleasurable feelings. And sometimes, when it has been so quietly and privately sung in a low voice, I have known a whole company of grey-headed Maoris, men and women, to join in the singing: to me, such was always indicative of an affectionate and simple heart. How true it is, "One touch of nature makes the whole world kin"![3]

In the summer season the sleeping-houses of their chiefs were often strewed with the large sweet-scented flowering grass *karetu* (*Hierochloe redolens*). Its odour when fresh, confined in a small house, was always to me too powerful.[4]

[1] Mokimoki Hill, from *mokimoki*, the name of that fern.
[2] See Trans. N.Z. Inst., vol. xii., p. 148.
[3] It is pleasing to notice that the observant artist Parkinson (who was with Sir Joseph Banks as his botanical draughtsman, and Cook on his *first* voyage to New Zealand) makes special mention of those little satchels in his Journal, saying of these Maoris who came off to the ship in their canoes, "The principals among them had their hair tied up on the crown of their heads with some feathers, and a little bundle of perfume hung about their necks" (Journal, p. 93). Captain Cook, also, has similar remarks respecting the young women.
[4] Sir J. D. Hooker thus writes of this fine, sweet-smelling grass in his "Flora Novæ Zelandiæ": "A large and handsome grass, conspicuous for its delicious odour, like that of the common vernal grass (*Anthoxanthum*) of England, that gives the sweet scent to new-made hay" (*l.c.*, vol. ii., p. 300). A closely-allied northern species (*H. borealis*), which was also supposed to

Here, in conclusion, I may briefly mention an instance of their correct discrimination on the contrary side, clearly showing how well and closely the ancient New-Zealander agreed in his opinion of a plant with the highly civilized scientific visitor already named above, the botanist Forster. Forster named the *Coprosma* genus from the fetid odour of the first species he discovered in the South Island, which signification he also continued in its specific name, *C. fœtidissima:* this shrub also bears a similar Maori name, *hupiro*, highly expressive of its very disagreeable smell.

Of their Textile Manufactures.—These were formerly prominent among the great industrial achievements of the Maoris, and always elicited the admiration of their wondering visitors.

I divide them into two great classes—(1) of garments, which were woven; and (2) of threads, cords, lines, and ropes, which were spun.

Nature had given to the Maoris one of her choicest gifts in the well-known flax plant (*Phormium*), of which there are two ascertained and valid species (*P. tenax* and *P. colensoi*), and several varieties. These plants are pretty general throughout New Zealand, and are well known to the Maoris by the common names of *harakeke*, *wharanui*, *wharariki*, and *tihore*—excluding those of the many varieties as known to them.[1] So that what they may have lost on the one hand through not having the valuable wild edible fruits of other South Sea islands (as the cocoanut, bread-fruit, plantain, &c.) they more than merely gained in their flax plant, which is also common, and almost endemic, being only found outside New Zealand in Norfolk Island.

And here I may briefly mention an anecdote of the flax plant. On my arrival in this country the Maoris (who knew nothing, or very little, of any other land) would often inquire after the vegetable productions of England; and nothing astonished them more than to be told there was no *harakeke* growing there. On more than one occasion I have heard chiefs say, "How is it possible to live there without it?" also, "I would not dwell in such a land as that." This serves to show how highly they valued it. Moreover, at first and for many years the principal export from New Zealand prepared by the Maoris was the fibre of this plant—all, too, scraped with a broken shell, leaf by leaf.

1. *Of their Woven Articles* (*or Garments*).—I do not intend to say much of them in this paper. Many of them are well known, and still to be found in use among the Maoris, but their manufacture has for many years sadly deteriorated: indeed, I have not seen a newly-made first-quality clothing-mat for the last twenty to thirty years, and I very much doubt if such can now be made at all. Not that the art of weaving them has been entirely lost, but the requisite taste, skill, and patience in seeking and carefully preparing and using the several parts (including their dyes) are no longer to be found among the Maoris. I sometimes indulge in a contemplating reminiscence—an idea—a pleasing reverie of the long past—of great gatherings of Maoris, tribes and chiefs; and at such times the figures of some head men I have known, clothed in their handsome, clean, and lustrous dress-mats (*kaitaka* and *aronui*), would stand forth in pleasing high relief. The close and regular weaving of such flax dresses, having their silky threads carefully selected as to fineness and uniformity of colour, and their smooth, almost satiny appearance, as if ironed or calendered when worn new, was to me a matter of great satisfaction—a thing to be remembered—"a joy for ever."

Those best dress-mats were always highly prized, both by Maoris and Europeans, and brought a high price. I well recollect a young lady, daughter of very respectable early English settlers in the Bay of Islands, who, when she came across the inner harbour in a boat with her parents to attend the English Church service on Sunday mornings in the Mission chapel at Paihia, often wore one of them folded as a shawl, and to me it seemed a neat and graceful article of dress.

Three things more in connection with these fine mats I will ust relate: one, the cross-threads in weaving were always of a different sort of flax—the weft and the woof of these mats were not both taken from the same kind of flax; the second, that extremely soft lustrous appearance was given to the flax-fibres by repeated tawing done at different times—it was a pretty sight to see the various skeins of flax-fibres in their several stages of preparation neatly hung up in the weaving-shed; the third, that in the weaving of one of these garments, if a thread showed itself of a different shade of colour, that part of the garment was carefully unravelled to take it out, and to substitute another better suited in its stead. It was also from this superior knowledge and close attention to their work that the principal chiefs frequently took women who were clever at making those things to be their wives, in order to secure to themselves their valued manufactures.

They also wove very good and useful floor and bed-mats of unscraped flax-leaves, split into narrow lengths and carefully bleached in the sun—these were very strong and lasting; also baskets and kits of all sizes. Some of them were woven in regular patterns with black (dyed) and uncoloured flax; others were skilfully and pleasingly semi-damasked (if I may so term it) by changing sides to the flax-leaves used to form the pattern, the upper side of the leaf being smooth and shining, the under side not shining and of a glaucous colour. The little kit, or basket, for a first-born child was often a little gem of weaving art, and made by the mother.

Besides the flax plant they had other fibrous plants whose leaves and fibres were also used in making articles of dress: (1) the *toii* (*Cordyline indivisa*), of which they made black everlasting wraps or cloaks. The making of these was confined to the natives of the mountainous interior, where alone those plants grow. (2) The long orange-coloured leaves of the *pingao* (*Desmoschœnus spiralis*), a prostrate spreading sea-side plant, also afforded them good materials for weaving useful folded belts, which were strong and looked and wore well, and were highly valued. (3) The climbing *kiekie* (*Freycinetia banksii*) was also used; likewise the long, slender, and soft leaves of the *kahakaha* (*Astelia banksii*), but not frequently. (4) Of the leaves of the common swamp plant *raupo* = bulrush (*Typha angustifolia*), they formed large sails for their canoes. These leaves the Maoris curiously laced together. (5) I should not omit to mention their flying kites (*pakaukau* and *manuaute*), formerly in great esteem among them, and made of the manufactured bark of the *aute* shrub = paper mulberry (*Broussonetia papyrifera*), which was formerly cultivated by the ancient Maoris for its bark. Inferior ones, however, were made of the prepared leaves of some of the larger sedges. They were prettily made, requiring both time and skill in their construction, and much more resembled a bird flying than our English ones. They always served to remind me of those of the Chinese, as we see them in their own drawings and on their chinaware. The old chiefs would sometimes quietly spend hours amusing themselves in flying them and singing (*sotto voce*) the kite's song, using a very long string.[1] Kites being flown at any village or fort was a sure sign of peace. These, too, gave rise to proverbs, some being quaint and highly expressive. A pleasing one I give as a sample: "*He manuaute e taea te whakahoro*" = A flying kite made of paper-mulberry bark can be made to fly fast (away, by lengthening the cord). Used by a lover, expressive of impatience at not being able to get away to see the beloved one.

2. *Of their Spun Fibrous Articles.*—These were very numerous in kind, size, and quality, according to the particular use for which they were required; and, while the larger number of them were composed of scraped and prepared flax-fibres there were also other fibrous-leaved plants used by the Maoris, particularly the leaves of the erect cabbage-tree = *tii* (*Cordyline australis*) and of the *kiekie*, already mentioned. Here, too, in this department, the different kinds of varieties of the flax would be used for making the different sorts of threads, cords, and ropes, some of the varieties of flax enduring much greater strain when scraped and spun into lines than others; and of such their deep-sea fishing-lines were made. It was ever to me an interesting sight to see an old chief diligently spinning such lines and cords—always done by hand, and on his bare thigh. The dexterity and rapidity with which he produced his long hanks and coils of twine and cord, keeping them regular, too, as to thickness, was truly wonderful. Some of their smallest twisted cords or threads were very fine. Such were used for binding on the barbs to their fishing-hooks, and for binding the long queues of

be found here in New Zealand, is also used on the Continent of Europe for similar purposes. In some parts of Germany it is dedicated to the Virgin Mary (hence, too, its generic name of *Hierochloe* = sacred grass), and is strewed before the doors of the churches on festival days as the *sweet sedge* (*Acorus calamus*) is strewed on the floor of the cathedral at Norwich for the same purpose at such seasons.

[1] Sir James Hector, in his book on the *Phormium* plants, enumerates fifty-five named varieties; but it is doubtful whether more than half of that number are permanent ones.

[1] See an interesting historical tradition respecting such (Trans. N.Z. Inst., vol. xiii., p. 48).

dog's hair to their chiefs' staffs. One of those peculiar cords was a very remarkable one; it was a small cord, bound closely round throughout its whole length with a much smaller one (something like the silver or fourth string of a violin). I never saw this kind but once, and that was at the East Cape, in 1838. A specimen of it I shall now exhibit. This cord was used for a single and particular purpose, attached to the small under-aprons of girls—chiefs' daughters.

Their larger cords and ropes were composed of several strands, well twisted and put together. Besides their round ropes so made, they had also flat ones of various widths, which were plaited or woven, resembling our webs and bands, and much used as shoulder-straps in carrying back-loads; also double-twisted ropes, and three-strand ones; likewise a remarkably strong one that was four-sided. This was made of the unscraped leaves of the cabbage-tree, that had been gathered, and carefully wilted in the shade, and then soaked in water to make them pliant. It was used for their anchors, and other heavy canoe and house requirements. The leaves of the flax would not be suitable for this purpose. I have had all those different kinds of cords and ropes made for me in former years, but I much fear the art of making them is lost.

There were also their nets for catching fish and for other purposes, with their meshes of various dimensions. Their smaller ones (hand-nets) were made of all manner of shapes and sizes. Some of them were dexterously stretched over circular skeleton framework. And their large seine-nets, used for catching mackerel and other summer fish that swam in shoals, were very long and very strong, made of the leaves of flax, split and prepared, but not scraped, and completely fitted up with floats, and sinkers, and ropes, and other needful appurtenances. Cook, who was astonished at their length, has written much in praise of them. I make one striking quotation: "When we showed the natives our seine, which is such as the King's ships are generally furnished with, they laughed at it, and in triumph produced their own, which was indeed of an enormous size, and made of a kind of grass [*Phormium*] which is very strong. It was five fathoms deep, and by the room it took up could not be less than three or four hundred fathoms long."[1] (Voyages, vol. ii., first voyage, pp. 369, 370.)

In residing at Dannevirke, in the Forty-mile Bush district, during several months, I have often noticed the Maoris from neighbouring villages coming to the stores there to purchase tether and other ropes and lines (large and small) for their use with their horses, ploughs, carts, pigs, &c., while on their own lands and close to them the flax plants grew in abundance. These Maoris had very little to occupy their time, and could easily have made common lines and ropes for their own use if they knew how to spin them as their fathers did, and also possessed their forefathers' love of work.

[1] An interesting historical tragic story of the cleverly-planned taking and death of a large number of Maoris in one of these seine-nets, together with the fish (illustrating what Cook has written of their immense size), and of the deadly warfare that followed, is given in the Transactions N.Z. Institute vol. xiii., p. 43.

UGANDA.

AT a special meeting of the Royal Geographical Society on the evening of November 3, Captain F. D. Lugard gave an account of the geographical aspects of his work in Uganda. The hall of the University of London was crowded, and although the issue of extra tickets was suspended, a large number of Fellows and their friends failed to get admittance. An excellent hand-map, by Mr. Ravenstein, enabled the audience to follow Captain Lugard's route. The first part of the paper was concerned with the journey from Mombasa along the Sabakhi river, an unnavigable stream, to Machako, the furthest station of the I. B. E. A. Company at that time, the district passed through being almost uninhabited, and supplies difficult to procure. The greater part of the paper related to Uganda and the other countries surrounding he Victoria Nyanza, where Captain Lugard was in command for two years. On the Kavirondo plateau, east of the lake, there is a promising field for European colonization. The plateau is crossed by the Equator, but at elevations of from 7000 to 8000 feet the climate is cool and exhilarating. It is possible, judging from experience in other places, that highlands close to the Equator are healthier for Europeans than those of similar mean climate lying nearer the tropics. Kavirondo is admirably adapted for grazing, and ranches similar to those of the west of America might be tried. From the pasture lands of this plateau the transition to the rich plantations of bananas and casava of Usoga and Uganda is very marked, and the unclothed natives of Kavirondo give place to the comfortably-dressed Waganda, a warlike people, but skilful in all the arts of peace.

Uganda is a land of low hills and valleys. The hills are of red marl, or marl-gravel, and shale, generally covered with pasture grass of a kind apparently peculiar to these countries. The valleys are generally of rich black soil, and most frequently the lowest part of the dip is a river swamp. The swamp varies from a few score of yards to a mile or more in breadth, usually being from half to three-quarters of a mile. There is a slight trickling current—but very slight; the river is choked with dense papyrus, with an undergrowth of marsh ferns, grass, reeds, &c. The water is usually the colour of coffee, and red with iron rust. Most of these swamps are of treacherous quagmire without bottom; and unless the roots of the papyrus form a sufficient foothold it is necessary to cut down reeds and boughs of trees to effect a crossing. It is a singular characteristic of these countries that, spite of their altitude and hilly character, rushing water is rarely, almost never, to be seen. Thus Uganda has a mean elevation of some 4200 feet, and borders the trough of the Victoria Nyanza at 3700 feet only, and is a country full of hills and valleys. Kitagwenda, at about the same altitude, borders the Albert Edward Lake at 3300 feet. Unyoro, with more lofty hills and peaks of granite, with an altitude gradually increasing in the south, as you near the Albert Lake, to some 5300 feet, similarly borders the trough of the Albert, which has an elevation of only 2000 feet. Yet nowhere are these river swamps more frequent than here in South Unyoro at the highest altitudes. The origin of the water to supply the enormous Lake Victoria is an interesting problem. Throughout the British sphere, on the north and west of the lake, there is no single river, except the Nzoia, which is worthy of the name flowing into the Victoria. The Katonga—marked on the maps as a big river—is merely a broad papyrus swamp. It is by no means so important a drainage as the Marengo; and all the endless river-swamps (including the Marengo) send their sluggish streams northwards to the Kafur and the Somerset Nile. The superficial area of the Victoria being 27,000 square miles, crossed by the Equator, and at an altitude of about 3800 feet, an enormous amount of evaporation must occur, and yet spite of this evaporation, there issues from its north-western corner the magnificent Somerset Nile, a deep, broad, silent river.

The close of the year 1891 and the early part of 1892 were exceptional in the matter of rainfall. Usually in this part of Africa the lesser rains begin early in October and cease in the middle of December. From that time the heat and drought increase, and the grass dries up and is burnt, till in the beginning of March the greater rains set in, and a tropical downpour continues with few breaks till the end of May. Last October and November the lesser rains were unusually heavy, and continued with little intermission till the time of the regular rains in March. There was a little check, and then the rain continued up to the middle of June and later. The result was, that the Lake Victoria was some six feet perhaps above its ordinary level, and may probably rise still higher. Unusual floods occurred in the Nile in Egypt during September, this not being the time at which the usual high Nile due to the Atbara floods occurs.

Uganda is divided into ten provinces, and the ten chiefs who rule these districts entirely drop their personal names, and are called by the traditional title attached to those provinces. Of these the four largest and most important have separate titles. Thus, the chief of Chagwe is the Sekibobo; of Singo, the Mukwenda; of Buddu, the Pokino; and of Bulamwezi, the Kangao. The remaining six are called by the title of their province, viz. Kitunzi, Katambala, Kasuju, Mugema, Kago, and Kaima. Superior in rank to these ten governors of provinces are the Katikiro (the vizier and chief magistrate of Uganda), and the Kimbugwe. These two hold innumerable estates, scattered throughout the country.

In June, 1891, Captain Lugard left Uganda with the object of coming in touch with the Soudanese refugees from the Equatorial Province, who had assembled at Kavalli's, on the south-west shore of the Albert Lake. Marching from near Masaka, the capital of Buddu, he traversed Northern Ankole, a district hitherto unvisited by any European, though Mr. Stanley, in 1876, had travelled parallel to it within the boundaries of Uganda, and reaching the borders of Kitagwenda, proceeded south-west to the narrow channel or river which connects the upper lake of Rusango with the main waters of the Albert Edward Lake. Crossing this narrow channel (at most 500 yards wide) the force camped in the hostile country of the Wasura, a tribe subject to Kabarega of Unyoro, and identified with the Wanyora. Here they crossed Mr. Stanley's route at the Salt Lake; but since his book nor maps had not then reached Central Africa the journey was in the nature of entirely new exploration, though of course the discovery of the Albert Edward Lake and of Ruwenzori had been anticipated. The natives, too, being hostile, no one was met with who had seen Mr. Stanley, or could give information of his route, or tell of his exploits. On the route to the Albert Lake many deep and almost symmetrically circular depressions like the crater of a volcano, or a dried-up pond, were passed. A few of these, as shown on the map, were tiny lakes no bigger than a mill-pond, but apparently of great depth, with clear blue water, and all the characteristics of a lake. The alligator and great fish eagle haunted their waters. Others, again, were dry, the bottoms being perhaps 100 feet or more below the level of the surrounding country, which is about 4200 feet above the sea.

The Lake Albert Edward consists of two portions, the Mwutan-zigé (Barrier to Locusts), or the Great Lake and the Rusango on the north-east. This latter is in reality a separate lake, connected with Mwutan-zigé by a river. Its general direction is north-west and south-east. There is no swamp around it except at the north-west end, where dense jungle and impenetrable marsh afford a home for great herds of elephant. It is at this point that the rivers Wami and Mpanga, into which the countless streams from Ruwenzori flow, bring their waters to the lake. The gorge through which the latter flows is picturesque in the extreme, especially in the rains. The great body of water confined between its rocky walls boils and eddies over the sunken rocks below. The gorge is some 700 feet deep, and is full of tropical forest. The orchids, ferns, and mosses which are found in such a natural forcing-house, where the damp vapours hang, are extremely luxuriant.

Captain Lugard followed the eastern base of the Ruwenzori Mountain, crossing the endless streams which descend from its perpetual snows, and bear their clear, sparkling, icy-cold water to the Wami and Mpanga, and so to the Albert Edward. The drainage of the eastern Ruwenzori is not towards the Albert and so to the Nile, but to the southern lake, from which the only overflow is the Semliki, a river which at its exit probably conveys a lesser volume of water from the Lake than is contributed to it by the Mpanga alone. The ground rises gradually from the level of the Albert Edward 3300 feet to some 5300 feet at Kiaya. Here the route descends into the head of a narrow valley, while the plateau trends away to the right, and forms the uplands of Unyoro, its bold outline appearing from the Semliki Valley and the Albert Lake like a lofty range of hills. The valley of Kiaya is extremely fertile, intersected with streams, and studded with banana groves and cultivated land. Between the edge of the plateau on the east and the base of Ruwenzori there is a deep trough, or gorge, the hills rising steep as it were from their own foundations without connection with the plateau, which reaches to their very feet. Leaving Kiaya, they passed through a wild country of quartz and scrub jungle, cut at right-angles by gigantic ravines of rich soil, in which are villages, forest, and cultivation. This led to the edge of a lower plateau, overlooking the Semliki valley. Simultaneously the massive peaks of Ruwenzori sloped down to lesser hills, and mingled with the plain, and a new range of mountains, increasing in height from south to north, appeared opposite. Mountains they appear, but, like those left behind, they are really the escarpment of the plateaus on which the sources of the Ituri, and the other great affluents of the Congo, take their rise; which, for convenience, may be called the Kavalli plateau. From Kavalli's Captain Lugard escorted 8000 Soudanese troops, who had by their vacillation retarded the departure of Stanley with Emin for the coast. Some of these he settled in forts to protect Uganda from Kabrega's raiders, while others were sent back to Egypt by Mombasa.

SCIENTIFIC SERIALS.

American Meteorological Journal, October.—A meteorological balloon ascent at Berlin by A. L. Rotch. The ascent was made on the morning of October 24, 1891, and at the same time a captive balloon was sent up to 600 metres. The weather was hazy up to about 1000 feet, but above that the sky was nearly clear. The mean decrease of temperature between the ground and the captive balloon was 0°.6 C. per 100 metres. In the stratum of air between the captive and free balloon (700 to 1000 metres) the decrease was much slower during the morning, there being at first an increase, the temperature at 693 metres was 10° C., and at 858 metres 10°.4. In the afternoon the rate of decrease in the upper stratum became nearly the same as that which prevailed in the lower stratum during the morning.—Improvement of weather forecasts, by Prof. H. A. Hazen. The author recommends the study of moisture conditions at various heights in the atmosphere, and considers that the greatest hope of improvement is in the observation of atmospheric electricity.—The storms of India, by S. M. Ballou. The storms are divided into three classes: (1) the cyclones that occur at the changes of the monsoons; (2) the storms of the summer rains; (3) the winter rains of the northern provinces; he discusses the causes of their formation, and gives a brief description of each of these classes.—The ether and its relation to the aurora, by E. A. Beals. The author gives a brief summary of some of the facts respecting our knowledge of auroras, in view of their probable maximum during the coming year in connection with their correlation with frequency of sunspots.—There are also short articles on warm and cold seasons, by H. Gawthrop; facts about rain-making, by G. E. Curtis; and convectional whirls, by Prof. H. A. Hazen.

SOCIETIES AND ACADEMIES.

LONDON.

Anthropological Institute, October 18.—A special meeting was held, the president, Edward B. Tylor, D.C.L., F.R.S., in the chair, to receive a communication from Major R. C. Temple, I.S.C., on "Developments in Buddhist Architecture and Symbolism as illustrated by the Author's Recent Exploration of Caves in Burma." Major Temple commenced by saying that the object of the paper was chiefly to draw attention to the extraordinarily rich and for the present practically untouched field for the ethnographist and antiquary existing in Burma. He exhibited some photographs of life-size figures in wood, carved by a well-known artist of Maulmain, of the "four sights" shown to Buddha as Prince Siddhartha on his first visits to the outer world, viz., the old man, the sick man, the dead man, and the priest; and also some admirable gilt wooden representations from Rangoon of Buddha in his standing and recumbent postures, with his begging bowl, and seated as King Jambupati, surrounded by priests and other worshippers. He next showed a remarkable set of gilt wooden images from the platform of the great Shwedagon pagoda at Rangoon, of *nats*, *belus*, *hanuman myauks*, and other spirits believed in by the Burmese, seated on the steps of a lofty *tagon-dain*, or post, on the top of which is always perched the figure of the hentha (hansu), or sacred goose, which apparently protects pagodas in some way. From these he passed on to four representations of large glazed bricks or tiles from Pegu. These curious, and (so far as English museums are concerned) probably unique antiquities may be presumed to be at least 400 years old, and formed at one time the ornamentation of the three procession paths round a now completely ruined pagoda. They represent the march, battle, and flight of some foreign army, represented in true Indian fashion with elephant, monkey, and other animal faces. Some of the figures are clad in Siamese and Cambodian fashion. The glazing is remarkably good, and Indian influence is clear in their construction. They may probably represent a scene from the *Ramayana*, which in a mutilated form is well known to Burmese mythology. These were followed by a huge figure of Buddha from Pegu, in his recumbent attitude, which may be referred to King Dhammacheti, who flourished in the fifteenth century. This image is 181 feet long and 46 feet high at the shoulder. It is built of brick, and is well proportioned throughout. Its history is lost, and so was the image itself until 1881. Pegu was utterly destroyed about 1760 by the Burmese, and the interest in its holy places lost for more than a generation. This image became jungle-grown and hidden from view, and was accidentally discovered by a railway contractor searching for ballast for the line in the neighbourhood. General and detailed views of the Kawgun Cave were shown, exhibiting the wonderful extent of its decoration by a vast number of terra-cotta tablets and images in wood, marble, alabaster, and other materials, and the extraordinary variety and multitude of the objects connected with Buddhistic worship, both ancient and modern, to be found in it. The Kawgun Cave is the richest of those visited by Major Temple, but he explained that he had examined about half a dozen others in the district, and had since gathered positive information from local native sources of the existence of about forty altogether. Many of these are hardly inferior to Kawgun in richness of Buddhistic remains, and several are said to contain in addition ancient MSS., which must now be of inestimable value. A few such MSS. have actually been found. It will thus be seen how great and valuable is the field, and how well worth systematic study by competent students.

Royal Microscopical Society, October 19.—Mr. G. C. Karop, Vice-president, in the chair.—The chairman exhibited and described Messrs. Swift's aluminium microscope, which he believed to be the first microscope made of that metal. The chief point in the instrument was its extreme lightness, the whole when complete, and including the condenser and eyepiece, weighing only 2lb. 10½oz. as against the weight 7lb. 13oz. of a precisely similar stand made in the usual way of brass. It was perhaps not entirely correct to say that every portion was of aluminium, because there were certain mechanical difficulties met with which prevented some portions from being made of that metal; for instance, he believed it was almost impossible to cut a fine screw upon it without the thread "stripping," and it was also found extremely difficult to solder, so that the necessary screws in the instrument were made of brass, the Campbell fine adjustment of steel; the rack and pinion coarse adjustment was also not made of aluminium, and the nose-piece was of German silver.—Prof. F. Jeffrey Bell read a letter received from Mr. H. G. A. Wright, of Sydney, stating that a scale of Podura in his possession was deeply notched, and that an exclamation mark had become detached and projected from the edge. Mr. Wright also sent photomicrographs to support his statement. The chairman said he could not be sure, from the cursory examination he had been able to make, that the exclamation mark referred to was to be seen.—Dr. C. E. Beevor read a paper on methods of staining medullated nerve-fibres, illustrating the subject by photomicrographs, and by a number of preparations under microscopes. The chairman said they were very much indebted to Dr. Beevor for his interesting paper. It was a good thing to be able to differentiate nerve fibres in the ways described, but it was a pity that they could not also so differentiate them as to show from which part of the nervous system they came. If this could be done he need hardly say it would be of great value.—Prof. Bell read a paper by Dr. H. G. Piffard on the use of monochromatic yellow light in photomicrography. Mr. T. Charters White said that he had himself tried a similar process with monochromatic light obtained by using screens and solutions, but the chief difference he found was that it very much prolonged the time necessary for exposure. Mr. T. Haughton Gill said that he had used the copper light filter for the same purpose, and had found that by its aid any good ordinary lens would give as good results as were otherwise obtained by using an expensive apochromatic, because it filtered off all the rays except those which were visually strong. He had not found, in the course of his work, that the use of this light prolonged the exposure, that was to say, that with a magnifying power of ×300 and an exposure of ten minutes, he could get a good strong printing image with the isochromatic plates.—Mr. G. Massee's paper on *Heterosporium asperatum*, a parasitic fungus, was, in the absence of the author, taken as read.

Entomological Society, November 2, Frederick DuCane-Godman, F.R.S., president, in the chair.—Mr. S. Stevens exhibited, for Mr. J. Harrison, a beautiful series of *Arctia lubricipeda* var. *radiata*, which had been bred by Mr. Harrison this year.—Mr. G. T. Bethune-Baker exhibited specimens of *Polyommatus dispar* var. *rutilus*, taken in England by his father about sixty years ago. He stated that it was generally believed that this form of the species was confined to the Continent, but his specimens proved that it formerly occurred in England.—Mr. C. G. Barrett exhibited dark varieties of *Acronycta leporina*, bred by Mr. J. Collins: also a white variety of *Triphæna pronuba*, taken at Swansea.—Mr. M. Jacoby exhibited a specimen of *Sagra femorata*, from India, with differently sculptured elytra, one being rough and the other smooth.—Mr. J. A. Clark exhibited a long series of remarkable varieties of *Liparis monacha*, bred from two specimens taken at Scarborough. Several of the specimens were as light in colour as the typical form of the species; others were quite black; and others intermediate between these two extremes.—The Rev. Seymour St. John exhibited a monstrosity of *Abraxas grossulariata*, and a specimen of *Tæniocampa stabilis*, with a distinct light band bordering the hind margin of the upper wings.—Mr. E. B. Poulton, F.R.S., exhibited two series of imagos of *Gnophos obscurata*, which had been subjected to dark and light surroundings respectively. The results were seen to be completely negative, the two series being equally light.—Mr. F. Merrifield showed a number of pupæ of *Pieris napi*. About eight of them, which had attached themselves to the leaves of the cabbage plant on which they were fed, were of a uniform bright green colour, with light yellowish edgings; of the others, those which had attached themselves to the black net covering the pot, or the brownish twigs which supported it, were dark coloured, with dark spots and lines. Mr. R. Adkin exhibited three bred female specimens of *Vanessa c-album*, two of which belonged to the first brood, and the third to the second brood. One of the specimens of the first brood was remarkable in having the under side of a very dark colour, identical with typical specimens of the second brood. He thought the peculiarity of colouring had been caused by a retarded emergence, due to low temperature and absence of sunshine.—Mr. F. W. Frohawk exhibited varieties of *Satyrus hyperanthus*, bred from ova laid by a female taken in the New Forest in July last.—Mr. F. D. Godman, F.R.S., exhibited a specimen of *Amphonyx medon*, Cr., received from Jalapa, Mexico, having a pouch-like excrescence at the apex of its body.—Mr. C. J. Gahan communicated a paper entitled "Additions to the Longicornia of Mexico and Central America, with notes on some previously recorded species."—Mr. W. L. Distant communicated a paper entitled "Contributions to a knowledge of the Homopterous family Fulgoridæ."—Mr. Oswald Latter read a paper (which was illustrated by the Society's new oxy-hydrogen lantern) entitled "The Secretion of Potassium-hydroxide by *Dicranura vinula*, and the emergence of the imago from the cocoon." The author stated that the imago produced, probably from the mouth, a solution of caustic potash for the purpose of softening the cocoon. The solution was obtained for analysis by causing the moths to perforate artificial cocoons made of filter-paper. Prof. Meldola, F.R.S., said that the larva of *D. vinula* secretes formic acid, and Mr. Latter had now shown that the imago secretes potassium-hydroxide, a strong alkali. He stated that the fact that any animal secreted a strong caustic alkali was a new one. Mr. Merrifield, Mr. Hanbury, Mr. Gahan, Mr. Poulton, and Prof. Meldola continued the discussion.—Mr. H. J. Elwes and Mr. J. Edwards read a paper (also illustrated by the oxy-hydrogen lantern) entitled "A revision of the genus *Ypthima*, principally founded on the form of the genitalia in the male sex." Mr. McLachlan, F.R.S., said he attached great importance to the genitalia as structural characters in determining species, and he believed that he could name almost any species of European Trichoptera simply from an examination of the detached abdomens of the males. Mr. O. Salvin, F.R.S., said he had examined the genitalia of a large number of Hesperidæ, with the view of considering their value in distinguishing species. Mr. Bethune-Baker, Colonel Swinhoe, Mr. Lewis, Dr. Sharp, F.R.S., Mr. Hampson, and Mr. Champion continued the discussion.—Mr. S. H. Scudder communicated a paper entitled "New light on the formation of the abdominal pouch in *Parnassius*." Mr. Elwes said he had based his classification of the species of this genus largely on the structure of this abdominal pouch in the female. Mr. Jenner-Weir remarked that a similar abdominal pouch was to be found in the genus *Acræa*, and Mr. Hampson referred to a male and female of *Parnassius* in Mr. Leech's collection, in which the pouch had come away from the female and was adhering to the male organs.

PARIS.

Academy of Sciences, October 31.—On the geometry of position, by M. H. Poincaré.—Observations on M. Berthelot's ommunication regarding the fixation of nitrogen, by M. Th.

Schlœsing. Reply, by M. Berthelot.—On the laws of compressibility of liquids, by M. E. H. Amagat. Deformations of the piezometers were investigated and allowed for in these experiments, and the pressures carried as far as 3000 atmospheres. The liquids operated upon were ether, alcohol, carbon bisulphide, acetone, the ethyl halides, and chloride of phosphorus. In every case the coefficient of compressibility was found to decrease regularly as the pressure increased. At 3000 atmospheres that of water was reduced by nearly one-half its ordinary value, that of ether by two-thirds. This diminution again is greater the higher the temperature. The ratio of the difference of the coefficient to the corresponding difference of temperature, $\frac{\Delta\mu}{\Delta t}$, increases rapidly with the temperature, and decreases rapidly as the pressure increases. The value of $\frac{1}{\mu}\frac{\Delta\mu}{\Delta t}$ also diminishes rapidly as the pressure increases; but whilst for alcohol it grows decidedly with the temperature, for ether it seems sensibly independent of it. It is probable that the ratio passes through a maximum at a certain temperature.—Observation of the comet Barnard (October 12), made at the Algiers observatory with the *equatorial coudé*, by M. F. Sy.—Elliptic elements of the comet Barnard, by M. Schulhof. Discussing the probabilities of the new comet being identical with, or a part of, the comet Wolf, which was subjected to considerable perturbations by Jupiter in 1875.—On the equations of dynamics, by M. R. Liouville.—On the solution of the ballistic problem, by M. E. Vallier.—Displacements of a magnet on mercury under the action of an electric current, by M. C. Decharme. If a light magnetic needle be floated on a bath of perfectly pure mercury, and conductors carrying a current be dipped into the mercury at different places, the needle will, before assuming the position of equilibrium according to Ampère's law, go through a series of excursions, rendered necessary by the difficulty of its motion, perpendicular to its length. If the current crosses the mercury in a direction perpendicular to the length of the needle for instance, with the negative pole of the current on the left of the south-seeking pole, the needle will move away parallel to itself, will turn round, and return to take up the normal position.—On the temperature of maximum density of mixtures of alcohol and water, by M. L. de Coppet. The lowering of the freezing-point in solutions of alcohol is sensibly proportional to the quantity of alcohol, in confirmation of Blagden's law. But the lowering of the temperature of maximum density is not proportional to the percentage of alcohol. For weak solutions there is no lowering, but rather an elevation of the temperature of the maximum.—On the dissociation of barium dioxide, by M. H. Le Chatelier.—On a limited reaction, by M. Albert Colson.—On the fixation of free nitrogen by plants, by MM. Th. Schlœsing, jun., and Em. Laurent.—Purification of drain waters by ferric sulphate, by MM. A. and P. Buisine.—Experiments on bread and biscuit, by M. Balland.—Ptomaïnes extracted from urines in erysipelas and puerperal fever, by M. A. B. Griffiths.—Hermerythrine, a respiratory pigment contained in the blood of certain worms, by M. A.-B. Griffiths.—Morphology of the skeleton of the star fish, by M. Edm. Perrier.—The secreting apparatus of the *Copaifera*, by M. Léon Guignard.—New observations on sexuality and parasitic castration, by M. Ant. Magnin.—A possible cause of the doubling of the canals of Mars; experimental imitation of the phenomenon, by M. Stanislas Meunier.—Devonian and permio-carboniferous of the Aspe valley, by M. J. Seunes.—A short account of the voyage of the *La Manche* to Iceland, Jan Mayen, and Spitzbergen during the summer of 1892, by M. Bienaimé. The maps of Jan Mayen were found to be very accurate, those of Spitzbergen much less so. The barometric changes in Iceland, Jan Mayen, and the Faroes agreed strikingly with those of Great Britain and Scandinavia, while those of Spitzbergen were of a particular order. Pendulum observations gave $g = 9{\cdot}82345$ for Jan Mayen, and 9·82866 for Spitzbergen.—Eruption of Etna of 1892, by M. A. Ricco.—The analysis of complex odours, by M. Jacques Passy. Proceeding from very small doses, say of amyl alcohol, two different perfumes will be perceived to increase and then diminish in succession, finally giving way to an odour which soon becomes disagreeable as it increases in strength. The transition from perfume to unpleasant odour is very general in volatile substances.—Immunity against cholera conferred by milk, by M. N. Ketscher.—A new apparatus for hypodermic injections, by M. G. Baÿ.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

BOOKS.—A Text-book of Magnetism and Electricity: R. W. Stewart (Clive).—Public Health Problems: J. F. J. Sykes (Scott).—An Elementary Manual on Applied Mechanics: Prof. A. Jamieson (Griffin).—Mind in Matter, 3rd edition: Rev. J. Tait (Griffin).—Arthur Young's Tour in Ireland, 2 vols.: edited by A. W. Hutton (Bell).—Text-book of Elementary Biology: Dr. H. J. Campbell (Sonnenschein).—The Volcanoes of Japan, Part 1, Fujisan: J. Milne and W. K. Burton (Low).—Strange Survivals: S. Baring-Gould (Methuen).—Finger Prints: F. Galton (Macmillan).—Modern Mechanism: edited by P. Benjamin (Macmillan).—Catalogue of Eastern and Australian Lepidoptera Heterocera in the Collection of the Oxford University Museum: Part 1, Sphinges and Bombyces: Col. C. Swinhoe (Oxford, Clarendon Press).—An Introduction to the Study of Botany: A. Dendy and A. H. S. Lucas (Melville).—Hydrostatics and Elementary Hydrokinetics: Prof. G. M. Minchin (Oxford, Clarendon Press).—New Vegetarian Dishes: Mrs. Bowdich (Bell).—British New Guinea: J. P. Thomson (Philip).—Autres Mondes: A Guillemin (Paris, Carré).—Stéréochimie: J. H. Van't-Hoff (Paris, Carré).—Théorie Mathématique de la Lumière, II.: H. Poincaré (Paris, Carré).—Traité de Mécanique: V. Jamet (Paris, Carré).—In Savage Isles and Settled Lands: F. S. Baden-Powell (Bentley).—Stanford's Contoured Map of the County of London (Stanford).—Naked-Eye Botany: F. E. Kitchener (Percival).—Geometrical Drawing: A. J. Pressland (Percival).—Practical Physics, Part 1, Physical Processes and Measurements; the Properties of Matter: Prof. Barrett and W. Brown (Percival).—Beetles, Butterflies, Moths, and other Insects: A. W. Kappel and W. E. Kirby (Cassell).—The Principal Starches used as Food: W. Griffiths (Cirencester, Baily).—Charles Darwin: F. Darwin (Murray).—University College, Nottingham, Calendar, 1892–93 (Nottingham, Sands).—Proceedings and Transactions of the Royal Society of Canada, 1891 (Montreal, Dawson).

PAMPHLETS.—Report on the Operations of the Department of Land Records and Agriculture, Madras Presidency, 1890-91 (Madras).—Entwurf einer Neuen Integralrechnung: Dr. J. Bergbohm (Leipzig, Teubner).—Leaves from the Book of Nature: L. Piers (Ridgway).—Fossil Mammals of the Wahsatch and Wind River Beds, Collection of 1891: H. F. Osborn and J. L. Wortman.—Present Problems in Evolution and Heredity: H. F. Osborn.—Revision of the Species of Coryphodon: C. Earle.

SERIALS.—Quarterly Journal of the Geological Society, November (Longmans).—Festschrift zur Feier des 150 Jaehrigen Bestehens der Naturforschenden Gesellschaft in Danzig am 2 Jan.' 1893 (Danzig).—Schriften der Naturforschenden Gesellschaft in Danzig, Neue Folge, Achten Bandes, Erstes Heft (Danzig).—Notes from the Leyden Museum, vol. xv. No. 1 (Leyden, Brill).—Journal of the Chemical Society, November (Gurney and Jackson).—Mitteilungen des Vereins für Erdkunde zu Halle a/s 1892 (Halle a/s).—Medical Magazine, November (Southwood).

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