THURSDAY, JULY 6, 1899.

MAMMALIAN DISTRIBUTION.

The Geography of Mammals. By W. L. and P. L. Sclater. Pp. xviii + 335. Illustrated. (London: Kegan Paul, Trench, Trübner, and Co., Ltd., 1899.)

THIS work may be best described as being of an extremely conservative nature; so conservative indeed that the authors seem under the impression that scarcely any improvement or alteration in views advanced many years ago can by any possibility be rendered necessary through the general progress of science and the work achieved by other investigators. It may likewise be described as a unionist production, for, in addition to the names of the two authors which appear on the title-page, we are told in the preface that two other gentlemen have assisted in the compilation of the lists of genera. Unfortunately, although there has doubtless been "a union of hearts," a union of pens is conspicuous by its absence; so that, as will be shown in the course of this notice, there are many glaring incongruities between different portions of the work, while the want of correspondence in the nomenclature employed can scarcely be designated as anything less than appalling.

The work really consists of three distinct sections. First, we have seven chapters by Mr. W. L. Sclater on the terrestrial regions into which the globe may be mapped out from the distribution of its mammals. Secondly, there is a chapter by the senior of the two authors on the marine regions indicated by the distribution of cetaceans and sirenians. And, thirdly, the seven last chapters of the book, by the same hand, treat of the distribution of the various orders of mammals.

As the results of their investigations, both from the strictly geographical and the purely zoological standpoint, the authors are convinced that the regions originally proposed by the senior of the two, chiefly on the evidence of passerine birds, are also, in the main, those best adapted to show the present distribution of mammals. For reasons which will be apparent to many of his readers, the present reviewer has no intention on this occasion of recapitulating the arguments which have been used against some portions of this grouping. It will suffice to say that he does not agree with them; and criticism may well be left to American zoologists, who may be trusted to fight strongly in defence of their own views, which receive, if we may say so, somewhat scant justice at the hands of the Messrs. Sclater. Taking, then, the groupings of the regions as they stand, attention may be concentrated on some of the details of the book before us.

Perhaps the most satisfactory feature of the book is the prominence given to the three primary divisions—Arctogæa, Neogæa, and Notogæa—into which nearly all authorities are agreed that the land surface of the globe should be parcelled out from a distributional point of view. We should, however, have much preferred seeing these great divisions indicated in the general map forming the subject of Plate I.; and the component "regions" into which the first is subdivided marked by colour-shadings. As it is, the essential difference between the single regions respectively constituting the two latter divisions and those included in the first are totally unapparent. One very distinct improvement on all previous works on the subject we are happy to recognise. This is the separation of Celebes from the Australian and its transference to the Oriental region. But we think the authors have scarcely gone far enough, and that Timor and the Moluccas might likewise have shared in the same westerly shift. In any case, it seems scarcely justifiable to retain the term "Wallace's line" solely for the small channel separating Bali from Lombok, seeing that it is generally taken to include the one between Borneo and Celebes.

Admitting that the authors and the present reviewer "agree to differ" in regard to the number of regions, the work would have had a greater value had it been a thoroughly up-to-date and trustworthy *résumé* of what we take leave to call the old-fashioned view. But is this really the case? As is stated in the preface, the seven chapters by the junior author first made their appearance in the *Geographical Journal* between the years 1894 and 1897. They are now reprinted "with some slight alterations." Bearing in mind the rapid movements of science in all its branches, to which allusion is likewise made in the preface, is it, we ask, fair to the author himself and the public at large to make what may have been very good in its way in 1894 do duty in 1899?

To take one instance out of many, we find it stated on pp. 53 and 54 that "there can be *no doubt*[1] that the Galapagos have never, at any period of their history, been joined to the mainland." Now, so far back as 1892 (so that, by the way, the statement might have been included in the original paper) the late Dr. George Baur[2] wrote the following sentence:—"That it has been made probable that the Galapagos are of *continental* origin, I consider one of the most important results of the expedition." And this view Dr. Baur has subsequently endeavoured to develop in not less than five separate communications. Of course the authors have every right to take their own view, but they have no justification either to ignore the existence of an opposite opinion, or for the use of the words "no doubt."

Dogmatism is indeed much too apparent throughout the book. For example, on p. 217 we find the statement (by the senior author) that certain views

"would tend in favour of the now generally accepted doctrine that the principal masses of land and water are not of modern origin, but have existed in *their present shapes throughout all ages*."

In regard to this astounding statement, we may well ask whether the author is acquainted with a work which has attained some celebrity on the continent—to wit, the second edition of Neumayr's "Erdgeschichte." If not, his attention may be directed to the map on p. 203 of the second volume; and if he can say that the continents then retained "their present shapes," he evidently puts a different interpretation on the word shape than the one to which we are accustomed.

But without the aid of foreign works the author may,

[1] The italics in this and other quotations are the reviewer's.
[2] Proc. Amer. Antiquarian Soc. for 1891.

we think, in this connection be "hoisted with his own petard." On turning to pp. 236–7 we find the following statement :—

"This fact would seem to show that the ancient 'Lemuria,' as the hypothetical continent which was originally the home of the Lemurs has been termed, *must* have extended across the Indian Ocean and the Indian Peninsula to the further side of the Bay of Bengal and over the great islands of the Indian Archipelago."

Is this quite a case of the retention of their present shapes by the continents?

But there is more to be said in regard to this paragraph, and especially in respect to the use of the objectionable *must*. Turning back to pp. 149–50, we find the junior author discussing the theories that have been advanced as to a direct communication between Africa and India across the Indian Ocean. As the result of his own criticism we have the following very definite statement :—

"This land connection may be of use in explaining the distribution of some of the lower vertebrates, but is of *no assistance so far as the Mammals are concerned;* because in those early times it is probable that none of the families or even orders of our present Mammals had arisen."

And yet in the passage previously quoted we are calmly told by the senior author that the old home of the Lemurs *must* have extended across the Indian Ocean! Comment is superfluous!

Possibly if this were a single isolated instance it might be passed over as one of those unfortunate slips to which the most careful of us are occasionally liable. But it is by no means so; and, out of several others, we select another instance.

On p. 216 Dr. Sclater, in treating of seals, writes that

"In former ages there must have been some barrier in the Atlantic which did not exist in the Pacific to stop their progress northwards. The only barrier one can imagine that would have effected this must have been a land uniting South America and Africa across which they could not travel."

Apart from the question whether such a barrier accords with the dictum as to the retention of their shape by the continents at all periods of the earth's history, we find Mr. W. Sclater making the following very definite statement on p. 55 :—

"Everything points to the conclusion that during a long geological age, probably *throughout the greater part of the Tertiary period, South America* was entirely *isolated* from the rest of the world."

If, therefore, an Atlantic barrier stopped the northward progress of the seals, it must have existed, at the very latest, in the Lower Eocene period; and at present we are unaware of the existence of seals previous to the Miocene!

The truth is (and there are occasions when plain-speaking is necessary) neither of the authors, nor the two gentlemen who have assisted them, have the slightest practical acquaintance with palæontology, and (to use a word "made in Germany") *erdgeschichte*. And they would have been well advised had they left such subjects severely alone, and made what they could out of the present distribution of animals. That a true geographical scheme of distribution can be made on such knowledge alone we are not prepared to admit; but that is a detail.

As an example of palæontological ignorance, we may refer to the twice-repeated statement (pp. 189 and 195) that fossil camels are unknown in Europe; and yet one from Rumania has been described some time since. Again, on p. 80 we are told that opossums occur in the Santa Cruz beds of Patagonia; and here, as well as on p. 9, they are consequently regarded definitely as members of the endemic South American fauna. And yet on p. 156 it is stated that the Virginian opossum "may be a survivor rather than an intruder in North America." On p. 323 we meet with the statement that whether the same animal is certainly indigenous in North America, "or whether it may not have extended its range northwards from Central America in more recent times, it is hard to say." All this confusion arises from insufficient acquaintance with the facts; what we believe these to be need not be mentioned here.

Allusion has already been made to the want of reference to modern literature in the case of the Galapagos islands, and this is also noticeable in other cases. For instance, what can be thought of the omission of all reference to Dr. Merriam's papers on distribution in the introductory chapter? Here, too, mention should have been made of Mr. Pocock's distribution of Arachnida, seeing that it takes much account of other groups. Mr. Baldwin Spencer's important observations on the origin of Australian Mammals, published in the "Results of the Horn Expedition," are likewise unnoticed; as are those of Dr. Schärff on that of the European fauna. Somewhat curiously, too, a small work published a few years ago on mammalian distribution, which has been deemed worthy of translation into German, likewise receives no recognition.

In addition to all the foregoing (to say nothing of other) inconsistencies and omissions, the present work is, unfortunately, open to very severe criticism on account of carelessness in proof-reading, and the lack of correlating the names used in the later pages with those that precede them. Since the book appears to be written to a certain extent for amateur zoologists, these errors are the more to be deprecated. To quote all that we have detected would be impossible, and a few must accordingly suffice.

To the beginner it will be decidedly puzzling to reconcile the statement on p. 2, that mammals may be divided into eleven orders, with the one on p. 219 that the number of such divisions is fourteen; more especially as the monkeys are classed under the name Primates in the one place, and as Quadrumana in the other. Again, the uninitiated will be somewhat disconcerted to find the dormice figuring as *Myoxidae* on p. 182, and *Gliridae* on p. 276. Neither is it conducive to clearness to find the Picas described as *Lagomys* on p. 166, *Ochotoma* on p. 274, and *Ochotona* on p. 281. Minor discrepancies in the spelling of family and generic names, such as *Phyllostomatidae* on p. 265 against *Phyllostomidae* on p. 269, *Pteropidae* on p. 64 against *Pteropodidae* on p. 161, and *Haplodon* on p. 159 against *Haplodontia* on p. 272, are so numerous that the corre-

spondences are almost in a minority when compared with the discrepancies. More serious is *Hydropotes* on p. 139 against *Hydrelaphus* on p. 296. But the culmination is reached when we find, pp. 115–6, *Otocyon* twice identified with the Cape hunting-dog, and, p. 313, the giant *Armadillo* miscalled the giant *Kangaroo!*

With regard to the authors' view on nomenclature, which we venture to regard, with certain curious exceptions, as somewhat old-fashioned, it is not our intention to offer any general criticism on this occasion. We may, however, point out that in rejecting the earlier *Mazama* in favour of the later *Cariacus* for the name of the American deer, they are led into a difficulty when they come to sub-genera; *Dorcelaphus* (a sub-genus) antedating *Cariacus* (the genus)! Moreover, whereas they term the guemals *Xenelaphus* on p. 297, the same animals are designated *Furcifer* on p. 78.

With the statement that the chapter on marine regions is a new feature in books of this nature, and that those by Dr. Sclater on the distribution of the various mammalian families and genera will be found of the greatest value to students, the latter half of the book must be dismissed without further notice.

A large number of figures, for the most part specially prepared for it, illustrate the volume; and to the excellence of these we are glad to be able to testify. The maps, too, which are numerous, are all that can be desired to illustrate the text. And here it may be mentioned that in the majority of instances the sub-regions are well determined, and their distinctive faunas well described. The portion of the work relating to these must, indeed, claim a high value for students. We cannot, however, but regret that the authors have not seen their way to follow Mr. W. T. Blanford in the recognition of a Tibetan sub-region, the animals of that area being of so remarkably isolated a type.

Throughout the foregoing criticisms it will be noticed that we have studiously avoided bringing forward our own views, and have been content to call attention to the discrepancies and misstatements in those of the authors. Had the authors taken more pains in bringing their subject up to date, and did they possess (if we may say so) the all-round knowledge necessary to the proper fulfilment of their task, the volume, as an expression of what we regard as somewhat old-fashioned views, might have been worthy of higher commendation than we can venture to bestow. R. L.

ANTIQUITIES FROM BENIN.

Antiquities from the City of Benin, &c., in the British Museum. By C. H. Read and O. M. Dalton. Pp. 61 + Plates 32. (London: British Museum, 1899.)

THE real interest in the finding of the Benin bronze castings centres in the fact that a negro people seem at one time to have been able to produce bronze work showing great skill in manufacture, coupled with indications of a considerable amount of knowledge of art. The question how the craft was learned immediately suggests itself. Messrs. Read and Dalton appear (p. 16) to accept the statement of the natives (p. 6) that it was introduced by the Portuguese, but further on (p. 19) they acknowledge that it is "not easy to solve how far Europe is responsible for the art of metal casting in West Africa." From what may be called internal evidence, we may reasonably suppose that some of the best castings date back to the end of the fifteenth or the beginning of the sixteenth century. If the Portuguese introduced the art we should expect that some specimens of Portuguese work of that date, and of equal merit, should be found in our museums. So far no such evidence is forthcoming. There is, however, no reason why the art should not have been in existence before the arrival of the Portuguese amongst the Bini in the same way as the domestic architecture in Benin and the surrounding country is most probably indigenous, or in the same way as the decorative art of the Ashantis is indigenous in so far as our knowledge goes. In all probability, the solution of the question will be found to lie in the fact that the existence of the art antedates the arrival of the Portuguese, who, however, may have given it considerable impetus. Yet it must not be taken for granted that the Portuguese were the only people who influenced the art, for there is plenty of evidence pointing to other influences, and we can rest assured that, amongst a people so fond of trade as the African negroes, trade objects would be numerous, and these would leave their impress behind them. For instance, an almost exact copy of a spiral bracelet from Benin was brought many years ago from Tunis, and is now in the Blackmore Museum, while its prototype is to be found at the present day on the banks of the Upper Congo.

From a time shortly subsequent to the arrival at the British Museum of the large collection of these bronze castings, the authorities prohibited any student from taking notes, on the plea that they intended to publish a work on the collection. The work is now before us. It consists of an historical introduction with a descriptive summary, for purposes of comparison, of the Yoruba gods taken from Burton instead of from Ellis's later and more comprehensive account, a chapter each on the ivory work, the metal work, the early Europeans, and on dress, ornament and weapons, as exemplified by the specimens in the collection. The illustrations are fair, but some—as, for instance, those of the ivory tusks and a king's or chief's helmet—are reproduced on too small a scale to be of much assistance to the student. It is to be regretted that the authors have limited themselves to deal solely with the specimens in the British Museum collection. The museum possesses a unique collection of the bronze castings used as historical or decorative plates on the pillars of the king's compounds, but it possesses very few of the numerous domestic and other utensils, many likewise unique, which have from time to time been on sale in London. In other words, the collection is not a representative one, as is, for instance, that of General Pitt-Rivers at Farnham. The opportunity for a comparative study of the objects *inter se* is impossible, and the student will therefore have to go to other museums to complete his studies. However, even restricted as the work is in its scope, the monograph will always be found useful, and the authors are to be congratulated on a good piece of work. H. LING ROTH.

THE LOST VOLUME OF HUTTON'S THEORY OF THE EARTH.

Theory of the Earth, with Proofs and Illustrations. In four parts. By James Hutton, M.D. and F.R.S.E. Vol. iii. Edited by Sir Archibald Geikie, D.C.L., F.R.S. (Geological Society, Burlington House, 1899.)

AS we learn from Sir Archibald Geikie in his interesting preface, the history of the later portion of James Hutton's great work on the "Theory of the Earth" is a perplexing question. In 1795 the well-known two volumes appeared, containing the first and second parts, but the title-page bears the words "in four parts." Of those two the first is little more than a reprint of the essay on the same subject read to the Royal Society of Edinburgh in 1785. The second part, dealing with the operation of natural causes on the surface of the globe—or dynamical geology, as it is now sometimes called—was new matter. These volumes are without preface or preliminary sketch, so that no clue is given to the plan of the remainder of the work, while the fact that Hutton ends his second volume with an elaborate summary suggests that he contemplated a pause of some duration before issuing the remainder. At his death, in 1797, the third volume, according to Playfair, was practically complete; and we do not know why his friends did not publish it. Perhaps, as Sir A. Geikie suggests, they waited for certain illustrations, which Mr. John Clerk, Hutton's great friend, had promised to furnish. Gaps are left for these in the text; but, at any rate, Playfair and Lord Webb Seymour quote from the manuscript in a paper on Glen Tilt, read to the Royal Society of Edinburgh in 1814. It was then lost sight of—the earlier portion, including three chapters, has vanished; the other was a parting gift from Lord Webb Seymour to Leonard Horner, and was presented by him to the Geological Society of London in 1856. In its charge it has remained, forgotten by most of the Fellows, till Sir Archibald Geikie urged its publication on the Council, promising to take upon himself the laborious task of editing. Needless to say, this has been admirably done. The manuscript is printed as though it had followed on the preceding volumes. A few small lacunæ or matters needing explanation are dealt with in explanatory notes, which are models of terseness and a great help to the reader, who, in addition, has to thank the editor for an index, not only to this volume, but also to the two others.

This fragment of a geological classic is well worth the cost of publication. Three of its six chapters are more or less controversial, and are thus, to some extent, obsolete, though it is always interesting to see how difficult problems were viewed by the greater intellects in the infancy of the science. But the other three chapters, descriptive of geological journeys in the Highlands (including the famous examination of Glen Tilt), in the Southern Uplands, and in the Isle of Arran, retain their vivacity and freshness though a full century has passed since they were penned. They also demonstrate Hutton's power as a field geologist, and thus help to refute the reproach which has sometimes been levelled at him of being a mere speculator. Besides this, they show that he could describe accurately and reason profoundly in the ordinary English tongue; and this is not the least charm in days when geological writing is apt to become a conglomerate of scientific jargon unintelligible to all but specialists. Fragment though it be, this volume has an interest and value all its own, and our best thanks are due to both the learned editor and the Council of the Geological Society, for "The Theory of the Earth" is one of the chief foundation stones of modern geology. We trust that the attention thus drawn to "Volume iii." may bring about the discovery of the manuscript which is still missing.

T. G. BONNEY.

OUR BOOK SHELF.

Animals in Motion. An Electro-photographic Investigation of Consecutive Phases of Progressive Movements. By E. Muybridge. Pp. 264 + 1600 half-tone Pictures. (London: Chapman and Hall, Ltd., 1899.)

MR. MUYBRIDGE'S book, "Animals in Motion," with its numerous illustrations, offers a most interesting study, not only to the physiologist, the man of science, and to lovers of animal nature, but also to the artist and archæologist. Mr. Muybridge's attention was first directed to the movements of animals in the year 1872, while directing photographic surveys of the United States Government on the Pacific coast, by a controversy concerning animal locomotion which was being carried on in San Francisco. Mr. Muybridge tells us that according to Plato the same subject was warmly argued by the ancient Egyptians. (This statement is not verified by a reference, and it is improbable that the point is mentioned by Plato.) Mr. Muybridge determined to settle the question whether, in trotting, the horse ever had the four feet simultaneously off the ground. By an ingenious arrangement of electrically controlled cameras, Mr. Muybridge discovered and definitely proved that the trotting horse, in certain phases of his movements, has all four feet off the ground at the same time.

Mr. Muybridge became so fascinated with the new subject, namely animal locomotion, that he studied and photographed the movements of men, women, children, lions, tigers, and other animals both wild and domestic, and also the flight of birds. His book contains a series of most beautiful and interesting pictures, each illustrating some feature of movement. Of these, probably the most instructive are those of the child crawling (p. 69) and the baboon walking (p. 75). The pictures he obtained show the exact positions of the legs and feet of the animals at certain definite times. The other motions of the horse, namely the amble, the trot, the canter, the gallop, and some more, are carefully analysed by the electro-photographic method. In the fourteen series pictures of the trot, 2 and 19 (p. 107) show the four feet off the ground at the same time; these are the pictures which entirely settled the question which fortunately started Mr. Muybridge on his excellent work; the series was photographed at Palo Alto in 1879. The series on p. 229 of the mule "Ruth," bucking and kicking, show that the animal adds marked rotation of the hind-quarters to movements which, in themselves, must be terrible to the rider. In addition to the electro-photographic analysis of the movement of animals, the author devised an instrument whereby a series of pictures was recombined, and by it a life-like picture of a moving animal was projected on to a screen. The instrument is called the Zoöpraxiscope; it is in a large degree similar to the old Phenakistiscope, made by Dubosq of Paris, by means of which moving pictures were projected on to a screen at the old Polytechnic Institution ("Play-book of Science," by J. H. Pepper, 1864). From beginning to

end Mr. Muybridge's electro-photographic analysis of the movement of animals is excellent, and his results have been reproduced with great clearness of detail.

F. J. J.-S.

Sanatoria for Consumptives in various Parts of the World. By F. Rufenacht Walters, M.D., M.R.C.P With an Introduction by Sir Richard Douglas Powell, Bart. Pp. 374; Illustrations 41. (London: Swan Sonnenschein and Co., Ltd., 1899.)

THIS book represents the result of a most painstaking inquiry on the part of the author into the institutions for the treatment of consumptive patients. The various sanatoria are described with a great amount of detail, more especially with regard to situation, charges, access, &c. The actual information with regard to the details of treatment is, however, scanty. Phthisical patients differ so widely *inter se* that of course anything approaching a sanatorium diary, even had it been given by Dr. Walters, would only have been of general interest. Presumably the book is intended for the professional and lay reader—both these may confidently rely upon getting much information from it with regard to the possible places for treatment; but the practitioner who intends initiating a so-called open-air treatment, of which we have heard so much and seen so little, will find considerable difficulty in getting the practical information he wants from Dr. Walters' book. He will do better to consult the earlier works of Brehmer and Jaruntowsky. Those, however, who want to build a sanatorium will do well to thoroughly master Dr. Walters' book, and especially the plates which he gives of the most known sanatoria abroad.

The book will doubtless be a surprise to many English professional readers, who probably have no idea to what an extent the sanatorium treatment has progressed abroad, and especially in Germany. It will probably also have a very wide sphere of usefulness in showing the physician where he can have his patient treated at most moderate cost in the most enlightened manner. No one can doubt that the best advice which at present could possibly be given to many phthisical patients only scantily endowed with this world's goods would be to go to such a place, for instance, as Görbersdorf, where, for from 2*l.* to 4*l.* per week they can have everything they can possibly want—a skilled and patient doctor, suitable food, climate, and accommodation. By indicating clearly the relative merits of such institutions, Dr. Walters has performed a service for which the medical profession ought to be grateful.

F. W. T.

Measurement and Weighing. By E. Edser, A.R.C.S. Pp. vi + 111. (London: Chapman and Hall, 1899.)

THIS small manual is intended as a guide for teachers engaged in instructing classes of young students in the first principles of practical physics. As the author states in the preface, only a limited field has been chosen for consideration, and this has been intentionally treated with more than the usual amount of detail. This has been done with the object of showing, from more than one point of view, the applications of the various principles involved.

In Chapter i., "Linear and Angular Measurements," the pupil is led from the actual copying of a standard scale to the different uses of it in determining the dimensions of various objects, first approximately, then as accurately as possible. Most of the experiments in this chapter are original and, although simple, are evidently calculated to induce thought in their working out. Chapter ii. deals with "Superficial and Solid Measurements," introducing the usual problems of mensuration in a practical manner.

In Chapter iii., after describing the trigonometrical functions and ratios, the author gives a very ingenious and novel method of graphically determining the logarithms of numbers, by means of which the student can make himself independent of tables.

The concluding chapter consists of a very clear and detailed experimental exposition of the principles relating to "Mass and Density."

The system adopted has been actually followed in class teaching, and will no doubt be helpful to others in the arrangement of their experimental courses.

Die physikalischen Erscheinungen und Kräfte. By Prof. Dr. Leo Grunmach. Pp. viii + 442. (Leipzig: Otto Spamer, 1899.)

IN this volume the author brings before the reader a popular and accurate account of the greater number of physical phenomena and forces which are more or less commonly met with in every-day life. The book is intended for those readers who wish to gain a general insight into common physical matters and phenomena without being troubled with a too detailed account which would necessitate a more minute study.

Commencing with the definitions and means of determining mass and measurements, the author successively deals with the principles involved in and phenomena connected with sound, light, heat, magnetism, electricity, &c., concluding with most of the more recent discoveries, such as Röntgen rays and Marconi's system of telegraphy.

The contents of the book are far too numerous for us to deal with in a few words, so we must be content to point out that the text is profusely illustrated with well-chosen woodcuts, a special feature being a set of portraits of notable scientific men. We may mention here that on p. 143, in the chapter on spectrum analysis, it was intended to give the portrait of Sir Norman Lockyer; but although the illustration is coupled with his name, the portrait is that of Sir William Flower.

Not only should the book be read by those who wish to know something about natural phenomena and forces, but it should be useful to students who desire to make themselves acquainted with the German language.

Practical Plane and Solid Geometry (Test Papers). By George Grace, B.Sc., A.R.C.S. (London: Macmillan and Co., 1899.)

THIS publication consists of a series of twenty-four graduated test papers selected chiefly from the annual examination questions in the elementary stage of geometry of the Science and Art Department. Each exercise contains six problems, and being printed on cartridge paper the solutions may be worked out directly on the sheets under their respective headings. This feature should be specially commendable to teachers of large classes, as the uniformity of the arrangement of the questions and the size of the sheets will be found of considerable help from an examiner's point of view.

Practical Dictionary of Electrical Engineering and Chemistry in German, English and Spanish. By Paul Heyne, assisted by Dr. E. Sanchez-Rosal. Vol. II. English-Spanish-German. Pp. vii + 209. (Dresden: Gerhard Kühtmann. London: H. Grevel and Co., 1899.)

THE difficult task of preparing a technical trilingual dictionary has been accomplished in the present case with commendable accuracy. The Spanish and German equivalents are given of a large number of technical terms used in engineering, modern machine industry, metallurgy, electricity and chemistry, and other applied sciences. To the engineer, the student of physical science, and the commercial man, the dictionary should prove of great service.

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.*]

Magnetic Strain in Bismuth.

YOUR report of the meeting of the Royal Society of Edinburgh, held on May 16 (NATURE, June 22, p. 192), states that Dr. C. G. Knott has obtained a slight indication that there is a change of form in bismuth when strongly magnetised.

In the *Phil. Trans.*, vol. clxxix. (1888) A, p. 216, I described an experiment in which a rod of bismuth was found to exhibit an elongation of about 1·5 ten-millionths of its length in a magnetic field of 840 C.G.S. units. As to the reality of this effect and the fact that it was due solely to magnetism, there was no doubt whatever.

Since the publication of my paper I have repeated the experiment with another sample of bismuth obtained from Messrs. Johnson and Matthey; but though the field was brought up to nearly 1500 units, there was never the smallest indication of any magnetic change of length. An elongation one-tenth as great as that observed in the former case would have been easily perceptible.

After this experience I should hesitate to attach importance to any such observations unless the bismuth employed had been proved by analysis to be free from traces of magnetisable metals.

SHELFORD BIDWELL.

MY experiments were made with a bismuth *tube*, the notion being that, as in like experiments with nickel tubes, any existing strain would be much more easily detected by means of secondary volume changes than by means of the direct elongation measurements which Mr. Bidwell so successfully carried out. Mr. Bidwell's warning as to the necessity of having the material pure is well-timed. So far I have taken no special precautions in this direction; but in the improved form in which I purpose repeating the experiment, and from which I hope to get some really decisive result, this question of freedom from traces of strongly magnetic metals must of course be carefully considered.

C. G. KNOTT.

Gooseberry Saw-fly.

I SHALL be obliged if any reader of NATURE who has happened to pay attention to the gooseberry saw-fly will let me know whether my experience agrees with that of observers in other parts of the country. In Yorkshire the larvæ were so abundant in 1893, 1894 and 1895, that the bushes were in many places stripped of their leaves every summer. In 1896, there was a marked diminution, and many of the larvæ contained ichneumons. In 1897, 1898 and 1899, they have been so scarce that I have had difficulty in getting specimens for anatomical study.

L. C. MIALL.

The Yorkshire College, Leeds, June 29.

School Laboratory Plans.

REFERRING to Mr. Richardson's letter (p. 199), our laboratory, now approaching completion, will afford, as regards chemistry in a room 30 by 26 feet, accommodation for twenty-seven boys, including one 18-foot bench for general purposes, and two draught cupboards. We have one 21-foot wall bench and two 18-foot double central benches in parallel, and one 10-foot wall bench at right angles. I believe a novel feature to be the demonstrator's platform placed on the top of and slung across the central benches, provided with a revolving chair and a table, and approached by steps. The whole sacrifices two working places only. The demonstrator has sixteen boys in front of him, five parallel with him, and six behind him, at a maximum distance of fifteen feet. His commanding position should save considerable time usually spent in running about. A large mirror might further aid matters. The central benches alone have reagent shelves.

A. E. MUNBY.

Felsted School, Essex.

ILLUSTRATIONS OF MIMICRY AND COMMON WARNING COLOURS IN BUTTERFLIES.

AN interesting, though brief, paper entitled "Natural Selection in the Lepidoptera" was read by Mr. Mark L. Sykes before the Manchester Microscopical Society on November 4, 1897, and published in the *Transactions* for the year (p. 54). The chief interest of the paper consists, as the author points out, in the eight excellent plates by which it is accompanied. These plates contain a very large number of figures reproduced by a photo-mechanical process from the insects themselves. The author has evidently had at his disposal a very large and complete collection, and having selected a number of very fine illustrations he thus makes them available for all other naturalists.

At the opening of his paper the writer expresses some doubt as to whether the subject is a suitable one for a Microscopical Society; but on this question there need be no hesitation. The microscope is an instrument of the most varied uses, and is necessary in the investigation of this subject among others, for without its aid we cannot ascertain the depth to which mimetic resemblance penetrates into the structure of organisms. The interpretation of these resemblances as due to natural selection implies that they are confined to visible effects, and therefore the microscope should reveal an underlying difference beneath the superficial similarity. Hence a paper which, by describing this fascinating subject, and abundantly illustrating it, directs attention to a promising field for microscopic inquiry, is in every way suitable for the audience before which it was read, and the Manchester Society is to be congratulated upon the broad view it has taken of its subject and responsibilities. The present writer has already commenced the study of mimetic resemblance from this point of view, and has found that the methods by which the transparency which is necessary for the likeness attained in a group of Lepidoptera from South America differ in the most marked degree, although the superficial resemblance is of a very high order (*Journ. Linn. Soc.*, vol. xxvi., 1898, pp. 596–602; plates 42, 43, 44).

The great interest of Mr. Sykes' paper is the abundant illustration which it provides for the two different classes of resemblance often confused together under the name of "Mimicry." A few words on the history of the recognition and suggested explanation of these two classes may be useful, inasmuch as great confusion still exists upon the subject. The theory of mimicry was first suggested by H. W. Bates in his important paper published in the *Transactions* of the Linnean Society for 1862 (vol. xxiii.). He here suggested the idea of a conspicuous, abundant, and specially defended species, serving as the model towards which other comparatively rare and defenceless species are brought by natural selection. His illustrations were taken from the fauna of tropical America, and the explanation was suggested to him by the study of his collection after his return home from his prolonged visit to the Amazon Valley. The theory is of special interest, as it was probably the first great result of the theory of natural selection after its appearance in the *Journal* of the Linnean Society in 1858, and in the "Origin of Species" in 1859. Bates' generalisation was extended by A. R. Wallace to the tropical East (*Trans. Linn. Soc.*, 1866, vol. xxv.), and by Roland Trimen to Africa (*Trans. Linn. Soc.*, 1870, vol. xxxi.). In the first-named paper Bates expressly pointed out that his explanation did not cover all cases of mimetic resemblance, but that there were a very large number of species abundant in individuals, and presumably specially defended, which nevertheless "mimic" each other. Furthermore, this kind of resemblance is as close and detailed as that which the Batesian theory of mimicry sought to explain. For such

cases Bates could only suggest—and Wallace at first accepted the suggestion—that the likeness was produced by some unknown influence connected with locality. In some mysterious way the species were supposed to be made alike as a direct result of life in a common district. No further advance was made until 1879, when Fritz Müller suggested (*Kosmos*, May 1879, p. 100) that the resemblance between relatively unpalatable forms was advantageous in facilitating the education of their young and inexperienced enemies, thus preserving a large proportion of the individuals which would have been necessarily sacrificed if the "warning" pattern of each species were different from that of every other in the same locality. Prof. Meldola translated this paper (*Proc. Ent. Soc.*, Lond., 1879, p. xx.) and argued in favour of the explanation which Wallace also accepted. The same kind of likeness between specially protected forms was shown to exist in the tropical East by F. Moore (*Proc. Zool. Soc.*, 1883), and in Africa by the present writer (Report Brit. Association, 1897, p. 688).

The hypothesis associated with the name of H. W. Bates was believed by a large number of naturalists from the very first, while that due to Fritz Müller was a long time in making its way. Of recent years, however, it has come to the front, chiefly in consequence of the papers of F. A. Dixey (*Trans. Ent. Soc.*, Lond., 1894, 1896, 1897). In these papers Dixey has shown strong reasons for the belief that many examples formerly explained by the theory of Bates are in reality to be interpreted by that of Fritz Müller. The wonderful tropical American groups of remotely allied species with a common appearance, selected by W. F. H. Blandford, assisted by the late Osbert Salvin, from the great Godman-Salvin collection, and exhibited at the Royal Society (1896) and Entomological Society (1897), also tended to deepen the impression which the Müllerian theory was making. It was clear to every one who examined the various groups (lists of the species exhibited are given in *Proc. Ent. Soc.*, Lond., 1897) that the vast majority of the likenesses were between species which are known to be abundant and believed to be relatively unpalatable.

The great interest and value of Mr. Sykes' paper is given by the eight excellent plates which accompany it, reproducing many examples of Müllerian mimicry, and large numbers which are believed by the author and many others also to be still explicable by the theory of Bates. Their full discussion, as far as the facts at present known will allow, would be of great interest and would, in the opinion of the present writer, lead to the conclusion that a considerable proportion, at least, are more probably to be explained on Müllerian lines. The examples in the first two plates are almost without exception admitted to fall under the Müllerian theory, and they are described as "Mutual Protective Resemblance of Inedible Butterflies." All the examples are selected from tropical America, and supply a permanent record of many of the members of the groups selected by Blandford.

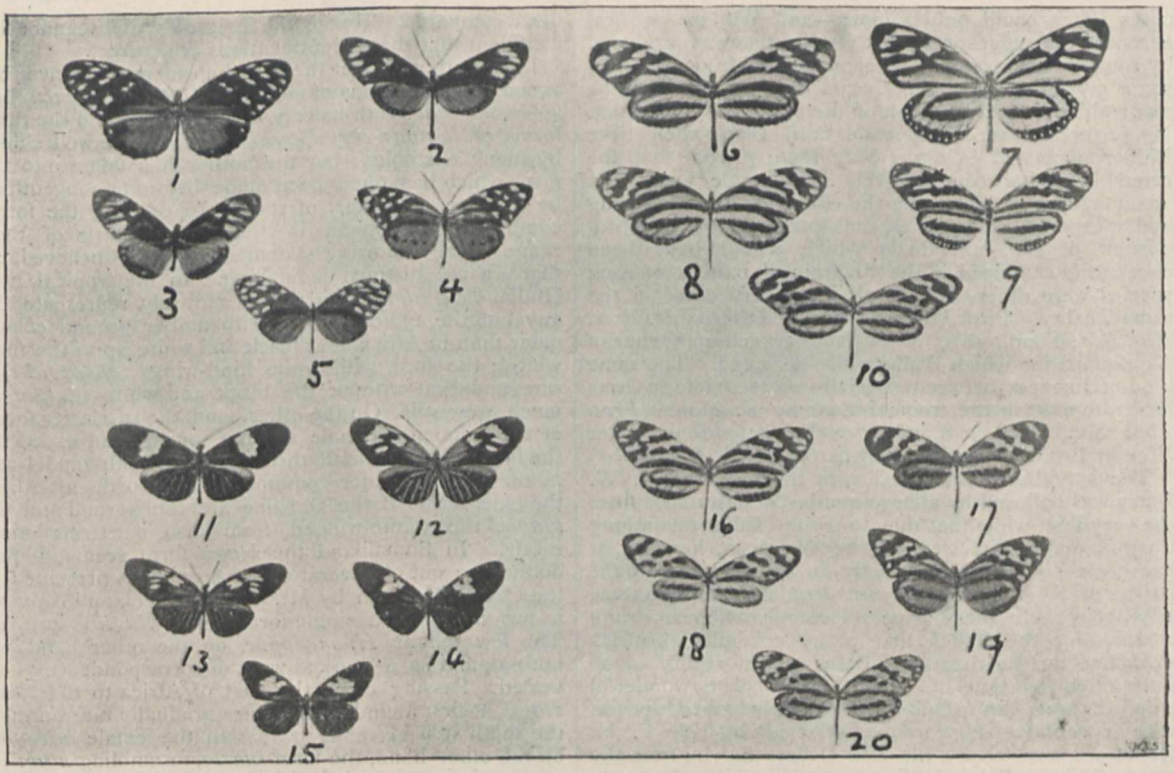
Plate II. is here reproduced, and will serve well to show the closeness of the likeness which is attained, as well as the composite nature of the groups. That containing Figures 6 to 10 is the most interesting in this respect, containing as it does representatives from three distinct subfamilies, all of which are believed to be unpalatable—the *Danainae*, *Ithomiinae* and *Heliconinae*. A few errors which have crept into the description of the figures have been set right in the present reprint. (Fig. 6 is that of *Heliconius telchinia*, not of *Eueides zorcaon*; *Eresia*, Fig. 15, belongs to the *Nymphalinae*, not the *Pierinae*.) The distinction between the *Ithomiinae* and *Danainae* is now generally recognised, and has been introduced. A few of the species, viz. those named in Figs. 3, 4, 11, 14, 15, 19, and 20, are insufficiently represented or altogether absent from the collection with which the plate has been compared. Hence the present writer cannot feel confident that these identifications are correct.

In the third plate the well-known resemblance between the three forms of female of *Hypolimnas misippus* (*Nymphalinae*), with its very different male, and the three forms of *Limnas chrysippus* (*Danainae*) are well shown by many examples; but the author has fallen into the error which has often been made before (among others by the present writer), of stating (p. 61) that the forms completely correspond in the various parts of their range. The following statement is, it is believed, all that we are justified in making. In the tropical East (India, &c.), *Limnas chrysippus* is rarely represented by any but the typical forms, with amber ground colour, paler than in Africa, and black and white tip to the forewings; the form with white hind-wings (*alcippoides*) is rare, and that without the black and white tip (*klugii*) much rarer still. On the other hand, the two latter forms of the mimicing female are not uncommon, especially the latter. At Aden all three forms of both model and mimic occur together commonly. In North-east Africa the chief forms of the Danaine are the normal and the *klugii*, the white-winged form also occurring more rarely. In Somaliland the *klugii* form seems to predominate; out of several dozen specimens presented to the Oxford Museum by Mr. C. V. A. Peel, and captured in two visits, not a single form except *klugii* is present. The few female *H. misippus*, on the other hand, are normal, and so a marked want of correspondence is revealed. Passing down the east of Africa to the south, *klugii*, at first abundant, becomes gradually rarer, until in the south it is extremely rare. In the female *misippus*, on the other hand, the form *inaria*, resembling *klugii*, is commonly intermingled with the typical form right down to the south. The white-hind-winged form of both model and mimic have a more parallel development occurring not uncommonly in both species. In tropical West Africa, on the contrary, the Danaine butterfly is always white-hind-winged, and the size of the white area is large (constituting true *alcippus*), while the very few females of *H. misippus* which I have seen from this part of the world were normal. Much more evidence is required before the relationship can be made out for all parts of the extremely wide range which these two species have in common. I have here set down the conclusions which seem to be warranted by the facts at present known, in the hope that others may be induced to publish, or at least to make their observations known to the present writer.

To summarise the facts set forth above, the varieties of *Limnas chrysippus* are more definitely restricted to certain localities than those of the female *Hypolimnas*, which is in all localities apt to be a more variable insect; furthermore, intermediate forms between the varieties are commoner in the latter than in the former. In the case of those localities where there is a marked restriction of the forms of *chrysippus* (Somaliland and tropical West Africa), there is no evidence of any equal restriction of the varieties of its mimic.

The figure of a white-hind-winged *alcippus*-like female *Hypolimnas* from Sierra Leone (Fig. 8) appears to have been taken from a not very perfect drawing, while all the other figures on all the plates are excellent reproductions from the specimens themselves.

In the brief but useful memoir which accompanies these plates, the principles of mimicry are described, and many of the figured examples alluded to. In describing the distribution of the varieties of *Limnas chrysippus* which has been here summarised, the author states that the uniformly coloured *dorippus* (*klugii*) is supposed to be the ancestral form. The immensely predominant mimicry of the type form by butterflies and moths belonging to all kinds of remotely allied groups, would, however, indicate with tolerable certainty that the type



MUTUAL PROTECTIVE RESEMBLANCE OF INEDIBLE BUTTERFLIES.

FIG.	1	2	6	7
SUB-FAM.	Heliconinæ.	Ithomiinæ.	Heliconinæ.	Danainæ.
GEN.	*Heliconius*	*Thyridia*	*Heliconius*	*Lycorea*
SP.	*zuleika* (Hew.).	*melantho* (Bates).	*telchinia* (Doubleday & Hew.).	*atergatis* (Doubleday & Hew.).
HABITAT	Central America.	S. and Cent. America.	Central America.	S. and Cent. America.
LOCALITY	Honduras.	Honduras.	Honduras.	Bogota.

FIG.	3	4	8	9
SUB-FAM.	Heliconinæ.	Ithomiinæ.	Ithomiinæ.	Heliconinæ.
GEN.	*Eueides*	*Tithorea*	*Melinaea*	*Eueides*
SP.	*thyana* (Feld.)	*irene* (Drury).	*imitata* (Bates).	*dynastes* (Feld.).
HABITAT	Central America.	Central America.	Central America.	Central America.
LOCALITY	Honduras.	Honduras.	Honduras.	Honduras.

FIG.	5	10
SUB-FAM.	Ithomiinæ.	Ithomiinæ.
GEN.	*Callithomia*	*Mechanitis*
SP.	*hezia* (Hew.).	*doryssus* (Bates).
HABITAT	Central America.	Central America.
LOCALITY	Honduras.	Honduras.

FIG.	11	12	16	17
SUB-FAM.	Heliconinæ.	Heliconinæ.	Ithomiinæ.	Ithomiinæ.
GEN.	*Heliconius*	*Heliconius*	*Melinaea*	*Mechanitis*
SP.	*venestus* (Salv.).	*vesta* (Cram.).	*lilis* (Doubleday & Hew.).	*veritabilis* (Butl.) (male).
HABITAT	South America.	South America.	South America.	South America.
LOCALITY	Bolivia.	Amazons.	Venezuela.	Trinidad Island.

FIG.	13	14	18	19
SUB-FAM.	Heliconinæ.	Heliconinæ.	Ithomiinæ.	Ithomiinæ.
GEN.	*Eueides*	*Eueides*	*Mechanitis*	*Tithorea*
SP.	*thales* (Cram.).	*heliconides* (Feld.).	*veritabilis* (Butl.) (female).	*doubledayi*.
HABITAT	South America.	South America.	South America.	South America.
LOCALITY	Amazons.	Bolivia.	Venezuela.	Venezuela.

FIG.	15	20
SUB-FAM.	Nymphalinæ.	Ithomiinæ.
GEN.	*Eresia*	*Ceratinia*
SP.	*cornelia*.	*dionaea* (Hew.).
HABITAT	South America.	South America.
LOCALITY	Bolivia.	Venezuela.

form is the ancestral one, just as the conclusion that Africa is the ancestral home of the species is justified by the predominant amount of mimicry of which *D. chrysippus* has been the attractive centre in this as compared with all other parts of its vast range. The time which would be necessary to bring about so deep an impression on so many diverse members of the surrounding insect fauna, justifies the view that the type form has persisted as it is for a very long period, and that it is an extremely ancient inhabitant of the country in which, far beyond all others, these effects are marked.

The statement on p. 61, that the varieties of the female *Hypolimnas misippus* are nowhere found "where the inedible *chrysippus* and its varieties do not occur," is an error. For many years now—certainly between twenty and thirty—the former species has been established in some of the West Indian islands and certain parts of tropical South America.

There are several errors in the spelling of names of species, and the figures in the plates are often wrongly sexed and sometimes wrongly named in the descriptions.

The doubtful points in the paper have been here discussed at some length, and errors of detail pointed out; but the present writer would wish in conclusion again to emphasise the interest of this short communication, and again to draw attention to the usefulness of the numerous illustrations. E. B. P.

THE UNITED STATES NATIONAL MUSEUM.[1]

THE last report issued by the U.S. National Museum furnishes abundant evidence of the energy with which America is now conducting scientific inquiry, and of the zeal with which she is augmenting the rich and varied collections preserved at Washington. Like most collections of the same character, the National Museum owes its origin to the generosity and enterprise of private individuals; and it was only after some years of precarious existence that it obtained due assistance and recognition from the State. The society organised in 1840, and called the "National Institute," may perhaps be regarded as the parent of the present Museum. Though prosperous during the first few years of its existence, it failed to interest a wide body of the public, and it was reserved for the Smithsonian Institution to obtain official recognition as the only lawful place of deposit for the national scientific collections. In 1846 such recognition was accorded by Act of Congress, and from that year until the present time the work of collecting and exhibiting new material has been carried on without interruption.

One striking characteristic which distinguishes the National Museum from similar institutions in other countries is to be found in the somewhat restricted area to which it has confined its attentions. While the museums of Europe include exhibits from all regions of the globe, the United States collections are, with a few exceptions, exclusively North American. The advantage of so restricting the area of research is obvious, for by this means the Museum has been enabled to attain an unrivalled completeness in the departments of science to which its energies have been devoted. The authorities have also found considerable assistance in the fact that for nearly twenty years they have received all collections of minerals and objects bearing on natural history archæology and ethnology which have been made during the numerous surveys undertaken by the Government of the United States.

The present report occupies over eleven hundred pages, and it would be impossible in a short notice to do more than sketch the general nature of its contents, and to indicate the sections into which it naturally falls. The volume is divided into two unequal parts, of which the first consists of the report of the late Mr. Brown Goode, assistant secretary of the Smithsonian Institution, to which are attached a number of appendices. This report covers the whole ground of the Museum's activities, describing new accessions, the arrangement and labelling of the collections, the work of exploration conducted during the year, the official publications and contributions made to scientific literature, and the work done in connection with visitors and students at the Museum. These general summaries are followed by detailed reports of the work done in the various scientific departments, concluding with the report of the administration department of the Museum. After a perusal of these reports it is evident that, in addition to prosecuting scientific inquiry, the Museum is doing much to render its resources available to the public at large. By its system of exchange and its distribution of duplicate specimens, a large number of local museums in the United States have benefited in the course of the year

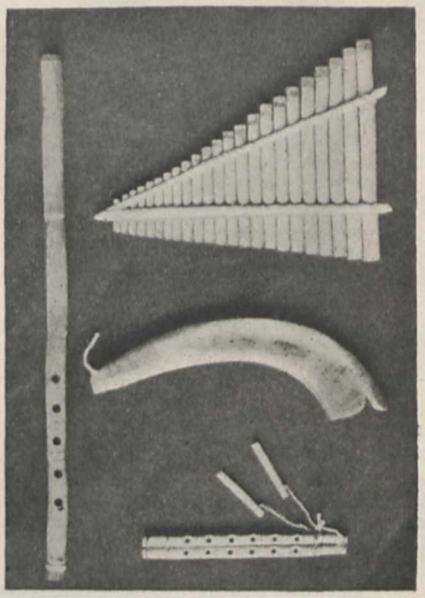


FIG. 1.—Wind Musical Instruments. 1, Reeds or Pan Pipes; 2, Ram's Horn; 3, Double Flute; 4, Flute.

The second and larger portion of the volume is of greater general interest, for it consists of a number of original papers describing and illustrating the collections preserved in the Museum. Of these, perhaps the most important is the paper on "Prehistoric Art" by Mr. Thomas Wilson, the curator of the Division of Prehistoric Archæology. Although in the main describing the specimens under his charge, Mr. Wilson has not confined himself to the art of primitive America, but has given a very exhaustive sketch of the products of early civilisations all over the world, and his essay forms a valuable contribution to the study of prehistoric man. Another interesting paper devoted to a special subject is contributed by Mr. Walter Hough, the assistant curator of the Division of Ethnology, who has written a monograph on "The Lamp of the Eskimo." The Museum possesses a very complete collection of Eskimo lamps, comprising examples used by nearly every tribe from Labrador to the Aleutian Islands. The lamps are

[1] Report of the United States National Museum under the direction of the Smithsonian Institution, for the year ending June 30, 1896. Pp. xxiv + 1107. (Washington: Government Printing Office, 1898.)

classified according to their *provenance*, and full descriptions and illustrations are given of a large number of typical examples.

Two other papers in the volume deserve special mention, as they illustrate another side of the Museum's activities. In addition to their purely scientific work,

FIG. 2.—Colossal Statue of the God Hadad, Gertchin, Northern Syria.

special attention is now being given by its officers to the function of the Museum as an educational institution, and to the popularisation of the collections. At the International Exposition held at Atalanta in 1895, special collections were organised and arranged for the illustration of distinct subjects of study, and the descriptions that were published at the time are here reprinted as a record of the collections that were shown. Of these papers, that on "Biblical Antiquities" is written by Dr. Cyrus Adler and Dr. Cassanowitz, who describe a number of exhibits illustrating the geology, flora and fauna of Palestine, while other exhibits dating from ancient as well as modern times throw valuable light on the text of the Old Testament narratives; one of the plates, for instance, which is here reproduced, is intended to illustrate some of the wind instruments mentioned in the Bible (Fig. 1). Moreover, by means of a fine series of casts, reproduced by photography, the antiquities of Western Asia during the principal periods of Old Testament history are fully represented. Two good specimens of these are here given—a colossal statue of the god Hadad from Northern Syria (Fig. 2), and a bas-relief of a lion chase in the so-called "Hittite" style (Fig. 3), which exhibits many interesting points of resemblance to its Assyrian prototypes. The other paper deals with "Chess and Playing Cards," and consists of a catalogue of games and implements of divination, which were also exhibited at Atalanta. This collection was formed by the Museum in collaboration with the University of Pennsylvania, and it is here described by Mr. Stewart Culin, the director of the Museum of Archæology and Palæontology in that University. We have not done more than indicate the varied nature of the contents of this report, but sufficient has been said to show that the study of science and archæology in the United States is receiving valuable encouragement from the Government, and that the system and methods there adopted compare very favourably with those in many European museums.

AN IMPROVED LIQUID INTERRUPTER FOR INDUCTION COILS.

THE following is a description of an improved form of Wehnelt-Caldwell interrupter for induction coils, devised by the writer in conjunction with Mr. J. C. M. Stanton and Mr. H. Tyson Wolff.

The two electrodes of sheet lead C and D dip into dilute sulphuric acid, contained in the glass vessel A. The electrodes are separated by a hollow glass or porcelain cylinder B, which surrounds the electrode C. This cylinder is closed at the bottom with the exception of a circular aperture E, about three or four millimetres in diameter. Through this aperture projects the small end of the conical glass or porcelain valve F, which by means of the screwed carrier tube H and the milled nut G, can be raised or lowered so as to open or close the aperture to any desired extent. As when the apparatus is at work

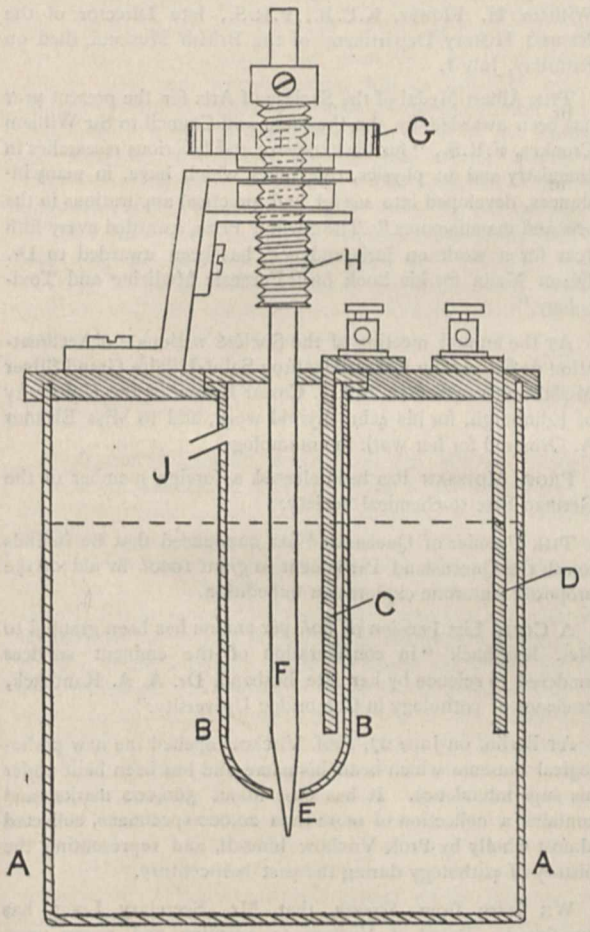
FIG. 3.—Hittite Lion Chase.

the liquid is found to rise in the cylinder B, the latter is provided with an overflow at J.

The interruptions take place in the valve aperture, and appear to be due to the formation of gas or steam therein. The extent to which the valve is open or shut determines the amount of current passed, and the

frequency within wide limits. The wider the valve is open the larger is the current, and the lower is the frequency, and *vice versâ*. With this apparatus in circuit with a 10-inch coil connected direct on to the 100-volt supply mains, it was found that by adjusting the valve the primary current could be altered from 0 to 25 amperes, while the pitch of the sound of the discharge could be changed from a very shrill whistle down to a rattling roar. By introducing additional self-induction into the circuit the frequency can be lowered still further.

The direction of the current through the apparatus does not affect the results, and the arrangement, when suitably adjusted, works well with alternating current, the sparks in each direction being of equal power. The troublesome fatigue phenomena to which the Wehnelt



instrument is liable appear to be absent, while the difficulties as to the fusing of the platinum wire and the cracking of its insulating sheath are also avoided. This improved instrument has in fact all the advantages of that of Caldwell, of which it is a modification, with the further advantage of easy adjustment to suit different voltages, and to give different amounts of power and different frequencies. A. A. CAMPBELL SWINTON.

THE SEVENTH INTERNATIONAL GEOGRAPHICAL CONGRESS.

AT the meeting of the sixth International Geographical Congress in London in 1895, it was decided that the seventh should take place in Berlin in 1899. The Berlin Geographical Society, according to the precedent of previous Congresses, undertook the necessary arrangements, and these have now been perfected. The Congress will differ from that of London by the absence of a geographical exhibition, and by the more thorough organisation of scientific excursions under specialist leaders before and after the meeting.

The proceedings will commence informally by an evening gathering on Wednesday, September 27, when an opportunity will be afforded for conversation amongst the members. Next day the formal opening of the Congress will take place in the splendid new buildings of the Prussian House of Representatives, which has been generously placed at the disposal of the Congress for the whole meeting. As in London, the proceedings of each day will include a forenoon sitting for the discussion of papers of general interest, and several sectional meetings in the afternoon for subjects which appeal to a limited number of specialists.

The Bureau of the Sixth Congress (of which Sir Clements Markham is President and Dr. Scott Keltie and Dr. H. R. Mill Honorary Secretaries) will present a report and resign its functions to that of the new Congress, the President of which is Baron von Richthofen and the Secretary Hauptmann Kollm. The various committees of the seventh Congress, honorary and executive, bear the names of the most distinguished geographers of all countries, and the gathering promises to be a really representative one.

The papers which have been promised are grouped into seven main divisions, viz. mathematical geography, physical geography, biogeography, anthropogeography, exploration, historical geography, and geographical education. The papers will be very numerous, but as a strict time limit of twenty minutes is to be enforced, there will be an opportunity for effective discussion.

Some of the most interesting subjects to be dealt with in the first group are the position of mean sea-level, the present state of research on the tides, and seismology, while in physical geography Prof. W. M. Davis and Prof. de Lapparent will deal with questions of geomorphology, and oceanography will be treated in great detail in conjunction with polar research.

Dr. Nansen, Sir John Murray, the Prince of Monaco, Prof. Chun (of the *Valdivia* expedition), Profs. Pettersson, Thoulet, &c., have all promised to take part. The plans of the German Antarctic expedition will be explained by Dr. von Drygalski, the chosen leader; while Sir Clements Markham and Sir John Murray will give an account of the progress of the arrangements of the British Antarctic expedition. It is hoped that a general scheme may be agreed upon for simultaneous and strictly comparable observations, so that by combined action the two expeditions will secure the maximum result for their labours.

The distribution of plants will be dealt with by Profs. Engler, Drude and others, while numerous papers on other branches of physical geography are promised.

Under the head of "Exploration," the names of several Germans are announced, but no British subjects have come forward to claim international importance for their journeys.

One feature of the Congress which promises a practical outcome is the prominence which is given to questions of nomenclature. Prof. Richter (of Graz) will propose a systematic terminology for use in research on glaciers; and the terminology and nomenclature of the forms of the ocean floor will be discussed by Profs. Wagner, Krümmel, Voiekoff, and Dr. H. R. Mill. Proposals for the uniform use of the metric system and the centigrade temperature scale in all geographical work will also be put forward.

The scientific excursions, which for the most part precede the meeting of the Congress, have been well organised. The programme has just been issued, giving particulars as to route, leaders, terms, &c., and also containing a list of the best maps and guide-books, and a

bibliography of the scientific literature bearing on each excursion. Most of the excursions start late enough to allow members who have been present at the British Association meeting at Dover to attend them, and they all terminate at Berlin in time for the feast of welcome. They are as follows :—

(1) Siebengebirge, Rhine, Eifel, Moselle, from September 19 to 25, under the guidance of Prof. Bonn and Drs. Philippson and Kaiser.

(2) Taunus, Rhine, Nahe, Lahn, from September 21 to 26, conducted by Prof. Sievers, of Giessen.

(3) The Vosges, from September 21 to 25, led by Profs. Gerland and Weigand, starting from Strassburg.

(4) Thuringia, from September 23 to 27, conducted by Profs. Walther and Regel.

(5) The Island of Rügen, from September 22 to 27, starting from Greifswald, led by Profs. Credner, Cohen, and Deecke.

(6) East and West Prussia, starting from Königsberg, and led by Profs. Jentzsch and Conwentz, from September 22 to 27.

(7) Glacial excursions in the North German Plain will be made to Rüdersdorf, near Berlin, on October 1, and from Hamburg along the Baltic shores, from October 7 to 11, under the charge of Prof. Wahnschaffe and Drs. Keilhack and Müller.

All communications as to the Congress or the excursions should be addressed to "The Seventh International Geographical Congress, 90 Zimmerstrasse, Berlin, S.W."

SCIENCE AT THE WOMEN'S INTERNATIONAL CONGRESS.

THE Science Section of the Women's Congress was held at the Small Hall in the Westminster Town Hall on Thursday, June 29, with Mrs. Ayrton in the chair, in the presence of a large and attentive audience. The proceedings were divided into two classes—the work of women in the physical sciences, and the work for women in the biological sciences. Astronomy was represented by Mlle. Klumpke, head of one of the departments at the Paris Observatory; geology by Miss Raisin, of Bedford College; chemistry by Miss Dorothy Marshall, of Girton College; bacteriology by Mrs. Percy Frankland; and botany and zoology by Miss Ethel Sargant. The work already accomplished by women in these various branches of science was dealt with by most of the speakers, as also the openings for women who desire to take up science as a profession. Mrs. Ayrton, in the course of her interesting and able address, pointed out that there was an important outlet for the work of women at the present time in the manufacture of electrical apparatus, the demand for electrical instruments being so great that manufacturers were not able to cope with it, and an opportunity was now offered for women with the necessary education, energy and capital to start a factory for this purpose. The subject of research work was also discussed, and stress was laid upon the fact that, inasmuch as the majority of students who take up science do so either as an avenue to a degree or with the idea of earning a livelihood by teaching later on, their training was as a rule insufficient and quite inadequate to permit them to undertake independent original work; whilst on the other hand the demands upon their time made by teaching was so great as to leave practically no leisure for higher work, even when they were qualified to do it. Until this condition of things is altered, and until more women are attracted towards science for its own sake, and not as a means to an end, the contribution of women in the shape of original work must necessarily be limited. It was highly satisfactory to find that, in the open discussion which followed, an attempt on the part of two speakers to introduce the question of vivisection from the anti-vivisectionist point of view was not tolerated by the audience, these speakers being refused a hearing. It is not too much to say that the papers contributed were worthy both of their subjects and their authors, and that there was a refreshing absence of the hackneyed comparison of the relative position and intellectual powers of men and women, which has been such a favourite theme with so many speakers at this Congress. The next International Congress of Women will be held five years hence in Berlin.

NOTES.

WE notice with much regret the announcement that Sir William H. Flower, K.C.B., F.R.S., late Director of the Natural History Departments of the British Museum, died on Saturday, July 1.

THE Albert Medal of the Society of Arts for the present year has been awarded by the President and Council to Sir William Crookes, F.R.S., "for his extensive and laborious researches in chemistry and in physics, researches which have, in many instances, developed into useful and practical applications in the arts and manufactures." The Swiney Prize, awarded every fifth year for a work on jurisprudence, has been awarded to Dr. Dixon Mann for his book on "Forensic Medicine and Toxicology."

AT the annual meeting of the Société nationale d'Acclimatation de France the Isidore Geoffroy Saint-Hilaire Grand Silver Medal was awarded to Prof. J. Cossar Ewart, of the University of Edinburgh, for his zebra hybrid work, and to Miss Eleanor A. Ormerod for her work in entomology.

PROF. MOISSAN has been elected a foreign member of the German Electro-chemical Society.

THE Premier of Queensland has announced that he intends to ask the Queensland Parliament to grant 1000*l.* in aid of the proposed Antarctic exploration expedition.

A CIVIL List Pension of 60*l.* per annum has been granted to Mrs. Kanthack "in consideration of the eminent services rendered to science by her late husband, Dr. A. A. Kanthack, professor of pathology in Cambridge University."

AT Berlin, on June 27, Prof. Virchow opened the new pathological museum which bears his name and has been built under his superintendence. It has cost about 560,000 marks, and contains a collection of more than 20,000 specimens, collected almost wholly by Prof. Virchow himself, and representing the history of pathology during the past half-century.

WE learn from *Science* that Mr. Secretary Long has appointed a Board of Visitors to examine and report upon the U.S. Naval Observatory, to consist of Mr. Wm. E. Chandler, Mr. Alston G. Dayton, Prof. Geo. C. Comstock, Prof. Geo. E. Hale, and Prof. Edward C. Pickering.

THE prize of 500 guineas, offered by the Sulphate of Ammonia Committee for the best essay on "the utility of sulphate of ammonia in agriculture," has been awarded by the judges—Mr. J. Bowen-Jones, of Shrewsbury, and Dr. J. Augustus Voelcker, of London—to Mr. James Muir, formerly professor at the Royal Agricultural College, Cirencester; subsequently at the Yorkshire College, Leeds; now County Instructor in Agriculture to the Somerset County Council. Seventy-three essays were sent in.

WE learn from the *Lancet* that the Senatus Academicus of the Clark University, Worcester, Massachusetts, which is about to commemorate the anniversary of its foundation, has invited

Prof. Angelo Mosso to deliver a lecture on a subject specially chosen for the occasion, and dealing with a scientific problem of present and universal interest, and Italy, to judge from her leading organs, professional and lay, is deeply sensible of the honour. Prof. Mosso started for the United States on June 20, and has chosen as his theme "I Processi Psichici ed il Movimento" (the Psychic Processes and Movement).

THE death is announced of Mr. Henry Wollaston Blake, F.R.S., at eighty-four years of age. Mr. Blake was an original member of the Institution of Civil Engineers, of the Institution of Mechanical Engineers, and of the British Association. He was elected a Fellow of the Royal Society in 1843.

THE forty-eighth meeting of the American Association for the Advancement of Science will be held at Columbus, Ohio, on August 21-26, under the presidency of Prof. Edward Orton. The first general session will as usual be held on Monday morning, August 21, when the president-elect will be introduced by the retiring president, Prof. F. W. Putnam, and addresses of welcome will be made by the Governor of Ohio and the Mayor of Columbus. The addresses of the vice-presidents will be given on Monday afternoon, and the address of the retiring president in the evening. The several sections will meet as usual during the week, and Saturday will be devoted to an excursion, probably to the mounds at Fort Ancient, the coal mines in Hocking Valley, and the natural-gas fields. Further information may be obtained from the permanent secretary of the Association, Dr. L. O. Howard, Cosmos Club, Washington, D.C., and from the local secretary, Prof. B. F. Thomas, Ohio State University.

THE annual general meeting of the Marine Biological Association was held in the rooms of the Royal Society on June 28. The president, Prof. E. Ray Lankester, F.R.S., occupied the chair. The Council reported that the laboratory at Plymouth continued in a state of efficiency, and was adequately equipped with the most modern requirements for marine biological research. The investigation of the natural history of the mackerel, commenced last year by Mr. Garstang, had been continued, and a report on the variations, races and migrations of this fish had been published. A systematic study of the physical and biological conditions prevailing in the waters at the mouth of the English Channel had also been commenced, which it was hoped would throw light on the causes which determine the movements of migratory fishes. The examination of the fauna and bottom deposits between the Eddystone and Start Point had been concluded by Mr. Allen, the director of the laboratory, and a report on the subject had appeared in the *Journal* of the Association. Seventeen naturalists and eleven students had worked in the laboratory, in addition to the members of the regular staff. The following were elected members of Council for the year:—President, Prof. E. Ray Lankester; hon. treasurer, J. A. Travers; hon. secretary, E. J. Allen; Council, F. E. Beddard, Prof. F. Jeffrey Bell, G. P. Bidder, G. C. Bourne, G. H. Fowler, S. F. Harmer, Prof. W. A. Herdman, Prof. S. J. Hickson, Prof. T. Johnson, J. J. Lister, D. H. Scott, Prof. C. Stewart, Prof. D'Arcy Thompson, Prof. W. F. R. Weldon.

IT is the opinion of many meteorologists that daily telegraphic reports from Iceland would be of inestimable value in weather predictions for Great Britain and northern Europe. The commercial intercourse with Iceland would, however, evidently not pay the interest on the cost of the cable, and it is only quite lately that the Danish meteorologists have received from business men a proposition, already mentioned in these columns, that makes the project seem at all feasible. The proposition is referred to by Prof. Cleveland Abbe in the *Monthly Weather Review*. It is as follows:—The "Grande Compagnie des Télégraphes du Nord," having its centre at Copenhagen, has undertaken to build and to maintain a line from Shetland, touching the Faroe Islands and ending at Iceland, if an annual revenue of 13,500*l*. is guaranteed for the first twenty years only. The Government of Denmark and Iceland will establish and maintain the meteorological stations and the expense of daily telegraphic bulletins, and will perform the hydrographic work necessary in connection with the laying of the cable, and will also guarantee an annual subvention of 5000*l*. for twenty years. Therefore, all that now remains to be done in order to secure telegraphic communication with Iceland for commercial and meteorological purposes is to secure the remaining annual income of 8500*l*. It is hoped that a large portion and perhaps all of this may be secured by national legislation in the States of Europe and America that are interested in this subject.

IT is announced in *Science* that Mr. Charles H. Senff has given 5000 dollars to the zoological department of Columbia University for purposes of exploration and publication. Mr. Harrington and Mr. Sumner expect, with the assistance of this fund, to make a second expedition to the Nile in search of *Polypterus*. The fund will also be used for the publication of a memoir on the anatomy of *Polypterus*, to be undertaken conjointly by Messrs. Dean, Harrington, McGregor, Strong, Herrick and Prof. Wheeler, of the University of Chicago.

THE inaugural lecture on the possibility of extirpating malaria from certain localities by a new method, delivered by Major Ronald Ross at the Liverpool School of Tropical Medicine, is published in the *British Medical Journal*. According to Major Ross's observations in India, human malaria is not conveyed by mosquitos of the genus Culex, but by members of the genus Anopheles. Species of the former genus are generally able to breed in pots and tubs of water, cisterns, wells, and drains—that is, they seem to prefer artificial collections of water of this character to natural collections, such as rainwater, puddles, and ponds. In the case of the other genus, Anopheles, however, the larvæ are scarcely ever to be found in vessels and other artificial collections of water, but only in natural ponds and puddles. But whether the dangerous mosquitos prove to be confined to the genus Anopheles or not, it appears certain that they breed in puddles, and are not of the common domestic kind. The practicability of eradicating malaria in a locality by the extermination of the dangerous mosquitos in it thus depends on a single question—Do these mosquitos breed in spots sufficiently isolated and rare to be dealt with by public measures of repression? It is to obtain information upon this subject that an expedition to the West African coast is being organised. If it can be shown by accurate investigation that all the malaria in a large town arises from a few small puddles which can be obliterated at small expense, the value of the discovery could not easily be over-estimated.

THE *Meteorologische Zeitschrift* for June contains a brief note of the results of some important observations made by Dr. J. Tuma in seven balloon ascents, for the purpose of obtaining measurements of the distribution of atmospheric electricity in clear weather, and of determining whether the balloon itself received electrical charges. The first question is of purely scientific importance, and the second is of practical interest, as lately the burning of some balloons has been attributed to electrical discharges. The observations show that the positive potential decreases with increasing height; the positive charges are, therefore, accumulated in the lower strata of the atmosphere. During the four last ascents, Dr. Tuma was unable to find that

the balloons were electrically charged. The details of the investigation were published in the *Sitzungsberichte* of the Vienna Academy in March last.

So many attempts have been made to produce photographic pictures in natural colours, that a bibliography of recent contributions to the subject is distinctly valuable. Mr. Philip E. B. Jourdain gives such a bibliography in *Photography* of June 22. His paper supplements similar bibliographies prepared by Mr. Bolas, the chief additions being a fuller account of Edmond Becquerel's work, and abstracts of two important papers by Clerk Maxwell and Lord Rayleigh on different branches of the subject. A number of processes, in addition to those known to most men of science, are described. The bibliography carries the subject to the end of 1898, so Mr. R. W. Wood's process (see p. 119) is not included.

THE property that the locus of the poles of an arbitrary plane with respect to the conics of a Steiner's surface is another Steiner's surface has been investigated by Lie, Koenigs, and Brambilla. In a communication to the *Rendiconto* of the Naples Academy (v. 4), Prof. Domenico Montesano has dealt with the following questions connected with this problem:—(1) In what relation of position are the two surfaces? (2) Whether the relation is invertible? (3) What forms are described by the double lines, the triple point, and the double tangent planes of the new Steiner's surface when the arbitrary plane is varied? In order to answer these questions, Prof. Montesano examines the correlative questions for the surface of the third order with four double points, making these depend on other more general questions relating to a surface of the third order without singularities.

IN the *Bulletin international* of the Cracow Academy, M. P. Rudski applies the well-known problem of the elastic sphere under given surface-tractions to calculate the radial displacements of the earth's surface under the weight of ice-caps. There are strong reasons for believing that during the glacial period large areas of land were submerged, which at the present time are at considerable altitudes above the sea-level, and M. Rudski's object is to test whether these displacements of the shore-line can be accounted for by the distortion of the earth due to circumpolar ice, assuming the total quantity of water on the earth's surface to be constant. M. Rudski considers the test case of uniform ice-caps extending down to latitude 60°, and he assumes the rigidity of the earth to be the same as that of steel. The deformations are different according to whether glaciation exists about one or both poles, the depressions at the poles being respectively 347·1 and 497·8 metres for an ice-cap 2000 metres thick. Moreover, with bipolar glaciation the displacement of the shore at the edge of the ice-caps is negative, while with unipolar glaciation it is positive but smaller. In either case, supposing fiords to extend inwards into the ice-caps, the shore-displacements towards the centre of the caps would be positive.

IT is well known that the influence of a magnetic field in general increases the electric resistance of the rarefied gases, except when the lines of electric and magnetic force coincide. Profs. Elster and Geitel, writing in the *Verhandlungen* of the German Physical Society, describe an experiment showing that a magnetic field has a similar effect on the conductivity imparted to air by the influence of Becquerel rays. Experiments have also been made by the same writers, showing that the observed results were not attributable to any deviation produced in the rays by the magnet, but that Becquerel rays, like Röntgen rays, possess the property of not being deflected by magnetic force.

IN the last number of the *Zeitschr. Wiss. Zool.*, Mr. L. Johann notices certain peculiar epidermal structures occurring at the base of the spines of one of the spiny dog-fishes (*Spinax niger*), which he believes to be luminiferous. They take the form of brown or black spots, which are not shining, and are situated on a dark ground. Although distinctly visible to the naked eye, they are seen better through a lens; and, owing to the nature of the skin, are more clearly displayed in the embryo than in the adult. When sectionised and examined microscopically, they are found to contain pigment. A tropical representative of the same family (*Isistius brasiliensis*) is already known to possess luminiferous properties, and the author therefore considers that the spots in the Mediterranean species have the same function. By a fortunate coincidence, as his paper was passing through the press, Mr. Johann received a communication from Dr. Beer, of the Zoological Station at Naples, stating that a specimen of *Spinax niger* had recently been captured and brought to the aquarium there. Although wounded and in a generally feeble condition, it emitted a distinct luminosity, which would doubtless have been stronger had the fish been in robust health. The author's conclusions as to the function of the dermal spots are, therefore, demonstrated by actual experiment to be correct.

STUDENTS of the Batrachians will be much interested to read in the *Proc. U.S. Nat. Mus.* Dr. Stejneger's account of the discovery of a North American representative of the family of disc-tongued frogs (*Discoglossidae*), hitherto supposed to be confined to the northern half of the Old World and New Zealand. The determination rests on a single specimen discovered in the western portion of Washington State, which is considered to belong to a new generic type (*Ascaphus*).

THE July number of the *Century Magazine* contains an exceedingly well-written and well-illustrated article describing a rocky islet in the Gulf of St. Lawrence known as "Bird Rock," and now utilised as a lighthouse station. From the accounts of early visitors to the rock (among whom was Audubon) it appears that the number of sea-birds—such as gannets, guillemots, puffins, razorbills and petrels, with which it was covered—was almost incredible, Dr. Bryant, who paid a visit in 1860, estimating the number of gannets alone at one hundred and fifty thousand. Although, to one who has not read the old accounts, the rock would even at the present day appear a marvellous example of the exuberance of bird-life, it is only too certain that unchecked plunder of the eggs and destruction of the adults are steadily tending towards the extermination of the feathered hosts. By all means, therefore, let the Government concerned forthwith take the simple steps suggested by the author as essential to ward off the occurrence of such a dire calamity.

THE useful series of "Manchester Museum Handbooks" has received an important addition in the form of an "Index to the *Systema Naturae* of Linnæus," by Mr. C. D. Sherborn. Needless to say, this work is executed with the thoroughness and care characterising all the efforts of its author. Whether, however, it will "help in bringing about that uniformity of nomenclature which is the great need of zoological science at the present day," the future alone will show. There may also be two opinions as to whether Linnæus, the founder of our nomenclature, "had no more power to alter a name once founded than has any other person."—The "Guide to the Natural History Collections" in the same series is so well written, and contains such a large amount of information in such a very small compass, that it will prove useful to many besides actual visitors to the museum.

SLOWLY but surely is our information as to the former extension of the range of the Saiga antelope of the Volga steppes tending towards completeness. The latest addition to the remains of this animal is a skull from the superficial deposits of Kulm, recently added to the museum at Dantzic. This specimen, which has been identified by Dr. A. Nehring, is the second hitherto obtained in Germany. As our readers may remember, an imperfect skull was dug up a few years ago near Twickenham.

TO the last number of the *Proceedings* of the Royal Physical Society of Edinburgh Messrs. W. S. Bruce and W. Eagle Clarke communicate a paper on the mammalia and birds of Franz-Josef Land. That such a desolate region would have but few land mammals was only to be expected, and the Polar bear and Arctic fox are the only two actually met with, although there are reports as to the occurrence of a hare, and the reindeer is represented by accumulations of its antlers, which were probably carried to their present position years ago by ice-floes. On the other hand, the birds number at least two-and-twenty species.

MR. F. TURNER reprints, from the *Proceedings* of the Australasian Association for the Advancement of Science, a paper on the supposed poisonous plants of South Australia.

THE most recent numbers received of the *Biologisches Centralblatt* contain a continuation of Dr. Keller's useful epitome of the results of recent researches in vegetable physiology and biology, as well as several original papers in different departments of zoology and botany.

WE learn, from an article in the *Board of Trade Journal* for June, that the source of the india-rubber exported from Peru through Pará has been determined by M. Hubert, a botanist on the scientific staff of the Museum of Pará, to be a species of *Castilloa*, possibly identical with the *Castilloa elastica* of Central America.

THE *Transactions* of the British Mycological Society for 1897–1898 contain several interesting papers on British Mycology, but some of them are (admittedly) reprints, and, with regard to the others, there is no information as to the date or place where they were read, or even any note of the meetings of the Society. No date even is given to the delivery of the "President's Address." The officers of the Society appear to be a President, an "Acting President," and an Honorary Secretary and Treasurer.

WE have received vol. i. No. 3 o. the Communicaciones del Museo Nacional de Buenos Aires. It contains a paper on the Coleoptera of Tierra del Fuego, and some short articles on botany, geology and nomenclature.

AN important paper, by Dr. Philip P. Calvert, on Odonata from Tepic, Mexico, with supplementary notes on those of Baja, California, has appeared in the *Proceedings* of the California Academy of Sciences (third series, Zoology, vol. i. No. 12). Detailed descriptions are given of many of the species.

THE thirteenth volume (new series) of the *Geographical Journal*, containing the six numbers of the *Journal* issued this year, has just been published. The papers printed in the volume; the record of geographical events and investigations; and the monthly bibliography of current geographical literature, make the volume, like previous ones, essential to the library of the student of geography.

THE second part of the first volume of the *Annals* of the South African Museum has reached us. Among the papers included in it are: a descriptive list of the rodents of South Africa, by Mr. W. L. Sclater; a further contribution to the South African Coleopterous fauna, by Mr. L. Péringuey; the South African species of Peripatidæ in the collection of the South African Museum, by Dr. W. F. Purcell; and a description of a new genus of Perciform fishes from the Cape of Good Hope, by Mr. G. A. Boulenger, F.R.S.

A THIRD edition, considerably enlarged, of "Metal-Plate Work," by Mr. C. T. Millis, has been published by Messrs. E. and F. N. Spon, Ltd. The volume shows how nearly all the patterns required by sheet-metal-workers can be set out on general geometrical principles. The book has proved of great value to pattern-makers since it was first published twelve years ago, and as the system of construction set forth in it is now regarded as the best means of making the practical man familiar with the geometrical principles underlying his work, the volume should be even more widely used in the future than it has been in the past.

THE additions to the Zoological Society's Gardens during the past week include a Common Paradoxure (*Paradoxurus niger*) from Java, presented by Mr. J. Osborne; a Barbary Mouse (*Mus barbarus*) from Barbary, presented by Miss Lyell; a Cormorant (*Phalacrocorax carbo*) from Scotland, presented by Mr. Percy Leigh Pemberton; two Carrion Crows (*Corvus corone*) British, presented by Lieut.-Colonel Vilett Rolleston; a Rock Thrush (*Monticola saxatilis*), European, a Yellow Hangnest (*Cassicus persicus*) from South America, presented by Mr. H. J. Fulljames; twelve African Walking Fish (*Periopthalmus koelreuteri*) from West Africa, presented by Dr. H. O. Forbes; a Brown Mouse Lemur (*Chirogaleus milii*), two Elegant Galidias (*Galidia elegans*) from Madagascar, a Red-bellied Tamarin (*Midas labiatus*) from the Upper Amazons, two Mexican Conures (*Conurus holochlorus*) from Mexico, a Tabuan Parrakeet (*Pyrrhulopsis tabuensis*) from the Fiji Islands, deposited; a Wapiti Deer (*Cervus canadensis*, ♂), a Great Eagle Owl (*Bubo maximus*), bred in the Gardens.

OUR ASTRONOMICAL COLUMN.

COMET 1899 *a* (SWIFT).—This comet, after passing perihelion, showed such a definite increase of brightness and other evidence of internal action, that its progress was closely watched at several observatories (*Astronomical Journal*, No. 464, vol. xx. pp. 60-61). Prof. E. E. Barnard, observing it on May 20 and several succeeding occasions, with the 40-inch refractor of the Yerkes Observatory, found the head of the comet to be distinctly *double*, the smaller component being *south preceding* with reference to the main body. From successive measures it was found that the position angle was gradually decreasing, while the distance between the two nuclei was increasing from 28″·84 on the 20th to 38″·16 on the 23rd. Though no tail was visible to the eye, a photograph obtained on May 18 showed a slender tail 6° or 8° long.

Prof. C. D. Perrine also secured several observations with the 36-inch Lick refractor, confirming the duplex character of the head of the comet. The two nuclei were estimated to be of the 8·0 and 9·5 magnitude respectively, and neither appeared stellar with power of 270.

The following continued ephemeris is given by Dr. A. Stichtenoth in *Astr. Nach.* (Bd. 149, No. 3574):—

Ephemeris for 12h. Berlin Mean Time.

1899.	R.A. h. m. s.	Decl. ° ′	Br.
July 6 ...	14 16 54	...+17 16·5	... 0·11
8 ...	15 29	... 16 12·6	
10 ...	14 20	... 15 13·0	... 0·08
12 ...	13 26	... 14 17·3	
14 ...	12 43	... 13 24·9	... 0·06
16 ...	12 12	... 12 35·6	
18 ...	11 52	... 11 49·2	... 0·05
20 ...	14 11 40	...+11 5·2	

TEMPEL'S COMET 1899 *c* (1873 II.).

Ephemeris for 12h. Paris Mean Time.

1899.	R.A.	Decl.	Br.
	h. m. s.	° ′ ″	
July 6 ...	20 22 29·7 ...	−11 13 0	
7 ...	23 44·7 ...	11 38 27 ...	3·008
8 ...	24 59·3 ...	12 4 37	
9 ...	26 13·6 ...	12 31 29	
10 ...	27 27·5 ...	12 59 1	
11 ...	28 41·2 ...	13 27 12 ...	3·229
12 ...	29 54·5 ...	13 55 59	
13 ...	20 31 7·6 ...	−14 25 22	

HOLMES' COMET (1892 III.).—

Ephemeris for 12h. Greenwich Mean Time.

1899.	R.A.	Decl.	Br.
	h. m. s.	° ′ ″	
July 7 ...	1 57 53·4 ...	+25 17 1	
9 ...	2 0 56·9 ...	25 51 37	0·0386
11 ...	3 58·5 ...	26 26 4	
13 ...	6 58·2 ...	27 0 21	
15 ...	9 55·9 ...	27 34 28	0·0398
17 ...	12 51·4 ...	28 8 26	
19 ...	15 44·6 ...	28 42 14	
21 ...	2 18 35·5 ...	+29 15 53	0·0412

MAXIMA OF MIRA.—Mr. A. A. Nijland, of Utrecht, communicates to *Astr. Nach.* (Bd. 149, No. 3576) an account of his observations of Mira during the apparition in 1898. During the period extending from August 9, 1898, to March 5, 1899, sixty-one observations of magnitude were obtained. The light curve being plotted from these gives the time of maximum as October 4, 1898, this being very close to the predicted time given by Chandler in his third catalogue. The following table shows the observed and calculated times of the last three maxima :—

Observed maximum.	Calculated Chandler III.	Retardation. Days.	Magnitude.	Period. Days.
1897 Jan. 11	1896 Dec. 13	29	3·70	
1897 Nov. 26	1897 Nov. 9	17	3·24	319
1898 Oct. 4	1898 Oct. 6	−2	2·91	312

THE NEW ALGOL VARIABLE IN CYGNUS.—Harvard College Observatory *Circular* (No. 44) contains the results of a detailed examination of all the Draper memorial plates covering the region of the variable star BD + 45°·3062, discovered by Mdme. Ceraski at Moscow (see NATURE, vol. lx. p. 114). Altogether 195 plates show the star, on 170 of which it is at its full brightness, while 20 show it below its normal magnitude. A full discussion of these plates resulted in the determination of the period of the variable to be

4d. 13h. 45m. 2s.

It is noticeable that the variation in brightness of this star amounts to about three magnitudes, and therefore exceeds that of any Algol star hitherto discovered. Like all other Algol stars, its spectrum is of the first type. A table showing the times of minima for the remainder of the year is included in the *Circular*.

THE HOUSING OF THE OFFICES OF THE UNIVERSITY OF LONDON.

THE history of the negotiations which have taken place between the Government and the Senate of the University of London, relating to the proposal of the Government to provide accommodation for the University in the Imperial Institute building, is contained in the subjoined extracts from the Report of the Special Committee appointed by the University to confer with representatives of the Treasury and of the Imperial Institute upon the matter.

At a meeting of the Senate held on December 7, 1898, a letter from Sir Francis Mowatt to the Vice-Chancellor (Sir Henry Roscoe) was read, stating that it had been suggested to the Cabinet that an arrangement might be possible by which an adequate and dignified home for the University of London could be provided in the Imperial Institute buildings, subject to some extension and internal alterations, if terms could be offered which would be acceptable to the authorities of the Institute.

The terms submitted to the Senate of the University are as follows :—

"The Government will provide adequate and suitable accommodation for the University of London, as constituted by the Act of last Session, in the buildings of the Imperial Institute, such accommodation to include examination rooms and laboratories either in the building itself or in a new building to be erected immediately adjoining it.

"The Government will undertake the entire cost of the upkeep and maintenance of the buildings, including their protection from fire.

"The works necessary for providing the accommodation in the Institute buildings, corresponding to that now enjoyed by the University in Burlington Gardens—and including the new laboratories—will be put in hand at once; and the headquarters and offices of the University, as at present constituted, will be transferred from Burlington Gardens as soon as possible after the new accommodation is ready for their reception.

"The accommodation in the Institute buildings required for the teaching side of the University will be prepared in anticipation of the date at which the provisions of the Act of last Session come into full operation.

"A Committee consisting of representatives of the University, the Treasury, and the First Commissioner of Works, should be appointed forthwith to inquire and report as to the necessary alteration and adaptation of the Institute buildings for the purposes of the University."

After a brief statement of the scope and object of this offer, the discussion upon the proposals was adjourned. There seemed to be some uncertainty in the minds of certain of the Fellows as to the precise terms upon which the proposed joint occupation of the buildings of the Imperial Institute were to be arranged as between the Government on the one hand and the University and the Imperial Institute on the other. It was felt that if a statement could be made upon certain points raised in the discussion such statement would be of signal service in clearing away any misapprehension which might have arisen. The following inquiries were therefore sent to Sir Francis Mowatt, and, with the replies, were read at a meeting of the Senate on February 1 :—

"1. Is it to be understood that the Government proposes to take over the whole of the present building of the Imperial Institute for the use of (*a*) the University of London, (*b*) the authorities of the Imperial Institute?

"2. Will the University (in case the proposals are carried out) be the tenants of the Government under identical conditions as to fixity of tenure, maintenance, &c., as heretofore in Burlington Gardens?

"3. Is it understood :

"(*a*) That the University will become possessed for its sole use of so much of the Institute buildings as the Government shall decide, after communication with the University of London, to be sufficient for its present and prospective accommodation?

"(*b*) That the University shall have the first use of such halls, corridors, galleries, as are necessary for carrying on its work of examination?

"(*c*) That all concerts and other entertainments in the Institute are to be abolished?

"(*d*) That a suitable entrance to the University portion of the building will be provided after due communication with the architect?

"(*e*) That all educational work of University character carried on within such portion of the building handed over to the Institute authorities shall be under the direct control of the University?

"(*f*) That proper accommodation will be provided for the University examinations in practical science either in the Imperial Institute buildings or in others to be built outside as may be decided on after further discussion?"

The reply, dated Christmas Day 1898, was as follows :—

"It is not the intention of the Government that any of the three parties should enter on the proposed inquiry with their hands tied. Their sole wish is that the University, the Institute, and the Treasury should meet and discuss whether *any*, and, if any, what arrangement is possible, under which the University could be suitably housed, and under suitable conditions, in the

present Institute buildings. If the result of the discussion is to show that no suitable arrangement is practicable, the University will be in no way prejudiced by having shown its readiness to discuss the project in a friendly spirit. It will be quite open to the Senate to make an express reservation in the above sense a condition of sending its representatives to sit on the Committee.

"The answer to the first and second questions is yes.

"As regards the third, the answers are—

"(*a*) Yes.

"(*b*) I am not sure that I quite understand the meaning of the words 'the first use,' but if the following definition will meet the views of the Senate, I can answer the question in the affirmative, viz. 'Full and exclusive use and control at all times at which the said halls are required for the purposes of examination.'

"The regulations for giving effect to this condition will be drawn up by the Treasury, who will be responsible for seeing that they are carried out.

"(*c*) The representatives of the Institute have assured me that the entertainments and concerts will not again take place, but it will be quite open to the Senate to safeguard themselves by making the discontinuance of such things a condition of their presence on the Committee.

"The answers to (*d*), (*e*) and (*f*) are in the affirmative."

The views of Convocation upon the proposals are contained in the following letter from the Clerk of Convocation to the Registrar, read at the meeting of the Senate :—

"I am directed by the Special Committee of Convocation, appointed to communicate with the Statutory Commission and the Senate, to request you to inform the Senate that the Committee having had their attention directed to the subject of the proposed transference of the University to the Imperial Institute, adopted the following resolution :—

"That, in the opinion of this Committee, the Imperial Institute would furnish an adequate and dignified home for the University, provided that the exclusive and permanent control of the whole or a distinct and sufficient portion, with an adequate entrance, and with security of tenure, be vested in the University."

On the motion of the Vice-Chancellor, seconded by Lord Kimberley, it was then resolved :

"That with reference to the correspondence between the Vice-Chancellor and Sir Francis Mowatt, the Senate do agree to join in the Conference therein mentioned upon the terms generally set forth in the correspondence, and without prejudice to the ultimate action of the Senate, and that accordingly three Fellows be nominated as a Special Committee of the Senate to serve on the Conference, and to report to the Senate the result of the Conference."

The following Fellows were nominated Members of the Special Committee :—The Vice-Chancellor, Lord Kimberley, and Sir Joshua Fitch.

At the next meeting of the Senate, on February 22, further correspondence was presented. It was announced that the Lords Commissioners of Her Majesty's Treasury had selected the undermentioned gentlemen to represent them at the Conference :—

Sir F. Mowatt and Mr. S. E. Spring Rice, both of the Treasury, and Mr. Almeric Fitzroy, Clerk of the Council.

The following Treasury Minute, dated February 16, 1899, was read :—

"The First Lord and the Chancellor of the Exchequer state to the Board that Her Majesty's Government have had under consideration the possibility of an arrangement with the authorities of the Imperial Institute whereby a dignified and suitable home may be provided in the Institute buildings at South Kensington for the University of London, as reconstituted by the Act of last Session. The accommodation would include the sole occupation and control of rooms and offices fully equal in number and dimension to those now in the possession of the Senate at Burlington Gardens; examination rooms and laboratories either in or immediately adjoining the existing building; and also such provision as may hereafter be needed for the full extension and development of the University under the statutes and regulations made by the Commissioners appointed by the Act.

"The First Lord and the Chancellor of the Exchequer state that, as the result of negotiations which have taken place between representatives of the University, the Institute and the Treasury, there is reason to hope that an arrangement meeting all the requirements of the several interests is now possible; and they recommend to the Board that the authorities of the University and the Institute should be invited to nominate representatives, who will consider and report in conference with persons selected by the Treasury—

"I. Whether such an arrangement is in fact practicable.

"II. What is the amount and nature of the accommodation to be transferred.

"III. What alterations or adaptations are necessary to render it in all respects suitable to the needs of the University.

"IV. Under what conditions it should be held from Her Majesty's Government by the Senate.

"The object of the Conference would be expressly limited to furnishing Her Majesty's Government with full information upon the several points indicated above; and the consent of the several parties to enter the Conference would not pledge them to accept any recommendation which the representatives, or a majority of them, may make.

"My Lords approve the course recommended by the First Lord and the Chancellor of the Exchequer."

The representatives of the Council of the Institute appointed to take part in this Conference were Lord James of Hereford, the Right Hon. Sir Henry Fowler, M.P., and Sir Frederick Abel.

The Conference thus constituted held several meetings at the Treasury and at the Institute, and the Committee paid repeated visits to South Kensington with a view to ascertain the exact extent and capabilities of the building, particularly of that portion of it which it is proposed to assign to the University.

On the first of these occasions the Prince of Wales met the Committee and accompanied the members through the various rooms of the Institute. His Royal Highness evinced much interest in the proposed arrangement, and expressed a strong wish to meet the requirements of the Senate and to facilitate the work and due development of the University.

At a subsequent meeting the representatives of the University were requested to draw up, for the information of their colleagues, a statement showing the nature of the accommodation needed by the University, and also the way in which the eastern portion of the building might be adapted to the use and to the future requirements of the University. In conformity with this wish the Committee prepared a memorandum, which became the basis of discussion at subsequent meetings of the Conference.

Among the points referred to in this document are the future requirements of the University. Upon this subject the representatives of the University remark :

"In considering the proposal to exchange the present building in Burlington Gardens for a portion of that now occupied by the Imperial Institute, it is necessary not only to take into account the means of supplying these serious deficiencies, but also to forecast the probable requirements of the University under its new constitution. The details of that constitution are now being settled by the Statutory Commission appointed under the provisions of the University of London Act of 1898.

"The new statutes will certainly provide for a large extension in the work and usefulness of the University, will invest it with new teaching powers, will bring it into closer relations with the principal colleges and medical schools of the metropolis, and will, without encroaching on the ordinary functions of those institutions, probably do much to encourage the development of post-graduate study and of research, under the direction of the governing body of the University, and in its central building."

With regard to the central portion of the building, the memorandum states :—

"It is evident that joint user of this neutral territory, on the part of the Institute and the University, would be for many reasons inconvenient unless the relations and claims of the two bodies are clearly defined. Otherwise frequent references to the Treasury would become necessary.

"Moreover, it is essential for the credit and for the usefulness of the metropolitan University that it should not be regarded as, in any sense, a department of another institution. It would cause grave disappointment to the Senate and to the Graduates if we were unable to report to them that the Government were sensible of the importance of this consideration, and able to give effect to it.

"It is obviously desirable that the building to be known as the University of London should have a separate entrance."

It was in relation to the neutral territory referred to that the representatives of the University felt it necessary to receive further explanations. It was at first proposed by the authorities of the Institute that a joint permanent Committee should be formed, and that while the University and the Institute respectively should be entitled to have the use of the central hall and the east conference hall on certain occasions to be specified beforehand, the occupation of the rooms on other occasions should be settled by arrangement with this Committee. But grave inconvenience and the possibility of future complications were foreseen in such an arrangement. From the first it had been impressed upon the Treasury that the relations of the University should be with the Government alone, and that any plan which assumed that the University should be either tenants or partners with another institution would certainly be unwelcome to the Senate. The Committee therefore insisted that, in accordance with the letter of Sir Francis Mowatt of Christmas Day 1898, the University should be the tenants of the Government only. As a result the following formal communication, dated May 16, was received by the Vice-Chancellor from Sir Francis Mowatt:—

"With reference to our recent discussions as to the conditions on which the Government is prepared to offer to the University improved and enlarged accommodation in the Imperial Institute building, I am authorised by the Chancellor of the Exchequer to inform you that the original intention of the Government remains unchanged, namely, to take over *all* the present building for the use of (*a*) the University of London, and (*b*) the authorities of the Imperial Institute, and that he has caused notification to this effect to be communicated to the Council of the Institute.

"I am at the same time instructed to forward to you the enclosed memorandum indicating that the University will hold direct from the Government."

The memorandum enclosed was as follows:—

"In any arrangement under which the University is invited to occupy a part of the Institute building, it will be an absolute condition that the University holds directly and solely from the Government and not in any form or degree from the Institute.

"This is true equally of the part to be occupied exclusively by the University and of the part to be occupied alternately by the University and by the Institute under arrangements to be approved by the Treasury."

The exact nature of the arrangements here referred to between the University and the Treasury, with respect to the central portion of the building, the galleries, and the east conference hall, will be fixed from time to time on the understanding that the full and exclusive use of these portions of the building will be secured for the University at all times at which they are required for purposes of examination, for the annual ceremony of the presentation for degrees, and for the meetings of Convocation. The Senate will also afford, as it has been accustomed to do during many years, accommodation to meetings and congresses of a national and international character, as well as for assemblies of graduates or others interested in the promotion of collegiate or advanced education.

Subject, therefore, to any reservation which the Treasury may make as to the use of the central portion of the main building for occasional meetings of the Imperial Institute, the building, with the exception of the west wing, will either belong exclusively to the University or will be at its disposal when required. The main entrance will be used by the University and by the Imperial Institute jointly. An additional University entrance and staircase will give access to the east wing, and will serve for candidates for examination and for other purposes.

The assent of the Council of the Imperial Institute to the Government proposals was notified in a letter dated June 5 from Lord James of Hereford to Sir Francis Mowatt.

With regard to the future appropriation of land adjacent to the building, it is understood that, in view of the probable future requirements of the University, especially in the direction of scientific and literary research and of post-graduate lectures and studies, the University will be entitled to a first claim on any vacant ground which may hereafter prove to be needed. The area thus available is very large.

It is understood that the Government is prepared to undertake the whole cost of the removal of the effects of the University to its new quarters, and that the Chancellor of the Exchequer will include in the estimates for this year a sufficient sum to meet all charges for furnishing the rooms, for adapting them to the purposes of the University, and also for effecting such structural and other changes as may be found necessary in subsequent consultation between the officers of the University and the architect of the Board of Works. At present no change is proposed in the financial arrangement by which the charges of the University for the maintenance and care of the building, the provision of stationery and stores, the salary of the officers, and the expenses of administration are borne by the Treasury, and are provided, so far as they exceed the amount received from candidates in the form of fees, by an annual vote in Parliament.

This arrangement is, however, wholly exceptional, and does not apply to any other University in Great Britain. It undoubtedly relieves the authorities of the University from all financial concern or responsibility. But it cannot be regarded as a permanently satisfactory settlement, or one which is likely to conduce to the repute and independence of the University, or to its due development in the future. It has the obvious and serious result of discouraging endowments and gifts, and of diminishing the interest which the inhabitants of London ought to take in their chief academic institutions. So long as the University is dependent for its maintenance on an annual vote in Parliament, it can hardly be expected to receive much voluntary support. Such generous gifts from private persons or from municipal bodies as have enriched the colleges of the Victoria University, and have recently been promised to the contemplated University of the Midlands, are not likely to be forthcoming in London while the University exists on its present financial basis. But it may well be hoped that under different conditions the University will evoke similar local patriotism to that which has been so conspicuously shown in Manchester, Liverpool, Leeds, Cardiff, Newcastle and Nottingham, and that the citizens of London will become conscious of a new responsibility, and will take a pride in strengthening and enlarging from time to time an institution which ought to serve as a great centre of intellectual life for the whole metropolis.

The Government has throughout this negotiation shown a strong desire to make the best provision in its power to meet the needs of the University and the wishes of the Senate and the Graduates. And, having regard (1) to the fact that the present accommodation is insufficient, and that there are no means of enlarging it upon its present site; (2) to the size and dignity of the Institute building and its capacity for adaptation and expansion; (3) to the fact that no alternative proposal for the housing of the University in a more appropriate place is likely to be made; and (4) to the consideration that the building, though not geographically central for London, is placed in the midst of a group of institutions—the Royal College of Science, the Natural History Museum, the City and Guilds of London Institute, the College of Music, and the Science and Art Galleries and Museums—which are all in various ways cognate in their objects with the purposes and work of the University, the Committee conclude by expressing the opinion that the proposal of the Government has been conceived in a fair and liberal spirit, and that it deserves the favourable consideration of the Senate.

PHYSICAL MEASUREMENTS IN ANTHROPOLOGY.

THE question of the value of physical measurements is one that lies at the base of physical anthropology. Large numbers of often very extended series of measurements are continually being published, new methods are constantly being proposed and tried; but in spite of all this, it is questionable whether the value of the results obtained is proportionate to the trouble expended. Unfortunately there is variability in the methods employed, which may change according to the nationality of the investigators; some methods are complicated like those of Benedikt and Tœrœk, or, as in the case of the latter anthropologist, who takes 5000 measurements on a single skull, they may be impracticably numerous. Very precise measurement with refined instruments gives an apparent exactitude which appears to be more scientific than it really is. Preferable is the system that adopts a small number of measurements which can be readily made, and which have a better chance of being taken on a large number of subjects. The

extreme exactitude of cranial measurements, especially when based, for example, on the cephalic index only, has often led to creating imaginary races among a given people.

These and other wholesome warnings are uttered by O. Hovorka Edler von Zderas in the *Centralblatt für Anthropologie*, iii. p. 289, who also points out that there is no need to calculate indices to the first or second decimal, and he also states that in the analysis of a people one should not take account of differences of less than ten units in the index.

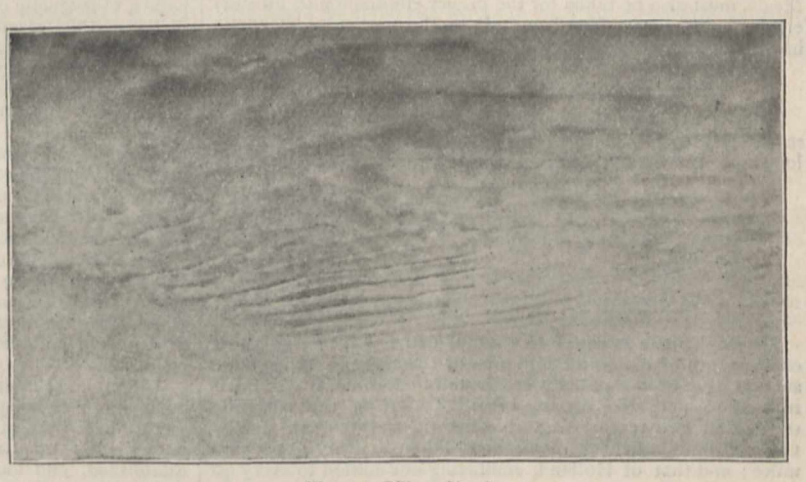
As all investigators are well aware, the cephalic index gives no information upon the real form of the skull; this has been well emphasised by Sergi, who has sought to establish a more rational system of skull nomenclature. M. L. Laloy supports (*l'Anthropologie*, x. p. 105) Hovorka's general contention, and refers to the clever visual analysis of the inhabitants of Bretagne by Dr. P. Topinard, which was published in the *Journal of the Anthropological Institute* (1897, xxviii. p. 99). In the last number of the *Journal* (new series, i. p. 329) Dr. Topinard gives the results of the trip which he made to Cornwall last year in order to compare the anthropological types there with those he had previously ascertained in Bretagne. But in our own country Dr. J. Beddoe has long adopted a similar method of investigation, and his acute and trained powers of observation have thrown a flood of light on the problems of the races of Britain. The methods of the *doyen* of British anthropologists are those of the field naturalist, and there are many who realise that what is generally known as "natural history," is as integral a part of biology as is the most refined laboratory technique. It is well to use one's eyes for other purposes than for reading off scales on instruments.

WAVE OR BILLOW CLOUDS.

A SERIES of cloud photographs taken by Mr. Alfred J. Henry, of the United States Weather Bureau, and contributed to the *Monthly Weather Review* for February, is on several grounds specially instructive. It is too frequently the case that photographers content themselves with a single plate of a cloudy sky, which specially recommends itself to their notice by the grouping and arrangement of the vaporous patches. But in this instance we have a succession of pictures of the same clouds, showing their variation during the interval, and, moreover, taken in various azimuths at different stations, so that we get the same formation viewed from different standpoints. We regret that we can only reproduce one of the very admirable pictures that Prof. Henry has secured, It is the first of the series, and shows the typical arrangement of these clouds as they first arrested the attention of the observer. The altitude was probably that of the mean altocumulus level. Occurring as these clouds do at all possible heights above the surface, we are glad to notice that the term wave or billow, following the nomenclature of Helmholtz, is coming into use, since such a description more nearly expresses the character of the formation than do other terms which generally refer to the height alone.

We have here in the cause of the formation of these clouds an instance of the advantage of theoretical investigation over simple observation. The readings of meteorological instruments explain nothing of the origin or behaviour of atmospheric waves. Prof. Henry has recorded for us, with the care that becomes a meteorologist, that the wind was blowing steadily from the north-west with a velocity of twelve miles an hour. Rain had ceased shortly before, and the temperature, which had fallen to 34° during the night, had risen at the time at which the photograph was taken (8h. 25m. a.m.) to 36°. The direction of the parallel bands when first observed was approximately east and west. Later they took up a position about N. 80° W. to S. 80° E. In an hour and a half the typical appearance of the billow wave had passed away, leaving the typical sky about half-covered with cirrus and cirro stratus. It is not unimportant to note, however, that the occurrence of similar weather conditions gave rise to a similar formation of clouds (also photographed) some two months later.

This is all that instrumental registration and careful observation can teach us, and possibly the slow onward movement of meteorological science is traceable to the strict adherence we have generally shown to the record of instrumental indications, rather than a confident appeal to theoretical research. But the study of such a cloud formation as that pictured here goes a step beyond the reading of instruments, and places in our hands a powerful means by which to investigate the motion of the atmosphere. It cannot have escaped general notice that this regular arrangement of streaks presents the peculiarity of covering a considerable extent of the sky, almost simultaneously. On a comparatively clear sky these strips of cloud are suddenly formed; and on the other hand, a sky uniformly covered can, in a very short space of time, break up and offer the appearance of these billow waves. This sudden origin of parallel streaks finds a complete analogy in the formation of waves over still water, when a slight wind agitates the surface, and it is seen to break into ripples over a considerable area. Von Helmholtz, working on this suggestion, has shown conclusively that these billow waves are due to the existence of air strata of different temperatures moving with different velocities, and are produced at the surfaces of separation of these various strata. Travellers in balloons have confirmed this theory from actual experiment, and have shown that at very various altitudes this peculiar formation is encountered. It may be that the billow clouds are visible to us only under peculiar circumstances of moisture, but the wave motion in the invisible air is probably a most common phenomenon, and one that plays a large part in determining our weather conditions.



Wave or Billow Clouds.

THE PROPOSED MAGNETIC SURVEY OF THE UNITED STATES.[1]

THE present superintendent of the Coast and Geodetic Survey, Prof. Henry S. Pritchett, perceiving the need of expansion in the magnetic work of the Survey, has brought about the formation of a separate division, known as the Division of Terrestrial Magnetism of the United States Coast and Geodetic Survey. The chief of this division is to be Dr. L. A. Bauer, who will have full control of all magnetic work, both in the field and in the office.

The following preliminary outline will serve to give some indication of the character and scope of the work it is proposed to carry out with the enlarged opportunities.

SECULAR VARIATION INVESTIGATIONS.

The best evidence of the great demand for secular variation data is the fact that, thus far, eight editions of Schott's secular variation paper have been successively issued by the Survey.

[1] Abridged from an advance proof of a paper by Dr. L. A. Bauer in *Terrestrial Magnetism*.

In all matters relating to the re-location of land boundaries, where it is frequently necessary to know the precise amount of angular change in the direction of the magnetic meridian since the first or original survey, the Coast and Geodetic Survey is recognised throughout the country as the ultimate authority. The amount of money saved to landowners by such authoritative determinations as the Survey is able to furnish, can scarcely be estimated. It certainly exceeds many times the total amount to be spent for magnetic work.

Every effort will be made in the future to multiply and verify the secular variation data, and requests for information on the part of surveyors will be encouraged in every possible manner and true meridian lines established for them.

This involves the determination of the magnetic elements, declination, dip, and intensity at various points throughout the land. Exactly how close the stations shall be to each other depends upon the special purpose to be accomplished with the means at hand, and the magnetic character of the regions involved.

A magnetic survey has peculiar difficulties to contend with; for the quantities to be experimentally determined are for ever undergoing changes—some periodic, others not periodic. A magnetic survey must, therefore, be made to refer to some particular moment of time, and such means must be taken as to enable one to reduce all the measurements, not only to the selected epoch of the survey, but also, as occasion may demand, to some other epoch in the near past or in the near future. Means must also be taken for the proper elimination of all such errors as are to be referred entirely to the particular magnetic instrument used, *i.e.* instrumental errors.

Number and Distribution of Stations.

At how many stations it will be necessary to determine the magnetic elements? The areas of the countries at present belonging to the United States are, approximately, as follows:—

United States	3,025,600	square miles
Alaska	577,390	,,
Hawaiian Islands	6,250	,,
Porto Rico	3,530	,,
Total	3,612,770	,,

Hence the area is equal to that of entire Europe, or about one-fifteenth of the entire land area of the globe. As magnetic surveys have been especially prosecuted in Europe, it will be of interest to note the density of distribution of the magnetic stations in two recent, fruitful magnetic surveys—viz. that of Great Britain, where there was one station to every 139 square miles; and that of Holland, embracing one station to every 40 square miles.

Suppose one station is decided upon, on the average, to every 100 square miles—an end that may be obtained some day—then the determination of the magnetic elements would be required at 30,000 stations within the United States. At the rate of 400 stations a year, the magnetic survey, as detailed as this, would require for its completion at least seventy-five years. It is not well, however, to have a magnetic survey extend over such a long interval of years. The errors incurred in reducing the observations to a common epoch would greatly exceed the errors of observation.

It is evident, then, that a very large number of observers and instruments would be required to complete the survey within a short interval, say ten years at the most, or a less detailed survey will have to be undertaken.

The plan of conducting a magnetic survey of the United States which appears to be best suited to the present conditions, and one that it is possible to carry out within a reasonably short time, is as follows:—To make first a general magnetic survey of the country with stations about twenty-five to thirty miles apart; then, as opportunities present themselves, to add stations in the magnetically disturbed areas. The observations at the "repeat stations," made from time to time, will furnish the proper secular variation corrections.

The great advantages of this plan over that of attempting a greatly detailed magnetic survey at once, the steady progress of which over the entire country, on account of its extent, would necessarily be very slow, will be readily perceived. It will be of interest, however, to point out that the plan, as briefly outlined, will make it possible, within a reasonable time, to construct two sets of magnetic maps for the same epoch, each set based upon a different distribution of the stations. An opportunity will thus be afforded, as in the case of the magnetic survey of Great Britain, to obtain some idea of the accuracy with which the isomagnetic lines can be determined. The satisfactory solution of this question will serve as a valuable guide in future magnetic work.

Various State geologists, incited by the example set by the State Geologist of Maryland, Prof. William Bullock Clark, either have already made plans, or are making plans, for detailed magnetic surveys of their respective States, in co-operation with the Coast and Geodetic Survey.

Magnetic Survey of Ocean Areas.

Provision for the determination of the magnetic elements at sea are being made. With the many vessels at the service of the Coast and Geodetic Survey, exceptional facilities for this purpose will be afforded. In fact, one of the chief duties of the Survey is the supplying of magnetic data to the mariner. From an economic standpoint this feature of magnetic work is the one really of the greatest practical importance. In recognition of this fact, the Survey vessels will hereafter take advantage of every opportunity to obtain the magnetic elements on sea and on shore.

Magnetic Observatories.

The rapid, successful, and economical execution of the plans as above briefly outlined requires the establishment, at certain points, of magnetic observatories, where the countless variations in the earth's magnetic force are continuously and automatically recorded, enabling thus the proper corrections to be applied to observations made at stations at any hour of the day.

The present plans contemplate the establishment of a magnetic observatory near Washington City—this will be the Central or Standard Observatory; another near Seattle, State of Washington; one in the Hawaiian Islands, and one in Alaska. With the co-operation of the observatories at Toronto, Mexico and Havana, and with the aid of secondary or temporary observatories established as occasion may demand, the areas to be surveyed will be fairly well covered.

It is very much to be hoped, however, that the universities and colleges in the United States will seriously consider the establishment of magnetic observatories. Many an institution which lacks the means of making a reputation in astronomical work, could still afford to inaugurate useful work in terrestrial magnetism.

The United States stands at the bottom of the list of civilised countries possessing magnetic observatories. Almost every European Power of note maintains, not only one, but several permanent magnetic observatories. France has four already established, and four additional ones in process of erection; and progressive Japan, with its small strip of territory, has six continuously operating magnetic observatories.

The recent International Magnetic Conference recommended the establishment of a magnetic observatory at the Lick Observatory. It is earnestly to be hoped that this suggestion will be carried out. It is unfortunate that the San Antonio observatory in Texas had to be abandoned. A permanent observatory should be re-established in this locality.

The scheme of work for the Coast and Geodetic Survey observatories will embrace, in addition to the regular magnetic work, observations in atmospheric electricity and of the electric currents within the earth. Such observations can be carried on with practically no additional cost, and yet add greatly to the value of the observatory work. Arrangements will likewise be entered into with the Potsdam Magnetic Observatory for the making of strictly simultaneous observations of a special character.

The plan of referring the initiation and prosecution of magnetic work in America to such a well-organised department as the Coast and Geodetic Survey, the work of which is recognised universally as of the highest order, will readily be seen to have decided advantages. In the first place, the machinery for carrying on the work is already to a great extent in existence. The observer engaged in geodetic or astronomical work can frequently include to advantage magnetic observations, and thus can often be saved the chief cost of magnetic work—the occupying of stations. Again, the care and refinement with which the geodetic and astronomical work of this Bureau is carried out will ever be an incentive to keep the magnetic work of the same high order.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—The following is an extract from the speech delivered at the Encaenia on the presentation of F. D. Godman, F.R.S., Trustee of the British Museum, for the degree of D.C.L., June 21.

"In ea Naturae parte quae ad animalium herbarumque varietates pernoscendas spectat neminem vel diligentius vel utilius hoc viro laborasse scitote.

Ille enim, scientiae amore instigatus, Americae quae dicitur centralis saltus silvasque una cum amico suo caro Osberto Salwino (nuper fato eheu! nobis abrepto) longis pererravit peregrinationibus atque fruges fetusque omnes ejus orbis terrarum partis adcurate investigavit.

Nec illud tacendum arbitror eundem diversi generis species illic ab ipso cura infinita collectas quum rarissimas tum etiam pretiosissimas singulari munificentia Museo nostro Britannico donasse."

THE Committee of the City and Guilds of London Institute are inviting applications for the appointment of Assistant Professor in the Department of Civil and Mechanical Engineering at the Institute's Central Technical College. Particulars of the appointment may be had of the Honorary Secretary of the Institute, Gresham College, E.C.

THE Board of Education Bill was considered by the House of Commons Committee of Ways and Means on Tuesday. It was resolved "That it is expedient to authorise the payment, out of moneys to be provided by Parliament, of a salary, not exceeding 2000*l.*, to the president of the Board of Education, and of salaries and remuneration to the secretaries, officers, and servants of the Board, in pursuance of any Act of the present Session to provide for the establishment of a Board of Education for England and Wales."

MAJOR-GENERAL SIR JOHN F. D. DONNELLY, K.C.B., retired on Monday from the Secretaryship of the Science and Art Department, after forty years in the public service. In consequence of Sir J. Donnelly's retirement, the Duke of Devonshire, Lord President of the Council, has made the following appointments:—Sir George W. Kekewich, K.C.B., the present Secretary of the Education Department, to be also Secretary of the Science and Art Department. Captain W. de W. Abney, C.B., to be the Principal Assistant Secretary of the Science and Art Department. Mr. W Tucker, C.B., to be the Principal Assistant Secretary of the Education Department.

THE Duke and Duchess of York visited Exeter on Tuesday and opened a new wing of the Albert Memorial Museum and College. The Museum became affiliated with the Cambridge University several years ago, when the Exeter Technical and University Extension College was started, with Mr. A. W. Clayden as principal. This institution, to be known in future as the Royal Albert Memorial Museum and College, is now sufficiently equipped for the requirements of a local college. In opening the new wing, the Duke of York remarked that the efficient results attained at Exeter and also at Reading seem to indicate that it is possible for the municipal authorities of towns of moderate size to establish, with the co-operation of the great universities, institutions providing for higher and technical instruction. The co-operation of the universities, with their expert knowledge, and the local authorities with their control of funds for educational purposes and their practical knowledge of local needs, cannot fail to be of the greatest advantage to the community from an educational standpoint.

SCIENTIFIC SERIALS.

Meteorologische Zeitschrift, June.—On the amount of cloud in Europe during cyclonic and anticyclonic days, by Dr. C. Kassner. In this important discussion the author has investigated the cloud observations at five principal stations in Europe for twenty years (1871-90), and has followed a plan adopted by Dr. Leyst in another discussion by selecting the days in each month when the readings of the barometer were lowest or highest. These days, including the days preceding and following that on which the extreme reading occurred, are those called respectively cyclonic or anticyclonic periods. He finds that in cyclonic periods the maximum amount of cloud only occurs on the principal day in summer and autumn, while in winter and spring a large amount of cloud occurs in the evening of the preceding day as well as on the morning of the principal day. The preceding day has generally somewhat less cloud than the principal day, and almost always more than the following day. This result agrees with that deduced by the late Mr. Ley, and by the Deutsche Seewarte with respect to the distribution of cloud in cyclones. In anticyclonic periods the least cloud frequently occurs, not on the principal day, but on the preceding or following day; this is especially the case at Christiania and Pavlovsk, where the least cloud occurs before the passage of the highest barometric pressure, and then gradually increases. Generally speaking, however, the principal day is clearest, and next to this the preceding day, but not always, for at Buda-Pesth and Tiflis the day following that of the maximum barometric pressure has less cloud than the day preceding.

Bollettino della Società Sismologica Italiana, vol. iv., 1898, No. 9.—Old seismic instruments, by P. Tacchini, referring to an old form of the Cecchi seismograph and to Cacciatore's mercury seismoscope, recently acquired by the Central Office of Meteorology and Geodynamics at Rome, and which, with others already in the possession of the office, will form the nucleus of a seismometrical museum.—Principal eruptive phenomena in Sicily and the adjacent islands during the half-year July to December 1898, by S. Arcidiacono.—Later modifications in the electrical seismoscope of double effect, by G. Agamennone. Describes several improvements by which the instrument may be put more rapidly in working order.—Notices of earthquakes recorded in Italy (December 25 to 31, 1897), by G. Agamennone, the most important being an aftershock of the Umbria-Marches earthquake of December 27, and the Haiti earthquake of December 29.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 15.—"The Colour Sensations in Terms of Luminosity." By Captain W. de W. Abney, C.B., D.C.L., F.R.S.

This paper deals with a determination of the colour sensations (based on the Young theory) by measuring the luminosity of the three different colour components in a mixed light which matches white. At the red end of the spectrum there is but one colour extending from its extreme limit to near C, and there is no mixture of other colours which will match it, however selected, and is, on the theory adopted, a colour which excites but one sensation. At the violet end of the spectrum, from the extreme violet to near G, the same homogeneity of light exists, but it is apparently due to the stimulation of two sensations, a red and a blue sensation, the latter never being stimulated alone by any spectrum colour. Having ascertained this, it remained to find that place in the spectrum where the blue sensation was to be found unmixed with any other sensation except white. By trial it was found that close to the blue lithium line this was the case, and that a mixture of this colour and pure red sensation gave the violet of the spectrum when the latter was mixed with a certain quantity of white. The red and the blue sensation being located, it remained to find the green sensation. The complementary colour to the red in the spectrum gave a position in which the green and blue sensations were present in the right proportions to make white, and a point nearer the red gave a point in which the red and blue sensations were present in such proportions as found in white, but there was an excess of green sensation. By preliminary trials this point was found. The position in the spectrum where the yellow colour complementary to the violet was also found. The colour of bichromate of potash was matched by using a pure red and the last-named green. To make the match, white had to be added to the bichromate colour. A certain small percentage of white was found to exist in the light transmitted through a bichromate solution with which the match was made, and this percentage and the added white being deducted from the green used, gave the luminosity of the pure green sensation existing in the spectrum colour which matched the bichromate. Knowing the percentage composition in luminosity of the two sensations at this point, the luminosity of the three sensations in white was determined by

matching the bichromate colour with the yellow (complementary to the violet) and the pure red colour sensation. From this equation and from the sensation equation of the bichromate colour already found, the sensation composition of the yellow was determined. By matching white with a mixture of the yellow and the violet, the sensation equation to white was determined. The other colours of the spectrum were then used in forming white, and from their luminosity equations their percentage composition in sensations were calculated. The percentage curves are shown. The results so obtained were applied to various spectrum luminosity curves, and the sensation curves obtained. The areas of these curves were found, and the ordinates of the green and violet curves increased, so that both their areas were respectively equal to that of the red. This gave three new curves in which the sensations to form white were shown by equal ordinates.

A comparison of the points in the spectrum where the curves cut one another, and of those found by the red and green blind as matching white, show that the two sets are identical, as they should be. The curves of Koenig, drawn on the same supposition, are mentioned, and the difference between his and the new determination pointed out.

The red below the red lithium line, as already pointed out, excites but one (the red) sensation, whilst the green sensation is felt in greatest purity at λ 5140, and the blue at λ 4580, as at these points they are mixed only with the sensation of white, the white being of that whiteness which is seen outside the colour fields.

"A Comparison of Platinum and Gas Thermometers, including a Determination of the Boiling Point of Sulphur on the Nitrogen Scale: an Account of Experiments made in the Laboratory of the Bureau International des Poids et Mesures, at Sèvres." By Drs. J. A. Harker and P. Chappuis. Communicated by the Kew Observatory Committee.

The present paper is the outcome of the co-operation of the Kew Observatory Committee and the authorities of the International Bureau of Weights and Measures at Sèvres, for the purpose of carrying out a comparison of some platinum thermometers with the recognised international standards.

A new resistance-box, designed for the work, and special platinum thermometers together with the other accessories needed were constructed for the Kew Committee, and, after their working had been tested at Kew, were set up at the laboratory at Sèvres in August 1897. The comparisons executed between these instruments and the standards of the Bureau may be divided into several groups. The first group of experiments covers the range −23° to 80°, and consists of direct comparisons between each platinum thermometer and the primary mercury standards of the Bureau. Above 80° the mercury thermometers were replaced by a gas-thermometer, constructed for measurements up to high temperatures. The comparisons between 80° and 200° were made in a vertical bath of stirred oil, heated by different liquids boiling under varying pressures. For work above 200° a bath of mixed nitrates of potash and soda was substituted for the oil tank. In this bath comparisons of the two principal platinum thermometers with the gas-thermometer were made up to 460°; and with a third thermometer, which was provided with a porcelain tube, we were able to go up to 590°. Comparisons of the platinum and gas-scales were carried out at over 150 different points, each comparison consisting of either ten or twenty readings of the different instruments.

By the intermediary of the platinum thermometers a determination of the boiling point of sulphur on the nitrogen scale was also made. The mean of three very concordant sets of determinations with the different thermometers gave 445°·27 as the boiling point on the scale of the constant volume nitrogen thermometer, a value differing only about 0°·7 from that found by Callendar and Griffiths for the same temperature expressed on the constant pressure air scale.

If for the reduction of the platinum temperatures in our comparisons we adopt the parabolic formula proposed by Callendar, and the value of δ obtained by assuming our new number for the sulphur-point, we find that below 100° the differences between the observed values on the nitrogen scale and those deduced from the platinum thermometer are exceedingly small, and that even at the highest temperatures the differences only amount to a few tenths of a degree.

Full details as to the instruments employed and the methods adopted are given in the paper.

"On the Comparative Efficieny as Condensation Nuclei of positively and negatively charged Ions." By C. T. R. Wilson, M.A. Communicated by the Meteorological Council.

When moist air is ionised, a greater degree of supersaturation is required to cause water to condense on the positively charged ions than on the negatively charged ones. The experiments consisted in measurements of the expansion required to cause condensation in the form of drops in air initially saturated and containing ions alternately nearly all positive and nearly all negative The ratio of the final to the initial volume being indicated by v_2/v_1, then to cause water to condense on negatively charged ions, the supersaturation must reach the limit corresponding to the expansion $v_2/v_1 = 1{\cdot}25$ (approximately a fourfold supersaturation). To make water condense on positively charged ions, the supersaturation must reach the much higher limit corresponding to the expansion $v_2/v_1 = 1{\cdot}31$ (the supersaturation being then nearly sixfold). Thus, if ions ever act on condensation nuclei in the atmosphere, it must be mainly or solely the negative ones which do so, and thus a preponderance of negative electricity will be carried down by precipitation to the earth's surface. Experiments were carried out which appear to prove that the difference in the condensing power of positive and negative ions is not to be explained by supposing the charge of each negative ion to be, for example, twice as great as that of each positive ion. Experiments were also tried to test whether the rainlike condensation, which always takes place in moist air when the expansion $v_2/v_1 = 1{\cdot}25$ is exceeded, is due to slight ionisation of the moist air. These experiments led to the conclusion that this is not a case of condensation on ions; unless the process of producing the supersaturation itself gives rise to ionisation.

Mineralogical Society, June 20.—Prof. A. H. Church, F.R.S., President, in the chair.—Mr. E. G. J. Hartley gave the results of analyses of so-called plumbogummite from Roughten Gill, Georgia, and Huelgoat. The blue mineral from Roughten Gill, usually regarded as a silicate or carbonate of zinc, proved to be identical with the hitchcockite from Georgia. Both minerals have been analysed by Mr. Hartley, and shown to contain about 19 per cent. of water and 3 per cent. of carbonic acid. In a note on the optical characters, Prof. Miers finds that these two minerals present absolutely the same appearance under the microscope, and differ somewhat from the only other known hydrated lead aluminium phosphate, viz. the plumbogummite from Huelgoat in Brittany. Mr. Hartley's analyses of this mineral differ from those of Damour, and shows that it has by no means the same composition as hitchcockite, and it is therefore considered to be a distinct species.—Mr. H. L. Bowman gave a detailed description of the optical crystallographic and chemical characters of a clear green rhombic pyroxene from the diamond-washings of South Africa.—Messrs. G. T. Prior and L. J. Spencer contributed a paper on the chemical composition of tetrahedrite. In a previous investigation proving the specific identity of the rare mineral binnite with tennantite, the numbers obtained in the analysis, like those of several older analyses of tennantite, agreed much more closely with the formula $3Cu_2S.As_2S_3$ than with the ordinary text-book formula $4Cu_2S.As_2S_3$, originally proposed by Rose. In the present communication the authors describe the physical and chemical characters of three specimens of tetrahedrite. The result of the analyses made by Mr. Prior is to confirm the idea that the true formula for tetrahedrite proper is $3Cu_2S.Sb_2S_3$, and also to show that when iron and zinc are present they enter into the composition of the crystals not as $3(Fe,Zn)S.Sb_2S_3$, but as $6(Fe,Zn)S.Sb_2S_3$, in which 6(Fe,Zn)S isomorphously replaces $3Cu_2S$. The proposed general formula for fahlerz (tetrahedrite and tennantite) is accordingly

$$3R'_2S.R'''_2S_3 + x[6R''S.R'''_2S_3]$$

where R′ = Cu, Ag; R‴ = Sb, As, Bi; R″ = Fe, Zn, and x is generally a small fraction, rising, however, to ½ in the case of the highly ferriferous tetrahedrite "coppite."—Mr. L. Fletcher described the chemical analysis of a constituent of the meteoric iron of Youndegin, Western Australia, and gave an account of the fall of meteoric stones at Mount Zomba, British Central Africa, on January 25, 1899.—Mr. Herbert Smith pointed out the specific identity of the new oxychloride of lead paralaurionite, described by him in April 1898, with the new mineral rafaëlite, a description of which by the late Dr. Arzruni has just been published.

Geological Society, June 21.—W. Whitaker, F.R.S., President, in the chair.—On a series of agglomerates, ashes, and tuffs in the Carboniferous Limestone series of Congleton Edge, by Walcot Gibson and Dr. Wheelton Hind. With an appendix on the petrography of the igneous rocks, by H. H. Arnold-Bemrose. After referring to the discovery of volcanic rocks in the upper part of the Carboniferous Limestone series at Tissington, the authors proceed to describe evidence of volcanic action of the same age on the western slopes of Congleton Edge.—On some ironstone fossil nodules of the Lias, by E. A. Walford.—Additional notes on the glacial phenomena of Spitsbergen, by E. J. Garwood. This paper contains the results of additional observations on the ice of Spitsbergen made by the writer in 1897. The inland ice visited occupies two distinct areas, separated by Dickson's Bay and Wijde Bay. The radiating point lies somewhat north-west of the centres of each area, with supplementary radiating points on the north and east. The group of peaks including the Three Crowns may be regarded as nunatakkr. The valley-bound ground-ice does not necessarily travel in the same direction as that of the surface. The effect of nunatakkr on the surface of the ice-sheet was studied, and from this it was often found possible to infer the existence and position of buried mountain-ridges. On the *stoss-seite* of a nunatak moraine-material is often discharged. The movement of the ice has frequently converted the ice-bridges across crevasses into arches and tunnels, some of which carry part of the drainage of the ice-sheet. Portions of old stranded ground-moraines, formed when the ice was more extensive, were sometimes found to have fallen upon the lowered ice-sheet, and to be mingled with modern moraine-material. Englacial and superficial rivers are described, and one of the latter was found to be depositing gravelly material along a line at right angles to the valley down which the ice was flowing. Certain observations on the rate of movement of the ice-sheet seem to indicate that this is not less than fifteen to twenty feet in twenty-four hours; while the glaciers near the sea-margin appear to be travelling about twenty-five feet in the same time. The action of sea-ice is described, and it is inferred that a certain amount of rounding and scratching of shore-rocks, and possibly part of the smoothing of boulders, may be due to this agent.—Additional notes on the vertebrate fauna of the rock-fissure at Ightham (Kent), by E. T. Newton, F.R.S.

Royal Microscopical Society, June 21.—Mr. E. M. Nelson, President, in the chair.—The President exhibited an old ⅛-inch objective made by Andrew Ross, which had been presented to the Society by the Master of the Rolls. It was a rare form of objective, constructed probably about the year 1838, and possessed a very primitive form of adjustment. A special interest was attached to it because it formerly belonged to the father of the donor, Prof. John Lindley, the second President of the Society (1842-43).—The President also exhibited a new coarse adjustment which Messrs. Watson had made in accordance with a suggestion contained in his paper read before the Society in March last. It showed that with a loose pinion it was possible to have a rack coarse adjustment that would work without "loss of time."—A paper by Mr. Jas. Yate Johnson, entitled "Notes on some sponges belonging to the Clionidæ obtained at Madeira," was taken as read. Six slides of Spiculæ, &c., in illustration of the paper, were exhibited under microscopes.—The President called the attention of the Fellows present to an exhibition by Mr. Beck of parts of various wild flowers shown with low powers.—This was the last meeting of the session, and the President announced that the first meeting after the vacation would be on October 18.

EDINBURGH.

Royal Society, June 5.—Sir Arthur Mitchell in the chair.—A note by Dr. Thomas Muir, on a persymmetric eliminant, was taken as read.—Dr. A. T. Masterman read a paper on contributions to the life-histories of the cod and the whiting. The paper was illustrated by numerous diagrams tracing the successive stages of development from lengths of 3 mm. to lengths of 25 mm. There was found to be a greater abundance of pigment in young whiting, and the body shows a characteristic pigmented lateral line. The migration of the young of each species shorewards was also studied. In the case of the cod the transition was very marked from surface to mid-water, and thence to the littoral region. Thus the limiting length of surface forms was 17 mm., of mid-water forms a little over 25 mm., and later forms were all found in the littoral regions. No attempt has as yet been made to trace outward migration, if there be any. As had already been pointed out by Prof. M'Intosh, the migration of the whiting was much more indefinite. Sufficient causes for these migrations had not yet been satisfactorily made out.—Dr. Hugh Marshall gave a preliminary note on the hydrolysis of thallic sulphate.

June 19.—Sir William Turner, F.R.S., in the chair.—A paper by Dr. Thomas Muir, on the eliminant of a set of general ternary quadrics, was taken as read.—Messrs. A. C. Seward, F.R.S., and A. W. Hill presented a paper on the structure and affinities of a Lepidodendron stem from the Calciferous Sandstone of Dalmeny. The fossil stem described in this paper was found by Mr. J. Kerr, of Edinburgh, and generously handed over by Mr. Robert Kidston, of Stirling, to Mr. Seward for examination and description. The peripheral portion of the stem is occupied by a band of secondary cortical tissue (phelloderm) about 5-7 cm. in breadth; the more internal cortex has not been preserved, but the central cylinder is unusually perfect. The specimen measures 33 cm. in diameter. A fairly broad pith occupies the centre of the stem, and this is enclosed by a ring of primary xylem succeeded by a broad band of secondary xylem. The leaf traces exhibit a well-marked secondary growth; each consists of a few primary tracheids, accompanied by a fan-shaped group of short and thin-walled tracheal elements. The stem appears to be identical with *Lepidophloios Wunschianus* from Arran, and a comparison is also instituted with *Lepidophloios Harcourtii*, a species characterised by the absence or late development of secondary wood.—Dr. T. H. Bryce read a paper on duplicitas anterior in an early chick embryo. This very rare condition in birds was examined in careful detail, and the structure of the duplex embryo was demonstrated by microphotographs of typical section.—In a paper on the trap-dykes of the Orkneys, Mr. J. S. Flett gave a description of a series of trap-dykes running mostly in an east-north-east direction, and cutting the Old Red Sandstone of Orkney. They are principally camptonites, but include also bostonites, monchiquites, fourchites, alnoites, and mellilite monchiquites. They are remarkably fresh, and show an interesting series of gradations between the different types. They are probably of Tertiary age, and have all proceeded from one focus. The presence of a single diabase dyke points to their origin from a gabbro magma.—Miss E. Chick presented a paper on the vascular system of the hypocotyl and embryo of *Ricinus communis*, which contained a detailed study of the behaviour of the vascular system in its passage from the root to the stem. Certain anomalies which have been observed were explained, and the inquiry brought out very clearly the individuality of the bundles as compared with the whole central cylinder of the root to which they belong.—Dr. W. Peddie, in a note on Mr. J. O. Thompson's paper on torsional oscillations (see NATURE, May 25, p. 86), pointed out that Mr. Thompson's suggested explanation of the results described by Lord Kelvin is very improbable, for there is no apparent reason why too large an initial oscillation should be given always to the fatigued wire and not to the unfatigued wire. Experiments on an iron wire, already described by Dr. Peddie, showed distinct fatigue of elasticity. It was also pointed out that Mr. Thompson's own results seem themselves to indicate fatigue.

PARIS.

Academy of Sciences, June 26.—M. Van Tieghem in the chair.—Note accompanying the presentation of the fourth part of the photographic atlas of the moon, by MM. Loewy and Puiseux. The salient characters of the regions represented are described.—Preparation of fluorine, by electrolysis, in an apparatus of copper, by M. Henri Moissan. The costly platinum apparatus hitherto employed in the preparation of fluorine may, it is found, be replaced by one of copper, which is less attacked than most other metals. It is probable that the copper becomes coated with a thin layer of copper fluoride which, being insoluble in hydrofluoric acid, prevents further action taking place.—Action of some gases on caoutchouc, by M. D'Arsonval. At pressures varying from 1 to 5 atmospheres caoutchouc absorbs large quantities of carbonic anhydride and, at the same time, increases considerably in volume and becomes more gelatinous and less elastic. On exposure to air the gas is gradually lost, and the substance resumes its original properties. In virtue of this property, vessels of caoutchouc readily allow car-

bonic anhydride to pass through their walls. The action is much slower in the case of oxygen and is very slight with nitrogen.—The report of the commission recommending the revision of the map of France was adopted.—Observations on the work of MM. S. Lie and A. Meyer. A mathematical paper.—A new formula relating to quadratic residues, by M. P. Pépin. A paper dealing with the theory of numbers.—On the equation of motion of automobiles, by M. A. Petot. A reply to the criticisms of M. Blondel on a former communication by the author.—On the temperature of maximum density of aqueous solutions of alkali chlorides, by M. L. C. De Coppet. Experiments were made with the chlorides of potassium, sodium, lithium, and rubidium. It is remarkable that the molecular lowering of the point of maximum density caused by lithium chloride is less than half that observed in the case of the other salts examined.—On an oscillation phakometer, by M. Ch. Dévé. The superior accuracy claimed for this instrument for measuring the curvature of optical surfaces, &c., depends on the use of a novel artifice for determining the exact position of an image.—On a laboratory spectroscope in which the dispersion and the scale are adjustable, by M. A. De Gramont.—On the polarisation of dielectrics, by M. Liénard. Observations on a previous note by M. Pellat on this subject.—Results of seismic observations in Greece from 1893 to 1898, by M. D. Eginitis. During the six years over which the observations extended 3187 disturbances were recorded, the average annual number being 531 and the maximum 876 (in 1893). Seismic disturbances are more frequent in the night than in the day, and, as regards their annual distribution, exhibit a maximum in spring and a minimum in autumn.—On the constitution of the oxides of rare metals, by MM. G. Wyrouboff and A. Verneuil. Considerations relative to the formation of various complex salts of cerium and thorium lead to the suggestion that the oxides of these metals have the formulæ $(CeO)_3$ and $(ThO)_4$ respectively, in which one of the CeO or ThO groups differs in function from the rest.—The action of ferric chloride and bromide on some aromatic hydrocarbons and on their halogen substitution derivatives, by M. V. Thomas. A continuation of previous work on the subject. From the product of the action of ferric chloride on paradibromobenzene the author has succeeded in isolating two new bromotrichlorobenzenes which melt at 93° and 138° respectively.—The preparation of phenylic chlorocarbonates, by MM. Et. Barral and Albert Morel. The action of a solution of carbonyl chloride in toluene on an aqueous solution of the sodium compound of phenols is shown to afford a ready means of preparing a number of aromatic chlorocarbonates. The temperature at which the reaction takes place should not exceed 40–50°, otherwise decomposition ensues, and the symmetrical phenylic carbonate is produced.—On cerine and friedeline, by MM. C. Istrati and A. Ostrogovich. By fractional dissolution in, and crystallisation from, chloroform, the substance formerly described by one of the authors as extracted from cork has been separated into two distinct compounds, cerine, $C_{27}H_{44}O_2$, and friedeline, $C_{43}H_{70}O_2$.—On some new reactions of indolic bases and albuminoid compounds, by M. Julius Gnezda. When indol and its derivatives are heated with excess of oxalic acid, a fine purple coloration is developed, and a similar reaction is given by albumen, peptones, and gelatin. Some other dibasic acids may be used instead of oxalic acid. Other colour reactions brought about by hydrofluoric acid and hydrofluosilicic acid are also described.—Preliminary tests for the presence of rare metals in mineral waters, by M. F. Garrigou. In the author's opinion, the presence of rare metals of the copper and tin groups in mineral waters is more frequent than is generally supposed.—On the formation of pearls in *Meleagrina margaritifera*, by M. Léon Dignet. Genuine pearls are not simple deposits of nacreous material accidentally produced by glandular secretions, but are the result of a definite physiological action having for its aim the elimination of parasites or other causes of irritation.—On the embryogeny of *Protula meilhaci*, by M. Albert Soulier.—Regeneration of members in *Mantides* and the constant production of a tetramerous tarsus in members regenerated after autotomy in pentamerous *Orthoptera*, by M. Edmond Bordage.—On the histology of the digestive tube in the larva of *Chironomus plumosus*, by M. P. Vignon.—Contribution to the study of *Actinidia* (*Dilleniaceae*), by M. Florentin Dunac.—On the experimental production of fascicular stems and inflorescences, by M. L. Géneau de Lamarlière.—Velocity of propagation of nervous oscillations produced by unipolar excitation, by M. Auguste Charpentier.—General and local anæsthesia of motor nerves, by Mlles. I. Ioteyko and M. Stefanowska.—Physiological significance of alcohol in the vegetable kingdom, by M. P. Mazé.—On the action of currents of high frequency in arthritis, by M. Apostoli.—On the influence of electrolytic action in the production of radiographic erythema, by MM. H. Bordier and Salvador.—Further demonstrations of the variations in the amount of iron present in the tissues under the influence of pregnancy, by M. A. Charrin.

GÖTTINGEN.

Royal Society of Sciences.—The *Nachrichten* (physico-mathematical series), part i. for 1899, contains the following memoirs communicated to the Society:—

January 14.—W. Voigt: On the inflexion of plane non-homogeneous waves at the straight edge of an infinite absolutely black screen.—E. Riecke: On the work expended in producing large sparks with a Töpler induction-machine.—H. Liebmann: A new property of the sphere.—O. Mügge: On new structural faces in the crystals of unalloyed metals.

February 11.—H. Minkowski: A criterion for algebraic numbers.

February 25.—C. Runge: On the solution of certain equations with integral coefficients.—R. von Zeynek: On the irritability of sensory nerve-endings by variable currents.—W. Nernst: On the theory of electrical stimulation.—F. Nachtikal: On the proportionality between piezoelectric phenomena and the stresses that produce them.

CONTENTS.