THURSDAY, JANUARY 24, 1901.

THE DEATH OF THE QUEEN.

NOT only the British Empire, but the whole world is mourning the death of one of the most beneficent Sovereigns who has ever adorned a throne. History will for many centuries record the fact that her long reign has been contemporaneous with the most tremendous advances of science which the world has so far seen. In consequence of one of these advances, the civilised communities spread over the whole surface of the planet have mourned simultaneously, and as with one voice, the loss of one universally beloved.

But besides the advances in pure science which have characterised the reign, and the applications of it to the amelioration of human ills and to the greater well-being of humanity, there has been progress along other lines which have been largely dependent upon the Queen's own perfect life and character; her efforts to keep the world's peace, and her intense anxiety that the well-being of even the humblest of her subjects should be fully cared for.

Thanks to all these causes, constantly at work, her glorious reign has possessed a special characteristic, and it has been well called the Victorian age.

What we owe to the circumstances of the time, and Her Majesty's unceasing efforts to mould them for the nation's good, has been well stated in the *Times*.

"Her reign coincides very accurately with a sort of second renaissance, an intellectual movement accomplishing in a brief term more than had been done in preceding centuries. Since the days of Elizabeth there has been no such awakening of the mind of the nation, no such remarkable stride in the path of progress, no such spreading abroad of the British race and British rule over the world at large, as in the period covered by the reign whose end we now have to deplore. In art, in letters, in music, in science, in religion, and, above all, in the moral and material advancement of the mass of the nation, the Victorian age has been a time of extraordinary activity."

To mention these facts is sufficient to recall the increased national activities, along these several lines, not long after Her Majesty began her reign, when she had by her side the late Prince Consort, to whom the nation owed the idea of the Exhibition of 1851 and everything which flowed from it. His wide culture and complete training enabled him to foresee then (that is, half a century ago) what very few of our statesmen recognise now, that brains and complete mastery of all the arts of peace are the most stable bases of a nation's greatness.

Few young rulers were so happy as the Queen in her family life until the lamented death of the Prince Consort—one of the best friends that the English nation has ever had. It was largely owing to his wise foresight and influence that the improvement of our British system of education was undertaken; and in 1852, in the Speech from the Throne, Her Majesty spoke as follows:—

"The advancement of the Fine Arts and of practical Science will be readily recognised by you as worthy the attention of a great and enlightened nation. I have directed that a comprehensive scheme shall be laid before you, having in view the promotion of these objects, towards which I invite your aid and co-operation."

The death of Prince Albert in 1861 was a blow from which Her Majesty may be said to have never recovered. It was also a blow to British science which the nation still feels.

The late Lord Playfair told the story how Her Majesty, not long after the commencement of her reign, expressed her desire to show, by distinctions conferred upon them, that she regarded men of science as fellow-workers for the nation's good. He also told us how it came about that at the time this desire was not carried into effect. But during recent years Her Majesty from time to time has shown in this way her interest in scientific progress, and the position of science in the national regard is vastly different to-day from what it was on Her Majesty's accession.

The world is all the poorer for the departure from us of our noble Queen. The nation is stunned: each of her late subjects is mourning a personal loss, but that does not prevent a universal sympathy with those near the throne who, as children or grandchildren, stood at the bedside at so great a passing.

The Royal Family may rest assured that, among the millions of mourners for the loss of one who was truly the Beloved and Revered Mother to all her subjects all over the world, there are none whose sympathy is deeper or more respectful than that felt by the students of science throughout the Empire.

EDITOR.

AN ALPINE CRUST-BASIN.

1: *Das geotektonische Problem der Glarner Alpen.* A. Rothpletz. Pp. vii+251, and Atlas. (Jena: Fischer, 1898.)

2: *Geologische Alpenforschungen.* A. Rothpletz. I. Pp. viii+176. (Mu nich: J. Lindauersche, 1900.)

A MORE than ordinary interest attaches to these two works by Prof. Rothpletz, as they treat of the boundary district between the Eastern and Western Alps. This district is already famous in geology, and has attracted all comers by its problems. My own opinion regarding its structure had been formed while I wrote my paper on the "Torsion-structure of the Dolomites" in 1898, and was given by me at the British Association Meeting and at the International Geographical Congress in 1899. I then compared the structure of this district with that of the areas of inthrow of various sizes that I had studied in the Dolomites. I described the Glarus-Prättigau area as a local area of depression or crust-basin within the Alps, around which fold-arcs had formed peripherally. Thrust-masses, taking origin in the peripheral arches, had moved towards the centre of the basin. And as across this area of depression the Alpine wave-movement of compression had also passed, the leading strike-curve of the Alps had been superinduced upon the local curves, making various angles with those, so that the actual crust-forms now presented to us were resultant combinations of the local movements round the subordinate basin, with the more extended Alpine movements round the North Italian crust-basins.

Our knowledge of the geology of this district has been vastly extended by Prof. Rothpletz. The actual observations recorded in these works, the discovery of many leading fossils in rocks whose age had hitherto remained doubtful or been erroneously determined, the large number of geological sections and the geological maps, must be regarded as one of the most brilliant achievements in Alpine geology. Two gems of detailed geological mapping may be recommended for careful study, namely, the north-west part of the Glarus district and the fault-blocks of the Rhätikon: (1: Taf. xi., and pp. 166–185; 2: Taf. i., and pp. 69–90.)

In all the leading text-books, the plication of the Alps is referred to lateral compression having acted mainly from the south in the Eastern Alps and rather more from south-east in the Western Alps, hence the curvature of the Alpine strike. Overthrusts are said to have taken place chiefly towards the north on the north side of the central chain, and towards the south on the south side. Glarus, on the north of the central chain, offered an exception to this rule, as according to Prof. Heim's epoch-making work ("Mechanismus der Gebirge," 1878) there had been within Glarus the advance of overthrust masses both from the north and from the south during the last Alpine upheaval.

Prof. Rothpletz contended (1) the existence of an overthrust mass in the south of Glarus, and (2) the correctness of Prof. Heim's conception of a crushed "middle-limb," as theoretically necessary in the process of overthrusting Prof. Rothpletz advocated that the phenomena of overthrusts were akin to differential movements between fault-blocks ("Querschnitt durch die Ost-Alpen," 1894, and "Geotektonische Probleme," 1895). Prof. Rothpletz, in his latest work on Glarus, in 1898, recognises the presence of a thrust-mass in the south of the Glarus area, but treats it as a mass originally continuous with the large thrust-mass on the north (*cf.* p. 211), and concludes from his observations that the whole of this "Glarus thrust-mass" had travelled *from east to west*, a distance of about twenty-five miles from the Rhine valley to the Linth. The rocks that form the *base* of the thrust-plane comprise all the geological horizons from the older gneiss to Oligocene strata, and have been folded along a *curved* strike, east-west near the Linth Valley, but curving round a southern arc to N.E.–S.W. direction nearer the Rhine Valley.

In the south or "Vorderrhein" portion of the "Glarus thrust-mass" the prevailing strike is N.E.–S.W. In the northern portion the rocks of the thrust-mass are folded along a curved strike, curving from S.S.W.–N.N.E. in the vicinity of the Linth Valley round a northern arc to an east-west strike.

In both the basal mass and the overthrust mass the folds have been overcast to the north and north-west, the compression of the folds having been very much stronger in the south than in the north. As many as ten folds overlie one another in the basal mass at Brigelser Horn, and are surmounted by a twisted portion of the thrust-mass with strike veering from S.W.–N.E. to S.N. This curvature is explained by Prof. Rothpletz as probably due to the local resistance offered by two eruptive masses (p. 160).

Three higher tiers of thrust-masses are present on the west of the Linth Valley in the Glärnisch Mountain; two of these thrust-masses continue in curved direction north-eastward to the Schild Mountain and Lake Walen. The names given to them by Prof. Rothpletz are the Schild, Urner and Schwyz thrust-masses. Prof. Rothpletz says these masses have travelled from the north-west, but he expressly states his opinion that they advanced subsequently to one another and subsequently to the advance of the Glarus mass from the east, or locally south-east (p. 216).

Looking now at the second work, which treats of the east side of the Rhine Valley, the most important result is the description of a Rhätikon and Silvretta overthrust from the east. Prof. Rothpletz proves that the rocks of the Rhätikon Chain rest on a basal mass which is the natural continuation of the Glarus thrust-mass eastward, and he concludes that the Rhätikon mountain mass travelled from the Montafon Valley to the Rhine Valley, about nineteen miles from east to west. Tracing the origin of this thrust southward, he finds the rocks of the Silvretta Massive have been thrust eastward above the basal mass of the Prättigau, and still farther south the overthrusts are continued in the Lenz and Oberhalbstein mountain-group. The independence of the over-thrusting and the folding processes may, in Prof. Rothpletz's opinion, be concluded from the fact that the direction which has been followed by the thrust-mass frequently makes an angle with the strike of the folds. He attributes the difficulties which have hitherto attended the solution of the geological problems here:—

(1) Partly to the fact that all these overthrust masses and the basal mass in the district of the Glarus and Rhätikon have been pushed subsequently towards the north-west above the folds in the outer, or "molasse," zone of the Alps; thereby the original inclinations of the several thrust-planes have been altered or masked. (2) Partly to subsequent displacements effected along longitudinal and transverse fault-lines. (3) Partly also to the insufficient knowledge of the details of the stratigraphical succession as exhibited in the different facies of the Helvetic and the Austrian Alps.

What occurs to me in reading these works is that a great number of the observations which Prof. Rothpletz has given are unaccounted for in the conception of the structure as yet presented by that author. The conception does not go far enough, it misses the significance of the author's carefully collected data of strike and dip which prove intercrossing and curved strikes to be really the leading structural feature of the district. Prof. Rothpletz does not offer any explanation of that remarkable fault-curve in his map which follows the Linth Valley N.N.E. as far as the Schild Mountain, then curves east to the Sees Valley, and again S.S.E. and S.E. to Sargans; or interpret that other zig-zagging fault which curves round the south of the Rhätikon and south-east through the Falknis Chain, then southward in the Silvretta Massive, and again south-west through the Lenzerhorn Chain. According to my experience in the Dolomites, and having regard to the variations of the strike in the folds of the thrust-masses, I would consider these as primarily strike-faults through curved folds that formed round a local crust-basin (*cf. Geological Magazine*, 1894, pp. 54-58; *Q.J.G.S.*, 1899; *Geographical Journal*, 1900).

Let any one glance at my figure of the torsion-curves round the northern periphery of the Adriatic crust-basin (*L.C.*, 1899, fig. 22). The curves are convex to the north; the chief overthrusts have come from the W.N.W., N.W., N. and N.E., and have moved centripetally with reference to a centre in the Adriatic depression. Or compare the much smaller fold-arc of the Gröden Pass arch and its accompanying fault-curve from Plon over the Gröden Pass to Ruon and Corvara.

The arc of origin of the thrust is convex to the north; the thrust-mass has advanced southward and been broken up into several fault-blocks by faults, for the most part, transverse to the arc of origin. Return, now, to the map of the Glarus (Rothpletz's Atlas, Taf. xi.), and it will be clear that there is a repetition of similar geological phenomena. Even the details in the typical fold-forms are essentially alike (compare Rothpletz, Plate v., Figs. 5, 6, with sections 4, 5, 6 and 16, 17 in my "Torsion-structure.") In passing, it may be said that this similarity is in so far important, as it shows how much closer is the resemblance in the structure of the Eastern and Western Alps than has been usually supposed.

My interpretation of Prof. Rothpletz's data may now be indicated. His description of the continuation of the Glarus thrust-mass westward and eastward from the Mürtschen-Stock shows that it is broken by numerous faults along which both horizontal and vertical displacements have taken place, and that the typical fold-form has undergone quite different modes and degrees of compression in the several fault-blocks. From the Firz Stock in the east to the Linth Valley in the west one is presented with a series of uplifts and downthrows having the character of incipient folds, where arches and troughs are limited by steep septa or faults. The Mürtschen and Firz group is buckled into three main fault-blocks, the central of which is the highest, while the Schild group is depressed relatively to the eastern group, but within itself shows also a central upthrow flanked by downthrown blocks. The faults which have determined this cross-buckling are practically transverse to the local curvature of the strike. They therefore represent what I termed "radial" faults, or the fault-radii of a fold-arc (*Q.J.G.S.*, 1899, p. 604). This cross-blocking of a fold-arc demonstrates the action of horizontal pressures parallel with the direction of the curved strike, in addition to the action of horizontal pressures rectangularly to the fold-arc, and indicates that we have here *a system of local pressures complete in itself.*

I further note from Prof. Rothpletz's sections that the horizontal compression along N.W.-S.E. lines has been much stronger in the case of the Schild group than in that of the Mürtschen group (1: Taf. vii., Figs. 8, 15). The N.W.-S.E. strike represents the general Alpine strike at this part of the Alps, and it will be observed that in the Schild area the "Alpine" strike coincides, or is very slightly oblique, with the local strike, hence the resultant crust-deformation here represents the sum of two almost similarly-acting sets of pressures. Moreover, it is well known that the Alpine movements became rapidly less intense from west to east in this boundary district between the Western and Eastern Alps. The predominance of the N.E.-S.W. or "Alpine" strike in the basal mass of plastic strata, and the general over-casting to N. and N.W. of the folds, both in the basal mass and the thrust-mass, together with oblique over-thrusting between the fault-blocks, seem to me conclusive evidence that the "Alpine" movements were not only subsequent to the formation of the fold-arcs, but also subsequent to the initiation of the N.N.W.-S.S.E. faults through the fold-arc (*cf.* footnote, *Q.J.G.S.*, 1899, p. 559).

Take, again, the Rhätikon thrust-mass in Prof. Rothpletz's map (2, p. 161). Faults virgate from Bludenz to W.S.W. and S.W., and cut the curved fault which separates the Rhätikon and the Falknis crust-blocks. These faults I take to have been originally fault-radii of a Rhätikon fold-arc formed round the north-east of the crust-basin. The overthrust of that mass has taken place in the main *from* this direction towards the south-west. Each fault-block in this thrust-mass is gently folded between the Montafon Valley and the Falknis, and a N.W.-S.E. strike is present in the Gorvion and other parts close to the Falknis Chain. This strike, together with the folding, indicates the action of horizontal pressures from the north-east; and the virgating group of faults across the Rhätikon indicates the action of horizontal strains parallel with the curved strike of the fold-arc, effecting transverse fractures in the sense of fault-radii of the arc. Hence there is in the Rhätikon evidence of a complete set of local phenomena of compression

analogous in character to those which appear in the north-west portion of the Glarus-Prättigau crust-basin.

The Falknis block is an anticlinal block separated by curved strike-faults from the Rhätikon on the north and he Prättigau on the south, and cut by north-south faults. It shows, therefore, the general east-west strike and transverse fractures characteristic of the eastern Alps. The curvature of the strike in the west part of the Falknis Chain from east-west to north-west may, like the curvature of the fault at this part, be taken to signify a resultant or compensatory divergence due to the intercrossing of the local and the east-Alpine strike. Similarly, at the east end of the Falknis, the east-west strike curves to the south-east. The Falknis fault-block is a replica of the Gröden Pass anticlinal fault-block. The east-west strike is the dominant strike of the Eastern Alps, trending to E.S.E. in South Tyrol. It is acknowledged to have been an ancient strike along which movements have recurred in various ages in the Eastern Alps, although during the Pliocene movement the horizontal compressions from north and south were much less intense in the eastern than in the western Alps. This fact expresses the chief difference which obtains between the structures on the east and the west of the Rhine Valley. The fold-arcs round the east of the Glarus-Prättigau crust-basin have not sustained the same degree of compression during the subsequent Alpine folding as those round the western periphery; neither have the horizontal pressures acted quite from the same directions, the Alpine pressures having acted across Glarus towards the N.W., and across the Prättigau and Rhätikon more towards the north.

The eastern thrust from the Silvretta Massive gives expression both to the horizontal compressions rectangular to the eastern fold-arc of the local crust basin, and to the horizontal strains acting along the strike of the Alpine curve. In the greater Alpine curve, just as in the case of the smaller curve of the local basin, the formation of radial uplifts and downthrows is determined by these tangential pressures. And it is this cross-system which is more particularly accountable for the diagonal N.N.W. and N.N.E. and transverse faults and thrust-fractures in the Alps.

In my interpretation the Lenzerhorn Chain represents fold-arcs on the south-east of the local basin. The curved strike veers here from north-east to west, and there are also fault-radii in N.N.W. direction. The oblique shearing that has occurred here is apparently stronger than in the Rhätikon, but not nearly so strong as in the Brigels and Vorderrhein Chain, which represents the southern fold-arc in the Glarus district. My inference is that the original Glarus-Prättigau crust-basin with its peripheral folds has been cut into two unequal halves by the development of the Rhine fracture during the later Alpine movements. The Rhätikon and the Glarus have been rent asunder at the north of a radial Alpine fracture. The regional Alpine movements have superinduced wider curves above the local curves and have affected the two halves of the basin with different degrees of intensity, so that the eastern half occupies a broader area from north to south than the more strongly crumpled western half.

Hence the ground-work of the structure in this region is based upon *intersecting fold-arcs*, and all the additional details supplied by Prof. Rothpletz can be adopted in the scheme of Alpine geology which I demonstrated in 1899 upon the basis of the "fold-arc" and the "unit-area of depression" surrounded by torsion-curves of strike (Report Intern. Geogr. Congr. Berlin, 1899). The science of geology finds itself, at the threshhold of this new century, entering upon a development of research in which advance can only be made if the student of earth-structures can bring to bear upon his observations a sound knowledge of the laws of higher mathematics, dynamics and physics. And, if I may make a forecast, it is that structural geology will be ere long grouped in our university curricula with these exact branches of science.

MARIA M. OGILVIE-GORDON.

THE ZOOLOGICAL RECORD FOR 1899.

The Zoological Record. Vol. xxxvi. Being Records of Zoological Literature Relating Chiefly to the year 1899. Edited by D. Sharp. (London: Gurney and Jackson, 1900.) Printed for the Zoological Society.

THE editor of this invaluable record is to be congratulated on its early issue, the present volume having been in the hands of the public during the first week in December. The amount of energy on his part necessary, in order to secure punctuality in the delivery of their quota of manuscript from twelve contributors, can scarcely be realised except by those who have undergone a similar experience. This early appearance of the volume is, however, in part due to the circumstance that the contributors are now instructed not to await the arrival of the whole of the year's literature, but to be content with as much as is to hand at the date when their manuscript is required. That this decision is a wise one there can be no doubt, for it is much more important to issue the record at as early a date as practicable, than it is to insist on its containing the whole available literature of the year to which it is specially devoted.

This leads naturally to the remark that some want of uniformity is noticeable with regard to the inclusion of portions of certain serials in each year's record. For instance, the fourth part of the volume of the *Proceedings* of the Zoological Society of London for each year is not issued till well on in the following year. Now we find that in the records of mammals and birds, the contents of this part are quoted in the year to which they nominally belong, while they are omitted in the reptile and fish records. It is not for us to discuss which plan is the better, but we do urge that strict uniformity in this respect should be insisted upon by the editor.

Nor is this the only instance in which that functionary does not appear to have his team sufficiently well in hand. As the record of insects is by the editor himself, we may take this as the model which ought to be strictly followed by all his subordinates. This record is preceded by a carefully written introduction, bringing into special notice the leading features in the year's work; the papers are numbered, and where a series of new species are described in any particular genus, they are collectively designated as such at the end of the paragraph. In the

main, this admirable model is copied in the mammal record; but in the bird section the introductory notice is confined to five lines, and the number of unnecessary repetitions of "n. sp." (as on page 38) wastes much valuable space. In the reptile and fish records no introduction at all is given, and the papers are not numbered. Introductions are likewise wanting to the Bryozoa and Cœlenterata records. On the other hand, in the Tunicate record the notices of work accomplished are, compared with other sections, disproportionately long and too verbose.

Again, there are many minute details where more supervision on the part of the editor might, we think, have been devisable. For example, some recorders use "P. Z. S.," and others "P. Zool. Soc., London," for a familiar zoological journal. In the case of another journal we find it abbreviated to "P. New England Zool. Club" in the editorial list at the commencement of the volume; but in the mammal record (p. 4) it is quoted as "P. New England Club"; and in the bird record (p. 39) as "New England Zool. Club." Again, on p. 4 of the reptile record we find the abbreviation "Bull. Philad. Mus.," for which there is no corresponding entry in the serial list.

As an example of another type of what we venture to call lack of smartness, it may be noticed that on p. 38 of the bird record the entry relating to temperature should have come under the heading of Ratitæ instead of under one of the subdivisions of the same; and a similar remark applies to the second entry under the heading Accipitriformes, on p. 47. Again, on p. 39 of the same record, we fail to see why initials are prefixed to some authors' names and not to others; and why a well-known ornithologist is alluded to in one line as W. R. Ogilvie Grant and a few lines later on simply as Grant. In our opinion, such initials, except when there are two authors of the same name, should always be omitted, whereby much space would be saved. But here, as elsewhere, we crave above all things for rigid uniformity, which, in our opinion, should be made a *sine quâ non* by the editor.

We should also think it an advantage if it were definitely decided whether reviews of papers are to be included in the record. Such reviews are quoted in the Echinoderm record, but are omitted in the majority of the others. And here we may take the opportunity of inquiring why the names of authors in the Echinoderm record are printed in much larger type than in the other sections of the volume. Much valuable space is also wasted in this record by the very unnecessary multiplication of paragraphs. Catalogue numbers are also added to the papers, which is not done elsewhere.

Turning from the unpleasant task of fault-finding to the more congenial duty of commendation, it may be said that, apart from trivial errors and what we regard as imperfections, the work on the whole has been carried out in a most excellent manner alike by the editor and his contributors. With the aid of the admirable subject-index which has been introduced of late years by Dr. Sharp in each record it is now practicable for a worker in any special branch of morphology—say histology of the eye—to find out what has been done in that particular subject in each group of the animal kingdom. The record of new species and sub-species seems to be as well kept as in previous years, and at present shows no signs of diminution in length. Of course there are some omissions which ought not to have occurred—notably one of a so-called new species of reindeer by the mammalian recorder; but these, it is to be hoped, will be filled up in the next year's issue.

And here it may be remarked that it is a great pity that certain scientific bodies are so dilatory in despatching their publications. For instance, the library of the Natural History Branch of the British Museum, on which so many of the contributors to the *Record* depend for their material, only received in November last certain parts of the *Bulletin* of the Paris Museum which were issued in 1899. Consequently the names of several species of mammals published during the year do not appear in the present volume, and similar omissions not improbably occur in other groups.

A feature of Dr. Sharp's insect record is the inclusion of an obituary list. There is no doubt that such a list is frequently very useful, but if a separate one were made for each division of the record a very unnecessary repetition of names would occur, and there would be some names whose position it would be difficult to allocate. A preferable plan, we think, would be to give a general obituary list, indicating the special subject or subjects connected with each name by appropriate letters.

We believe ourselves justified in saying that the Council of the Zoological Society have resolved to continue the issue of the *Record* for at least another year; and although to some it may appear an unnecessary expenditure of time and money to do work twice over, the convenience of having a special record of zoological work is so great that the apparent waste of energy may be justified.

As one who has worked for some years under Dr. Sharp's supervision, the writer of this review may take the opportunity of acknowledging the extreme lightness of the pressure of the editorial yoke, and the courtesy with which his own suggestions or objections have always been received. R. L.

OUR BOOK SHELF.

Practical Lessons in Metal Turning. By Percival Marshall. Pp. 166. (London: Dawbarn and Ward, Ltd., no date). Price 2*s.* net.

Of all the different trades included in the term "mechanical engineering," that of the turner is probably as interesting as any, and seems to appeal to the amateur mechanic rather more than the others, for, given an efficient foot lathe, the work done is of general interest.

The book under notice will be found to contain information of much value to the happy possessor of a lathe, more particularly to the apprentice or amateur in the early stages of learning his trade; and in dealing with his subject the author prefers to devote the space at his disposal to a description of how a lathe is worked, rather than to how it is made.

The various processes are clearly dealt with in nine chapters, commencing with the important question of cutting tools with their proper angles for clearance, cutting and top-rake when working various materials We note, however, that the question of cutting speeds appears to have been overlooked, and this is unfortunate because it leaves the apprentice or amateur very much in the dark at the very beginning. Further on, measuring appliances are dealt with. More should have been made of micrometer callipers, so largely used in the States. These are not even illustrated.

On chucks and mandrils our author has much to say, and useful advice is given on how to centre work for the lathe, the book concluding with a chapter on screw-cutting of a rudimentary nature, sufficient, however, to give the amateur a good start in this somewhat difficult subject.

Taken as a whole, the little book will be of much use to the young apprentice and amateur. It flavours more of the workshop than of the technical school, which is very much in its favour.

Principles of Plant Culture. By Prof. E. S. Goff. Second Edition. Pp. 287. (Wisconsin: Madison. Published by the Author, 1899.)

MANY of our county councils have now instituted training colleges for teachers, and laboratories for the instruction of pupils in the elements of agriculture and horticulture. In such establishments Mr. Goff's little treatise, which is now in a second edition, will be most useful. The phenomena of the life of plants are clearly explained, and the details of internal structure sufficiently set forth. The application of these facts to the practical details of cultivation is shown, and stress laid upon the conditions that are propitious, as well as on those that are adverse, to plants. Numerous illustrations are given and, as an appendix, is provided a syllabus of laboratory work containing directions whereby the pupil may be assisted in realising for himself the teachings of the text.

It is a book suitable not only for those who have the advantage of access to a laboratory, but also for those who have to acquire a knowledge of plant-life without the assistance of a teacher.

Photography in Colours. (Photography Bookshelf, No. 5.) By R. Child Bayley. Pp. 74. (London: Iliffe, Sons and Sturmey, Ltd., 1900.)

THERE are probably many people who wish to obtain a general survey of the different attempts that have been made to solve the fascinating problem of "photography in colours" without necessarily entering deeply, or at all, into the practice of any one or more methods. Every one who practises photography should, however, have an intelligent idea of the various processes in use, even if such knowledge amounts to a mere outline of the principles involved. Until now there has been no book devoted to such a summary, so the one before us is very welcome for filling such a gap in our literature.

The author has naturally avoided all technicalities, and confined himself strictly to the explanation of the fundamental principles on which each method is based. The book, it may be mentioned, originated from the editorial articles written by the author for *Photography*, which have been revised and published in this handy form.

The Romance of the Earth. By A. W. Bickerton. Pp. 181. (London: Swan Sonnenschein & Co., Ltd., 1900.) Price 2*s.* 6*d.*

THIS is an attempt to trace, in a popular manner, the history of the earth from the time it had a separate existence to the present, together with that of its fauna and flora. As giving an idea of the subjects touched upon it may be mentioned that among the titles of the various chapters are "The Beginning of the Earth," "Earth-Sculpturing," "Ice-Ages," "Evolution," "Embryology" and "Organic Ascent." In order to make the story a connected one, the author admits that where facts have not been available he has permitted himself "to speculate, to make deductions from the accepted laws of nature." To this there could be no objection had some clear indication been given whereby the reader might distinguish the generally accepted ideas from the personal views of the author. Still, the book is well written and appropriately illustrated, and provides an interesting first course of reading on some of the greater problems of science.

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.*]

Directions of Spirals in Horns.

THE direction of the spiral in the horns of Bovidæ is, I think, a less simple matter than might be inferred from Mr. G. Wherry's interesting note in NATURE for January 10, p. 252; at all events so far as sheep and goats are concerned.

The only wild goat with truly spiral horns is the markhor, *Capra falconeri*, in all varieties of which the spiral is, as Mr. Wherry states, "crossed" (right horn twisting to left, left horn to right), but in the great majority of tame goats the reverse is the case, the horns being "homonymous." This was pointed out to me many years ago by the late Edward Blyth, and I have been able to confirm his observations repeatedly in countries where tame goats abound, both in India and in North-East Africa. The rule is not without exceptions, a few tame goats having horns coiled like the wild markhor. I have already called attention to these facts in the "Fauna of British India, Mammalia," p. 508. The "homonymous" spiral in tame goats is the more interesting because it is probable that most of them are derived from the wild *Capra aegagrus*, which has horns curving backwards, not spiral.

As regards sheep, the horns in all the *Ovis ammon* group, including *O. poli*, are "homonymous," as Mr. Wherry says. But the bharal, *Ovis nahura*, has its horns arranged on the reversed or "crossed" system. It is true that the bharal is in some other respects intermediate between sheep and goats.

W. T. BLANFORD.

The "Usefulness" of Science.

IN your interesting article on "The New Century" in the January 3 number of NATURE, I notice that you endorse M. Lévy's account of the usefulness of "useless" studies and even proceed to suggest that "all our progress has come from the study of what was useless at the time it was studied." Now while fully agreeing with your main argument, it seems to me that this goes too far. Certainly M. Lévy's illustrations do not prove it. For it so happens that the early astronomical observations, to which he appeals, so far from being useless in the eyes of those who made them, were believed to be of the utmost practical importance. In fact, it may be doubted whether the study of astronomy has ever again been prosecuted in so directly utilitarian a spirit as in its infancy. For, quite apart from the practical need of determining the succession of the seasons, which M. Lévy seems to have strangely overlooked, it was generally believed that the observation of the heavenly bodies was "useful" as a method of forecasting terrestrial events. Astronomy was the offspring of astrology, and assiduously practised because no distinction had yet been made between those heavenly bodies which made great practical differences to human affairs, like the sun and the moon, and those whose influence was inappreciable. Furthermore, it must be remembered that these same bodies were regarded as literally deities of the highest order, so that their observation was a religious rather than a scientific act. This veneration of the heavenly bodies, moreover, persists throughout Greek science, and even Aristotle regards them as composed of a purer and diviner material than anything "sublunary." So that, when he advocates the "useless" θεωρία of astronomy and mathematics as the highest exercise of human faculty, he does *not* mean "seek knowledge for its own sake," but rather "raise yourself to the contemplation of what is nobler and diviner than anything earthly." For the eternal and immutable truths of mathematics also were regarded as being of more than human validity. Hence it seems a mistake to call these primitive researches useless because we do not happen to believe in the use they were supposed to have.

And this suggests a further scruple. Does not the doctrine that the "useful" discoveries arise out of the study of the "useless" come perilously near to a psychological paradox? For how can any one rationally pursue the study of what he at the time conceives to be useless? It must at least be useful to him, *i.e.* satisfy his desires in some way or other. In the last resort, what can the useful be but that which satisfies some human desire, subserves

some human purpose? In the widest sense, therefore, all knowledge which is desired must be useful in some way and for some purposes, and, even on the most narrowly "utilitarian" interpretation, the useful is nothing else or more than what satisfies desire—except that an attempt is made to restrict it to the satisfaction of a very limited set of desires. An absolutely useless method or study would be one that could not be worked in any conceivable manner or for any conceivable purpose, *i.e.* it would be not merely useless, but *false*. The proper defence, therefore, of the so-called "useless" researches seems to me to consist in showing in the first place that the context of a science requires them, and in the second in pointing out that it has always, so far, proved possible to find a directly practical application for what is organically connected with a system of knowledge.

Corpus Christi College, Oxford. F. C. S. SCHILLER.

The Field-mice and Wrens of St. Kilda and Shetland.

IN his notice of Messrs. A. H. Evans and T. E. Buckley's "Fauna of the Shetlands" (NATURE, May 24, 1900, pp. 75 and 76), your reviewer regrets that the authors are silent in regard to the special characters of the Shetland field-mouse, in view of my own recent recognition of a peculiar representation of this type in St. Kilda. It may be interesting to point out that in a recent paper on geographical and individual variation in *Mus sylvaticus* and its allies (*P.Z.S.*, 1900, p. 387), I found myself unable to separate the Shetland field-mouse (specimens of which I had fortunately been able to examine), at least at present, from that of Great Britain generally. I would not, however, therefore necessarily bind myself to follow your reviewer in his suggestion that the comparative distinctness of the local forms of wren and field-mouse may guide us in forming a decision as to the relative periods during which St. Kilda and the Shetlands have been separated from the mainland. So many factors seem to be brought into play in the evolution of a local race or subspecies that it is, I fear, unsafe to rely too much on such points, and I have a strong suspicion that the influence of the environment has been too little taken into account by recent writers. At all events the field-mouse of Iceland would, it might be thought, show remarkable deviations from the mice of Western Europe, yet the little that we know of it only shows us how closely allied it is to *Mus sylvaticus* proper.

As regards the wrens of Iceland and of the various Scotch islands, attention may be directed to an interesting series of measurements of wings given by Mr. R. M. Barrington in a footnote to p. 641 of his book on "The Migration of Birds as Observed at the Irish Lighthouses and Lightships." These seem to show a gradual diminution in size from the large *Troglodytes borealis* of Iceland through the Shetland wren, which, although smaller than *T. borealis*, seems to be larger than *T. hirtensis* of St. Kilda; the latter exceeds in size the wrens of Ireland. But no doubt intermediates occur, and a wing received from the lighthouse on the Tuskar rock off the Wexford coast in October, 1888, equals that of a specimen from St. Kilda, whence, perhaps, it may have been a migrant.

G. E. H. BARRETT-HAMILTON.

Kilmanock, Arthurstown, Waterford, Ireland.

Sexual Dimorphism.

IF Prof. Meldola does not suppose that all spontaneous variations are limited in inheritance to one sex, he is logically bound to admit that the theory of sexual selection does not explain unisexual inheritance. There can be no possibility of verbal juggle in my arguments, because I define a secondary sexual character as one that is affected by castration, one that does not develop normally after removal of the generative organs, a spontaneous variation as one that is not produced by the conditions of life.

But it is not my theory that "the stimulations which produced a male character necessitate the restriction of that character to the male," and therefore I am not affected by the dilemma in which Prof. Meldola thinks I am placed. On p. 94 of my book will be found these words:—

"It is possible that unisexual characters originally developed by special stimulations related to reproduction, tend sooner or later to be inherited in common by all individuals of the species, that, considered in relation to periods of evolution, their sexual limitation is only temporary."

I fear that Prof. Meldola has not yet sufficiently considered my theory. J. T. CUNNINGHAM.

Penzance, January 11.

THE theory of sexual selection never pretended to *explain* unisexual inheritance. Its author started with a fact:—"Inasmuch as peculiarities often appear under domestication in one sex and become hereditarily attached to that sex, so no doubt it will be under nature" ("Origin of Species," 6th ed. p. 69).[1] Neither does the theory of natural selection pretend to *explain* ordinary, *i.e.* bisexual, inheritance. But Mr. Cunningham pretends that his theory does explain unisexual inheritance, and having in spite of the statement contained in the concluding sentence of the above letter—given very full consideration to his views, I have come to the opposite conclusion. I repeat that his theory does not explain unisexual inheritance.

Mr. Cunningham has now given a further and more restricted "definition" of secondary sexual characters. In this he has not only gone far beyond Darwin, but he has virtually cancelled at least half of his own book. The whole of the evidence that characters developed in one sex are latent in the other was summarised by Darwin in 1868:—"We thus see that in many, probably in all cases, the secondary characters of each sex lie dormant or latent in the opposite sex, ready to be evolved under peculiar circumstances" ("Variation of Animals and Plants," 1st ed. vol. ii. p. 52). All the evidence with regard to secondary sexual characters which Darwin considered in arriving at the above conclusion was based on cases observed in mammals and birds, and, with his well-known caution, he only admits probability in extending it to all cases. But Mr. Cunningham now has converted Darwin's cautiously expressed probability into a "definition"! In doing this he has practically wiped out the whole body of material relating to classes other than mammals and birds which he has brought together in his own work. I confess that I have not of late years been able to follow very closely the progress of knowledge in this direction, but, so far as I know, there is no single observation, with the exception, perhaps, of *Stylopised* bees, which would bring the secondary sexual characters of fishes, reptiles, crustacea, insects, &c., within Mr. Cunningham's definition. Is there any known case among these lower groups where the "removal of the generative organs" (to use Mr. Cunningham's own expression) leads to the appearance of the characters of one sex in individuals of the other sex?

There is another inexplicable statement in the above letter: "It is not my theory that 'the stimulations which produced a male character necessitate the restriction of that character to the male.'" I must again quote Mr. Cunningham's own remark of December 29, 1900. "My theory is that they (the variations) were so limited in development because they were due to stimulations similarly limited" (NATURE, January 10, p. 252). If this does not mean that he is attempting to explain the sexual limitation of characters by "stimulations" applied originally to the sex in which they are now developed, then it appears that he has abandoned his fundamental proposition, viz., that his theory *explains* unisexual inheritance. The restriction of this sexually limited inheritance by considering it temporary instead of permanent, as indicated in the passage quoted by Mr. Cunningham at the conclusion of the above letter, does not affect the argument in any way. We still have to learn how and why the theory of "stimulations" explains unisexual inheritance, even if the latter be only temporary.

I venture to think that editorial hospitality has been sufficiently taxed in connection with this subject. So far as I am concerned I must beg Mr. Cunningham to consider the discussion as closed. The issue is before the readers of these columns, and I do not think that any further advance is likely to be made by mere iteration and reiteration. I consider that indirectly the author of "Sexual Dimorphism" has done excellent service to the cause of Darwinian evolution by enabling us to realise how a well-conceived and well-worked-out application of Lamarckian principles completely breaks down on critical examination. R. MELDOLA.

January 12.

[1] "We may conclude that one cause, though not the sole cause, of characters being exclusively inherited by one sex, is their development at a late age" ("Descent of Man," &c. 1st ed. vol. i. p. 256). This is the utmost extent of Darwin's application of the evidence in discussing the sexual limitation of certain characters. The explanation is based on the hypothesis of "pangenesis" (*loc. cit.* p. 284).

Very Cold Days.

THE following account of days on which the minimum temperature was under 20° (at Greenwich) may be found instructive.

There have been 162 of these very cold days in the last sixty

years; thus averaging about 2·7 days annually. (The annual number of frost days is about 55.)

The year distribution is as follows:—

1841	7	...	1856	2	..	1871	3	...	1886	4
1842	—	...	1857	—	...	1872	—	...	1887	4
1843	—	...	1858	—	...	1873	—	...	1888	3
1844	1	..	1859	3	...	1874	3	...	1889	4
1845	4	...	1860	3	...	1875	1	...	1890	7
1846	3	...	1861	5	...	1876	2	...	1891	6
1847	6	...	1862	—	...	1877	—	...	1892	2
1848	1	...	1863	—	...	1878	3	...	1893	5
1849	2	...	1864	4	...	1879	5	...	1894	5
1850	—	...	1865	4	...	1880	5	...	1895	11
1851	—	...	1866	—	..	1881	10	...	1896	—
1852	—	...	1867	7	...	1882	—	...	1897	—
1853	1	...	1868	—	...	1883	—	...	1898	—
1854	2	...	1869	—	...	1884	—	...	1899	1
1855	14	...	1870	7	...	1885	—	...	1900	2

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The greatest number in any one year is 14, in 1855. Next come 1895 with 11, 1881 with 10, four with 7 each, &c. Considering *winters* instead of *years*, the highest number is 12, in 1854-55. On the other hand there are 22 years with none of these days, *i.e.* more than a third of the whole. We do not find more than *four* such years in succession; such a group is presented in 1882–85.

The distribution in months is as follows:—

Jan.	Feb.	Mar.	Nov.	Dec.
68	42	5	2	45 = 162

Thus, January is *facile princeps*. February and December are nearly equal. The days are rare in March, and most rare in November. Of the two in November, one was on the 30th, in 1856 (19°·4), the other on the 28th, in 1890 (18°·3). The latest in March was on the 14th, in 1845 (13°·1).

Speaking roughly, we seem to have had an increase in those very cold days. Grouping in decades we find this:—

1841–50	1851–60	1861–70	1871–80	1881–90	1891–1900
24	25	27	22	32	32

The first three total 76; the last three 86. To put it otherwise, the thirty consecutive years ending 1895 had more of those days than any other thirty-year group.

Do these days present any definite relation to the sun-spot cycle? I think we may discern (as in the case of frost days) a tendency to greater cold before a maximum of sun-spots than after. This may be variously shown; here *e.g.* is one way:

Compare the group of years from the seventh after a maximum year to the next maximum year (inclusive) with the six years after the latter maximum. We may construct a table as follows:

	a Annual Average.		*b* Annual Average.	Relation *a* to *b*.
1844–48	3·0	1849–54	0·8	+2·2
1855–60	3·7	1861–66	2·2	+1·5
1867–70	3·5	1871–76	1·5	+2·0
1877–83	3·3	1884–89	2·5	+0·8
1890–93	5·0	1894–99	2·8	+2·2
			Av.	+1·7

Thus the group of years ending with a maximum year shows an average which is always in excess of that of the six-year group following.

These very cold days are often found in groups. Among the longest are February 16–22, 1855, and February 5–10, 1895.

I may close with a list of the ten coldest days:—

	Min.
1. January 9, 1841	4·0
2. January 5, 1867	6·6
3. February 8, 1895	6·9
4. February 12, 1845	7·7
5. January 4, 1867	7·7
6. December 25, 1860	8·0
7. February 7, 1895	9·6
8. January 8, 1841	9·8
9. December 25, 1870	9·8
10. December 29, 1860	10·0

ALEX. B. MACDOWALL.

NATIONAL PHYSICAL LABORATORY.[1]

THE first annual report of the Executive Committee of the laboratory, which was laid before the Royal Society at its annual meeting, is in some respects disappointing. It contains a record of much valuable labour, rendered useless by the opposition to the site on the Old Deer Park at Richmond, which had been selected for the laboratory; while the delays caused by that opposition have made the progress of the scheme very slow.

The Richmond site was chosen by Lord Rayleigh's committee, and approved by the Treasury; the director's first task, after taking up his duties, was to visit the Reichsanstalt and the Bureau International at Sèvres. The courtesy of the authorities of these two institutions is suitably acknowledged in the report, and is another evidence of the international character of science. Meanwhile, in order that the new laboratory might, from the beginning, adapt itself to real wants, various committees had been considering the questions which seemed to press most urgently for solution. With their reports before them, the executive committee prepared plans, and authority was given in June last to obtain tenders for the work. Then followed a delay of some four months. During the summer a deputation from the Royal Society waited on Mr. Hanbury, urging that the original scheme should go on; but towards the end of October it was announced that Her Majesty had been graciously pleased to assign Bushy House and grounds for the purposes of the laboratory, and that in order to meet the additional capital expenditure involved, the Government were prepared to ask Parliament to raise the grant of 12,000*l.* for building to 14,000*l.* This was accepted by the Council of the Royal Society, but it was pointed out that, to quote the words of the report:—

The executive committee "cannot, however, conceal from themselves that it will be very difficult for them to maintain and administer a national physical laboratory on the Bushy site for the amount annually allowed by the Treasury, and they fear that it may be necessary for them to press, in the near future, for an addition to that allowance."

Meanwhile, plan-making had to begin again. With the very cordial assistance of the Office of Works a new scheme was prepared and approved, and now the workmen are on the ground and the alterations have commenced.

Fortunately, the structural changes necessary will be remarkably small.

Bushy House is in many respects well suited, as it stands, for a physical laboratory; the basement, however, was dark and damp, and the whole sanitary arrangements needed reconstruction. The basement is to be improved by the construction of a dry area round the house, and the insertion of larger windows; the present flagged floor is to be removed, and to be replaced by concrete and cement. Modern drainage is to be introduced everywhere, and in place of the cess-pools now in use, connection is to be made with the public sewer; this necessitates a main drain some 300 yards long.

The house itself consists of a central block about 70 feet square, containing a basement and ground floor with two floors over. The ground floor rests on brick groining, forming the roof of the basement; it is thus possible to secure steady supports for apparatus at almost any point; the building is very substantial, and it will be easy to maintain a uniform temperature throughout the basement.

The front of the house faces east approximately; unfortunately, the two main rooms of the central block on the first floor look south and west respectively; in

[1] Report of the Executive Committee for 1900, and Programme of Work for 1901.

other respects they will make good laboratories, requiring only the provision of some steady supports, and, in common with the rest of the house, arrangements for heating and for the supply of gas, water and electricity for light and power.

But besides this main block, which is some 50 feet in height, there are five large wings, one at each corner and a fifth adjacent to the north front. This fifth wing, three stories in height, contains a number of small rooms, which will be of service for special pieces of work; the other four wings give the main laboratory accommodation. Two of these each contain two large rooms about 35 feet long by 25 broad—one of which has been subdivided—the other two are of about half the size, and contain one room each of the above dimensions. All these rooms are on the ground; they have excellent floors, and are in the main well lighted; in each wing there is considerable space between the ceiling and the roof; in two of the wings this space contains attic rooms. Thus omitting the room which has been subdivided, there are five large laboratories on the ground floor in the wings, and two in the central block. There are, in addition, a number of other smaller rooms, and at the back various kitchen offices, which can easily be rendered most useful.

This general plan has some distinct advantages; it is not unlike Principal Lodge's ideal laboratory, a central block to serve as a museum, entrance-hall, offices, &c., with four wings assigned to definite branches of the work. Each wing is isolated from the others, and the chances of an observer being affected by his colleague in the next room are reduced. At the same time the difficulty of supervision is increased, while the fact that the levels are different in the wings and in the main building renders the transport of apparatus a matter of some trouble.

Our illustrations give a view of Bushy House from the east and a plan of the ground-floor.

This building will serve then for the more delicate physical measurements. For the engineering work a new laboratory is to be built; this will be 80 feet by 50 feet in area, with a weaving-shed roof lighted from the north and arranged so as to be easily capable of extension. Adjacent to it will be an engine and dynamo-room, while some existing buildings will be utilised for a battery-room, a drawing office, and for other purposes. To the north of these buildings stand, at a distance of about 100 yards, the house. To minimise the risk of vibrations from the engine being felt to enter the physical laboratory, a Parson's Turbo-Generator will be used to provide light and power, and the latter will be transmitted electrically. The engineering laboratory will have a traversing crane fitted, and will contain the main workshop of the Institution.

The grounds of Bushy House, under the direct control of the Royal Society, are nearly twenty-five acres in extent; it will be possible, therefore, to put up, if required, isolated buildings for special experiments; the use, for example, of a large testing machine in the engineering laboratory might shake the physics laboratory, and would certainly disturb many of the experiments in the engineering laboratory itself. At present the funds available are insufficient to permit of the purchase of such a machine; if it is found that one is wanted, and money were forthcoming, the necessary buildings could be erected in another portion of the grounds.

[*Photo. by Lascelles London.*

FIG. 1.—National Physical Laboratory. Bushy House from the East.

Together with their report the Committee presented a scheme of work for the current year.

The experimental work, which it is possible to do with the appliances at the Kew Observatory, is small; still it is hoped to increase the testing work which goes on there. Arrangements are being made for examining chemical measuring apparatus, flasks, burettes, and the like, and also, at the request of the Board of Agriculture, the bottles used in the Babcock milk test. An air thermometer, given by Sir A. Noble, has been erected, and will be in use as a standard of temperature up to about 400° C., while preparations are being made for the construction of mercury standards of resistance.

As to work for the future, which is to be taken up when Bushy House is occupied, the subject to which three, at least, of the Advisory Committees gave the first place was the connection between the magnetic quality and the physical, chemical and electrical properties of iron and its alloys, with a view specially to the determination of the conditions for low hysteresis and non-agency

properties. This problem, then, will, as soon as possible, be taken in hand.

Another important task is the testing of steam gauges, indicator springs and the like; for this purpose a mercury pressure gauge will be provided in the physics building to measure pressures up to twenty atmospheres—the height of the building will not allow more to be measured directly—together with an arrangement for multiplying in a known ratio the pressure measured directly.

Again, gauges of all kinds used in engineering practice will be tested, including the standard screws which the Small Screw Committee of the British Association hope to issue. Another problem which calls for early attention is that of wind pressure on surfaces.

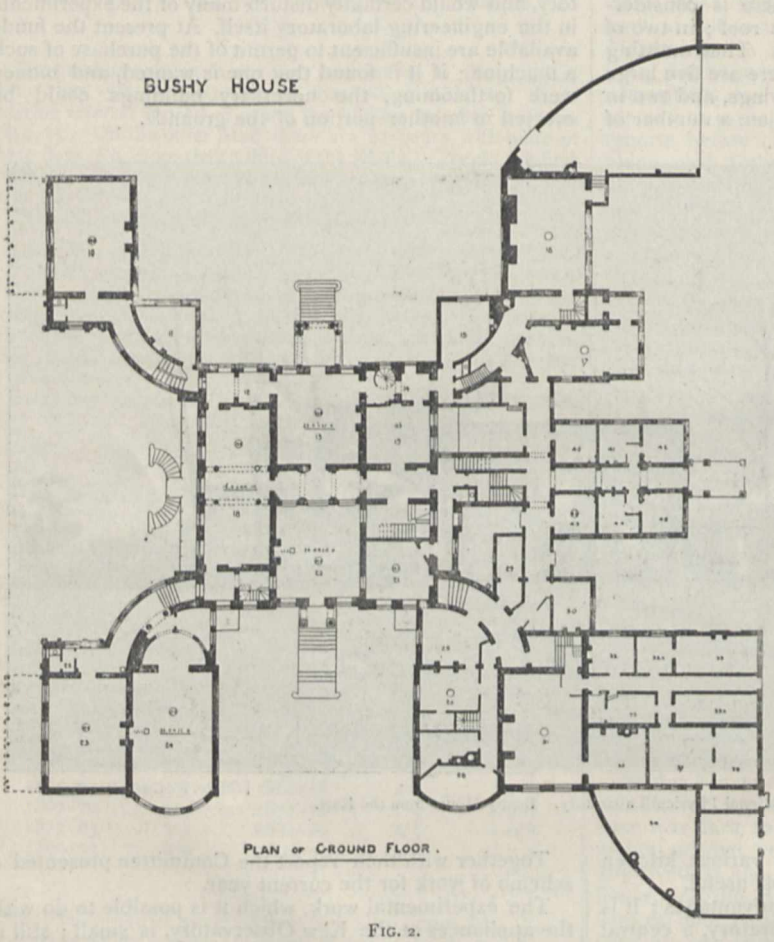

FIG. 2.

In electricity there is ample scope for work. The magnetic testing of iron for commercial use will be undertaken at once, and there are many forms of apparatus which do not come under the direct cognisance of the Board of Trade Electrical Department for which it is desirable to have some recognised test—*e.g.* condensers, special forms of cells, resistance boxes as distinct from standard coils and the like. A valuable list of measurements, by which the work of the Board of Trade Laboratory would be supplemented and assisted, has been submitted to the committee by Mr. Trotter.

Optical and thermometric testing is now carried out to a large extent at Kew Observatory, but both these branches of the work can be extended; the question of the measurement of very high and of very low temperatures is becoming more important each day. In the Optical Department photographic lenses are now tested by eye observations only. It is proposed to establish a photographic test, and to include microscope and other lenses.

It will be seen thus that there is a full programme of work before the staff of the laboratory; the Committee are anxious to keep in the closest touch with trade and industry, and the Director will welcome any suggestions to secure this end. The laboratory has been established to deal with physical problems bearing on manufacture and commerce; it can hope to succeed only through the cordial co-operation of the men who know what those problems are, and who can indicate the lines along which the necessary investigations should proceed; with their assistance it may soon do a national work.

THE PRESENT CONDITION OF THE INDIGO INDUSTRY.

FOR some time past letters on the subject of artificial *versus* natural indigo have been appearing in the *Times*. One by L. J. Harington, which appeared at the end of last month, is of considerable interest, since he writes as a planter of nineteen years' experience. He considers that the days of natural indigo are not numbered, and that the Government of India are not likely to take the advice of Dr. Brunck (NATURE, p. 111) and endeavour to grow food stuffs in place of cultivating indigo. He further remarks that "there is so little to choose between artificial and natural indigo that the whole thing is a matter of price, and the victory must go to the one who can afford to sell cheapest." He then goes on to say: "Indigo had always paid, at times well, at other times fairly so, and planters were content to grow and manufacture indigo exactly as their predecessors had done. Then in 1897 the Badische discovery came like a bolt from the blue." This is a rather remarkable admission. Here were men manufacturing indigo, and they had evidently not taken the trouble to ascertain what was being done in the scientific world and by other manufacturers. Were they not aware that so far back as 1880 indigo had been synthetically prepared, and that numerous patents had been taken out? Certainly the processes had not been commercially successful; but surely they should have taken warning, and endeavoured to improve their product and to manufacture it more cheaply.

Mr. Harington says that after the "bolt from the blue" in 1897 the price of indigo steadily fell until 1899, when, owing to the bad season, one of the finest crops ever seen in Behar was ruined and the price rose nearly 25 per cent. This naturally gave the producers of artificial indigo their chance, and they were able to offer their product at prices slightly lower than those ruling for the natural article. According to Mr. Harington, when synthetic indigo was first placed on the market the average cost of manufacturing Behar indigo was 170 rupees per maund, but that now, owing to more careful working and by sowing only on good lands, it

can be produced for 100 rupees, and he hopes that by engaging, not one chemist, but a dozen, the "cost of making indigo will soon be reduced to a level at which it will be quite impossible for synthetic to compete." Mr. Harington says, however, that the Behar planters cannot afford to spend more on experiments than they are now doing, and he appeals to the Indian Government to give a grant of at least 5000*l.* for five years. It is certainly refreshing when an indigo planter calls, not for one experienced chemist, but for a dozen. It is, unfortunately, more usual for manufacturers to sneer at chemists, saying that they only waste material in experimenting. Do they imagine that experiments which are carried out by chemists on the Continent and in America, and which enable these countries to undersell us, cost nothing?

If our manufacturers employed capable chemists and gave them a free hand, instead of employing what one may perhaps be allowed to term *glorified bottle washers*, there is very little doubt but that they would find experimenting does pay.

If it is true that, owing to bad seasons in India, the indigo producers cannot afford to pay for expert advice, then, owing to the enormous interests which are involved and the danger of delay, surely the Indian Government will not refuse its aid. It must, however, be remembered that Government cannot aid every industry.

It has already been stated in a previous article that Sir William Hudson had applied to the Indian Government for a loan to help the indigo planters to reintroduce the cultivation of the sugar-cane, as an auxiliary to the production of the dye-stuff. The Government of India thereupon appointed Mr. O'Conor, head of the Statistical Department, to report on the proposed scheme of rotating sugar with indigo crops.

Before 1840 sugar was cultivated and manufactured in Behar, but the methods employed were of the crudest, and transport was bad and expensive, therefore the production of sugar gradually died out, and many of the sugar planters turned to the manufacture of indigo. Since 1840 railways and good roads have been introduced. By careful selection and cultivation a better quality of cane-seed is now obtainable. Further, improved modern machinery and methods enable the sugar grower to obtain a much enhanced yield of a good class of sugar. The committee appointed to inquire into the possibility of the cultivation of sugar by indigo planters have nearly finished their work, and it is understood they are of the opinion that the cultivation should yield a handsome return to the planters in Behar, "*if its cultivation, manufacture and distribution are conducted on business principles.*" I might also add on *scientific* principles, and let them employ chemists who are able to do more than simply determine the strength of the sugar by means of a saccharometer. It is to be hoped that the indigo planters, if the cultivation of sugar is introduced, will not again settle down into lethargic coma with the idea that all is now well. They may be absolutely certain that any advantage which they obtain will only add to the energy with which the German men of science will attack the problem. F. MOLLWO PERKIN.

THE ROYAL INDIAN ENGINEERING COLLEGE.

ALL the members of the teaching staff at Coopers Hill must be gratified at the expression of public opinion in support of the cause of the seven gentlemen who have received notice of dismissal. Since our remarks upon the matter were written last week, leaders and letters have appeared in the *Times*, *Daily News* and other newspapers, expressing astonishment at the condition of things which permits distinguished men of science to be treated with indignity, and demanding that an inquiry shall be made not only into the present case of injustice, but also into the whole system which renders it possible for scientific service to be belittled by the action of an official unable to appreciate its value.

Testimonies to the importance and efficiency of the work done by the scientific staff at Coopers Hill have been given by men whose opinions carry weight with the public as well as in the world of science. As mentioned last week, Lord Kelvin has directed attention to the valuable work done at the College, and has given his great influence to the cause of the teaching staff. Prof. J. A. Ewing, F.R.S., professor of mechanism and applied mechanics in the University of Cambridge, has since come forward to add his testimony to that of Lord Kelvin and others. The following words of Prof. Ewing's are of particular value in enabling people to appreciate the gravity of the case.

"To suggest that the dismissal of men like Prof. McLeod and Prof. Hearson can make for efficiency is preposterous. I know nothing of the finances or of the administration of Coopers Hill, but I do know something of its teachers and of their teaching. I have examined Prof. Hearson's students at Coopers Hill, and have had the advantage of co-operating with him as examiner in the Mechanical Sciences Tripos at Cambridge. The pages of the Royal Society's *Philosophical Transactions* bear witness to his originality as a contributor to engineering science. Those who know, as I do, what fulness of knowledge and what infinite patience he brings to bear upon his teaching are not surprised that he teaches with success. One feels that to praise him is an impertinence, but when he and his colleagues are treated in this incredible fashion those who know their merits should speak out."

So far as personal qualifications are concerned, therefore, the dismissed members of the staff are perfectly competent to perform their duties; and the results obtained prove that the teaching has been done in a most efficient manner. But a much larger question is at issue. A writer, who signs himself "J. P.," in the *Times* substantiates this remark with a statement of personal experience.

"For upwards of a quarter of a century," he says, "Coopers Hill has supplied the Indian Public Works Department, and for more than half that time the Indian Forest Department, with a body of recruits whose efficiency has been the admiration of all those whose position and experience render them competent to judge the question, men with whom I for one (and I am sure that I express the opinion of all the older members of the Public Works Department) feel it an honour to be associated."

If it were worth while, evidence to this effect could be considerably multiplied, but no useful purpose would be served by doing so. Every one who has followed the expressions in the public Press since the letter from Colonel Ottley was published, is convinced of the abilities of the gentlemen who have been dismissed, and the efficiency of the College.

This efficiency has been attained in spite of circumstances tending to discourage the teaching staff. It is nothing short of a scandal that capable men like those giving instruction at Coopers Hill should be controlled as if they were orderly-room clerks or petty assistants in a private school, with a Mr. Squeers as their over-lord. The only reasonable way to carry on the work of an institution for higher education is to let the teaching staff be largely responsible for the arrangement of courses of studies as well as for the actual instruction, but this does not appear to be the method followed at Coopers Hill; for the present deplorable state of affairs could not have arisen if the views of the staff as to the reorganisation of studies had been obtained. "J. P." expresses this view in the following extract from his letter:—

"One of the reasons why it has been so successful is that former presidents have looked upon the college not as a field for the display of their own vanity, or for trying experiments

to prove their own powers of organisation, but as an institution of lofty traditions and high standards, the maintenance of which it has been their study to secure by constant watchfulness and such gradual changes as experience has shown to be necessary, rather than by hasty and sudden departure from the practice of the past. They have also recognised that the power of control vested in them is not one to be hastily and capriciously brought to bear upon every detail of the life of the college; that the members of the teaching staff are their colleagues and friends, men of honour, integrity and experience, whose advice and opinions on matters connected with their work should be sought for with eagerness and listened to with respect, even if they cannot ultimately accept them.

"When an institution has been worked under a particular system with conspicuous success for eight-and-twenty years, and in the twenty-ninth year we find, in place of order, chaos, in place of friendship and *esprit de corps* of the best kind, distrust and recrimination, when half the staff are dismissed with the notice that would be given to a coachman, and the other half are in the dark as to what their future duties are to be, when the students are on the verge of mutiny, and threats of dismissal are daily occurrences—it is not 'the system' which is to blame."

The president of the College apparently rules as an autocrat, and the members of the teaching staff have to do as he directs them, whatever their own opinions as to the scheme of work or value of subjects may be. The Board of Visitors has a conference with the president for an hour or so once a year, and his views or recommendations are naturally adopted. The board does not come into contact with the teaching staff, and the members are, therefore, unable to understand the conditions under which the work of the College is carried on. It is stated, indeed, that the Board of Visitors imagined the revised curriculum submitted to have been considered by the teaching staff, whereas the staff were not consulted.

We notice in the *Times* the statement that the Secretary of State for India has refused to grant the inquiry asked for, but it is to be hoped the matter will not be allowed to rest here. A strong deputation must be organised to present the memorial which we understand has been prepared, begging for an inquiry into the case, and directing attention to the position of the teaching staff in relation to the educational policy of the College. Unless there is a reformation, the case of the members of the staff left will be even worse than that of those who have been ordered to retire in such an inconsiderate way.

Among the signatures already appended to the memorial are those of—Lord Kelvin, Lord Lister, Lord Rayleigh, Sir William Huggins, Sir Frederick Abel, Sir Frederick Bramwell, Sir William Crookes, Sir Archibald Geikie, Sir Norman Lockyer, Sir Andrew Noble, Sir Henry Roscoe, Prof. Armstrong, Mr. W. H. M. Christie, Prof. Dewar, Prof. Ewing, Mr. R. T. Glazebrook, Mr. W. N. Shaw, Prof. J. J. Thomson, Prof. Marshall Ward, and of some seventy other Fellows of the Royal Society. Professors and teachers at all the educational centres in the country are sending in their names and testifying to the widespread indignation at the action of the India Office.

H. W. CHISHOLM.

MR. H. W. CHISHOLM, late Warden of the Standards, Board of Trade, died in his ninety-second year on January 16. He was formerly chief clerk of the office of the Comptroller General of the Exchequer, and on the abolition of that office in 1866 he was appointed to take charge of the old Department of Weights and Measures. In 1867 a new Standards Act was passed, by which all powers and duties of the Treasury and Exchequer were transferred to the Standards Department of the Board of Trade, and Mr. Chisholm was made the chief of the department with a salary of 1000*l.* per annum. In 1868, mainly on Mr. Chisholm's representations, a Royal Commission on Standards was appointed, on which he became an active member. The Commission included also the late Prof. W. H. Miller, Sir George Airy and General Sabine, eminent men of science, by whose efforts the Standards Department was raised to a prominent scientific position, furnished with proper standards of length, mass, capacity and cubic measurement, and with instruments essential for verifications for scientific purposes.

Mr. Chisholm held the appointment of Warden of the Standards until 1877, when he retired after fifty-three years of public service. With his retirement the title of Warden of the Standards was dropped, the duties then being undertaken by a superintendent of the Standards Department.

Mr. Chisholm issued an annual report during the ten years he held office, which was always full of information of great interest and public use, and in which metrological researches were dealt with in an exhaustive manner. For instance, amongst the subjects which his printed reports dealt with we find, besides the ordinary work of testing and comparing, standards of measure, &c., investigations as to the expansion of metals, density of water, effects of atmospheric pressure with reference to the measurement of gas, calculation of probable errors of observation in micrometric work, &c.

Mr. Chisholm took a prominent part in the early work of the Bureau international des Poids et Mesures at Paris, which was established under a Metric Convention; and he represented Great Britain at a diplomatic conference at Paris in 1875. In 1877 he published a book relating to the history, &c., of the standards, entitled "Weighing and Measuring" (Macmillan).

With Mr. Chisholm an important link has passed away between the old and the new civil servants, and all who had the pleasure of knowing him well will remember for many years his varied abilities, cheerful disposition, and his desire to help others.

NOTES.

IN consequence of the death of the Queen, all the lectures at the Royal Institution have been abandoned until further notice.

WE have received information from Cairo that the time ball at Port Said is dropped daily at 12 noon (30° meridian time) by direct automatic signal from Abbassia Observatory. Omdurman receives the same signal, and from about the middle of February the time ball at Alexandria will be similarly controlled. Arrangements have been made by which a daily weather telegram at 8 a.m. is exchanged between Alexandria and Malta, Brindisi, Trieste, Athens and Beirut. The information so received is posted outside the port offices at Alexandria and Pord Said daily for the use of shipping.

PROF. R. BLANCHARD has resigned his office of general secretary of the Zoological Society of France, after twenty-three years of service. The Society has decided to present him with a medal in commemoration of his work.

WE regret to see in the *Times* the announcement of the deaths of Dr. Danckelmann and M. Gramme. Dr. Danckelmann was director of the Prussian Royal Academy of Forestry at Eberswalde. He rendered great services to the science and art of forestry in Prussia, and was one of the first to advocate effectively the training of foresters in special colleges. He took a leading part in the teaching at Eberswalde and was the author of many interesting works on forestry. M. Gramme will be remembered by his inventions in connection with dynamos and electric batteries. For his dynamo he received 20,000 francs from the French Government and the Volta prize of 20,000 francs from the Academy of Sciences.

THE annual general meeting of the Geologists' Association will be held at University College on Friday, February 1. The president, Mr. W. Whitaker, F.R.S., will deliver an address entitled "Twelve Years of London Geology."

THE thirty-first course of lectures and demonstrations for sanitary officers will commence at the Sanitary Institute on February 1. There will be four lectures on elementary physics and chemistry in relation to water, soil, air, ventilation and meteorology; twenty-one lectures on public health statutes, the practical duties of a sanitary inspector, municipal hygiene, and building construction; and seven lectures on meat and food inspection.

CAPTAIN J. C. BERNIER, of Quebec, is in England, and has described to a Reuter's representative and the Royal Colonial Institute his plans for an Arctic expedition, which have received the approval of the Quebec Geograpical Society. His first plan is to enter Bering Strait during July, and, following the Siberian coast, the ice would be entered between 170 and 165 degrees, as far east as its state would permit, pushing north in August and September, and dropping buoys at intervals to test the ice drift. Monthly, as the wind suited, small balloons would be despatched with records, each balloon having a copy of the previous records. Photography would be largely employed, kites being used for long-distance photographs. With suitable appliances, it was known that a long distance could be run on the packed ice during the proper season. In the second spring and summer it is suggested that two routes be taken—one in a north-east, the other in a south-west direction—with stations at intervals, keeping communication with the ship by wireless telegraphy and gun signals. The routes would be marked at mile intervals by hollow staves, the hollows being filled with condensed provisions and records, and each staff would be numbered. When in the neighbourhood of the Pole, the north-eastern route would be extended to more stations, always in communication with the ship. These plans are to be laid before the Canadian Government.

THE annual report of the Council of the Institution of Mechanical Engineers was read at the annual meeting on Friday last. We learn from it that the award of the Willans premium has been for the first time in the gift of the Council, and, from the papers read before the Institution since the foundation of the fund in January 1895, they have selected that read in April 1895 by Captain H. Raill Sankey, on "Governing of Steam-Engines by Throttling and by Variable Expansion," as the most suitable for the award. Sir William Roberts-Austen is still at work upon the sixth report to the alloys research committee, dealing mainly with the effect of annealing and tempering on the properties of steel. Prof. F. W. Burstall expects to complete his second report to the gas-engine research committee in the course of a few weeks. Progress has been made in the experiments on the value of the steam-jacket, by Prof. T. Hudson Beare. Prof. D. S. Capper has made a first series of tests on the compound steam-jacketed engine at King's College with different steam-pressures and speeds, working single-cylinder, non-condensing. The results have been worked out, and are expected to be ready shortly. The Council have consented to take charge of the mechanical section of the Glasgow International Engineering Congress, the meetings of which will be held during the first week of September. They have also decided that these arrangements should not interfere with the ordinary summer meeting of the Institution, which will be held during the last week in July at Barrow-in-Furness. Mr. W. H. Maw has been elected to succeed Sir W. H. White as president of the Institution.

THE experiments made with a view to using liquid air as one of the constituents of an explosive are described by Mr. A. Larsen in a paper (No. 786) received from the Institution of Mining Engineers. The cartridges used for blasting trials in the Simplon tunnel consisted of a wrapper filled with a carbonaceous material, such, for instance, as a mixture of equal parts of paraffin and of charcoal, and dipped bodily in liquid air until completely soaked. The cartridges were kept in liquid air at the working face of the rock until required for use, when they were put quickly in the shot-holes and detonated with a small guncotton primer and detonator. The life of such a cartridge is, unfortunately, very short after the cartridge has been removed from the liquid air. A cartridge eight inches in length and three inches in diameter has to be fired within fifteen minutes after being taken out of the liquid to avoid a miss-fire. On this account the Simplon trials were discontinued; nevertheless, Mr. Larsen says that much attention is still being devoted to the matter in Germany, where investigations are being carried on in three different centres, one of them being the largest explosives works on the Continent, namely, the carbonite factory at Schlebusch.

A REPORT of the Government of India shows that during the year 1899 the number of deaths among human beings attributed to wild animals was 2966. Tigers caused the death of 899, wolves of 338, and leopards of 327 human beings, while bears, elephants, hyenas, jackals and crocodiles were accountable for a large proportion of the remainder. The loss of human life from snakes reached the high total of 24,621, a greater mortality than in any of the four preceding years. Nearly half the deaths occurred in Bengal, while the North-Western Provinces and Oudh came next with nearly one-fourth of the total. In Bengal the relatively high mortality is attributed to floods, which drove the snakes to the high lands on which village homesteads are built. As will be observed, snakes are more destructive of human life than are the wild animals, but the reverse is true of the destruction of cattle. In 1899 no fewer than 89,238 cattle were destroyed by wild animals, and 9449 by snakes.

THE U.S. Weather Bureau has published a very useful and comprehensive treatise on West Indian hurricanes, by Prof. E. B. Garriott (*Bulletin*, No. 232). The chief of the Weather Bureau points out that the paper in question reviews the writings of the more prominent meteorologists of the past century, so far as they refer to the tropical storms of the North Atlantic, and that it graphically illustrates and describes the more important hurricanes that have occurred during the last twenty-five years. A table is given (partly taken from that by Señor A. Poey) of the chronological occurrence of West Indian hurricanes since 1493. This list shows that while storms occurred in every month, the great majority took place between July and October. During the principal hurricane months the storms generally recurved east of the Gulf of Mexico, the mean track being farther west in September, when it approached very near the East Florida coast. But the tracks from 1878 to 1900, which are laid down on charts, show that during the principal hurricane months recurvature may occur from far to the eastward of the Bahamas to the west coast of the Gulf of Mexico.

WE have received from the meteorological reporter for Western India a copy of his "Brief Sketch of the Meteorology of the Bombay Presidency for 1899-1900." The meteorology of the year is of more than usual interest, owing to the almost unprecedented failure of the south-west monsoon rains over a large region, and the consequent partial or total failure of crops and water supply. From a statement showing the most severe droughts and famines of the last 150 years, and the areas affected, it appears that the drought of 1899 and famine of 1899-1900 extended over a very much larger area than that of

previous years. The failure of the rainfall was chiefly due to the weakness of the Arabian Sea monsoon current, which generally brings heavy rainfall in July and August. Another feature of the year was the abnormal high barometric pressure which obtained during the monsoon months. The observations of many years show that such conditions are attended by a general decrease in the rainfall; in the years 1876, 1896 and 1899, the most recent years of drought, the average pressures during the monsoon months were ·015, ·012 and ·054 inch, respectively, above the normal. It is noteworthy that in South Africa 1899 appears to have been a year of excessive rainfall.

THE *Electro-Chemist and Metallurgist* has made its appearance, and we trust it has come to stay; for it should be the means of directing attention to a very promising branch of applied electricity, and of advancing a knowledge of electro-chemistry. Germany has two periodicals devoted exclusively to electro-chemistry, and is in advance of us, not only in this respect, but also in the provision made for the study and use of electro-chemical processes. The first article in the new periodical, on "Recent Progress in Electro-chemistry," shows that England's share in the advances of recent years is not in proportion to her position in science and industry. It is stated that the total horse-power expended in electro-chemical industries is about 400,000, "equivalent to a total yearly production valued at over 30,000,000*l.*, of which the United States contributes between 60 and 70 per cent., Germany and France about 10 per cent. each, Switzerland about 2 per cent., and England not more than 1½ per cent." Among the subjects of other articles in the journal are little-known carbides, borides and silicides; electro-chemistry at the Paris Exhibition; deposition of metals from mixed electrolytes; and the present and future of accumulators. In addition, there are several pages of abstracts from foreign contemporary journals, and from recent patent specifications. The journal will be published monthly, and should have a wide sphere of influence in the electro-chemical and metallurgical professions in England.

TO the December issue of the *American Naturalist*, Prof. H. F. Osborn contributes the third instalment of his investigations into the origin of the Mammalia, taking as his text the evolution of the occipital condyles of the skull. It has been very generally supposed that the paired mammalian condyles are inherited directly from those of the Amphibia. This, however, the author considers to be a misconception; his objection being largely based on the circumstance that in the Amphibia the condyles are derived exclusively from the exoccipitals, without any trace of a basioccipital element. On the other hand, in many mammals, especially Echidna, the basioccipital forms the basal portion of the condyles, or, at all events, the intercondylar interval; and it is shown by figures how such condyles are traceable to the tripartite condyle of reptiles by the gradual abortion of the median basal element. In fact, one anomodont reptile (*Cynognathus*) has actually attained the dicondylar type by means of this elimination.

IN the same journal, Prof. C. S. Minot, preparatory to the publication of a text-book on the subject, calls attention to his own method of teaching mammalian embryology. He recommends, first, the study of pig embryos of from 9 to 12 mm. in length, and, secondly, larger examples of the same, after which the embryo chicken should be taken in hand to illustrate the germ-layers. Then should come the study of the fœtal envelopes, including the human placenta, and finally an investigation of the genital elements, segmentation, &c. Before calling attention to the importance of the "cervical bend" as distinctive of mammalian embryos, Prof. Minot takes occasion to refer to the superiority of the German system of "black line" wood-engraving for the purpose of illustrating embryological studies, the cheapness of German work being likewise an important factor.

DR. J. BEARD, of Edinburgh, has recently contributed to the current volume (xviii.) of the *Anatomischer Anzeiger* two suggestive papers bearing on the fate and function of that physiological puzzle, the thymus gland. In the former of these (Nos. 15 and 16) he identifies a certain structure in the spiracle of the ray (Raia) as the representative of the thymus. In the latter (Nos. 22 and 23) he arrives at the conclusion that the thymus is the source of all the "leucocytes" of all true vertebrated animals, and hence that it is the origin of all the lymphoid structures of the body. The latter statement, he observes, throws light upon the fact that the thymus is an example of an organ which, after being functional in early life, gradually atrophies. "This is only certainly known to happen in mammals, and from it the inference is drawn that in later life the organ ceases to exist. It no more ceases to exist than would the Anglo-Saxon race disappear were the British Isles to sink beneath the waves."

AN interesting description of the ravages of white ants, or termites, in Rhodesia is furnished by the Rev. A. Lebœuf to the *Zambesi Mission Record* for January. The special interest of the contribution centres in the account of the damage done to property by white ants in Rhodesia, which seems to be even greater than in India. It is no uncommon thing, says the writer, for the colonist, on returning from his day's labour, to find the coat he left hanging on a nail of his cottage wall and the books on the table absolutely destroyed by these tiny marauders. Nor is this all. "On awaking next morning," writes Mr. Lebœuf, "you are astonished to see in the dim light a cone-shaped object rising from the brick floor a short distance from your bed, with two holes on the top like the crater of a miniature volcano. Upon closer examination you discover that the holes have just the size and shape of the inside of your boots, which you incautiously left on the brick floor the night before. They have given form and proportion to an ant heap, and nothing is left of them except the nails, eyelets and, maybe, part of the heels." And as the same dismal story—with variations—has to be told about every other article of apparel and all perishable objects, it must be admitted that there are drawbacks to the lot of a settler in Rhodesia.

THE *Agricultural Students' Gazette* for December contains an appreciative article on the late Sir John Bennet Lawes, who always took a kindly interest in the success of the college at Cirencester.

THE West of Scotland Agricultural College has sent out an interesting report on a series of experiments on the growth of oats in the season of 1899. A considerable number of the leading varieties were grown under equal conditions in various districts of Scotland; their yield, as regards grain, straw, meal and husk, being subsequently determined. While the results of a single season—and that an altogether abnormal one—cannot be accepted as final, enough is shown to justify further attention being bestowed on the matter. Greater care should, however, be given in future to safe-guarding the crops against the depredations of birds and ground game, for where such pests are admitted to have interfered with growth, a justifiable lack of complete confidence in the results is engendered. On the whole the older varieties have come satisfactorily through the trial, most of the newer sorts being apparently unable to contend successfully with unfavourable conditions of growth. They have, moreover, in some cases an undesirably thick husk, and a correspondingly small kernel. It is to be hoped that Profs. Wright and McAlpine have continued this work during the past season.

THE current number of the *Journal* of the Royal Agricultural Society of England opens with an interesting account, from the pen of Dr. Voelcker, of the results obtained by means of pot-culture at the experimental station at Woburn. He first points out the advantages and the limitations of this form of research, and, like Wagner, of Darmstadt—the originator of this method of cultural experiment—advises that results obtained in pots shall subsequently be tested in the field before they can be confidently recommended to the attention of practical agriculturists. A considerable amount of time has been taken up in testing the effects, on farm crop-plants, of "rare forms of earth," as stipulated by Mr. Hills in his bequest. For the most part the results are not encouraging, though some benefit appears to have resulted from steeping the seeds of cereals in one per cent. solutions of sodium iodide and sodium bromide. Where equal numbers of large and small seeds of wheat and barley were sown in separate pots the yield was, rather unexpectedly, but little affected by the difference in character of the seed. The journal, further, contains some interesting matter on the manufacture and ripening of cheese, by Prof. Reynolds Green, and the valuable report of the Tuberculin Committee.

THE phenomenon of anaërobic life, originally discovered and defined by Pasteur as the existence of living forms in the absence of oxygen, has recently had fresh light thrown upon it by the important researches of Dr. Klett, of Würtemberg. Investigating the problems surrounding the production of spore-less anthrax outside the living body, Dr. Klett has found that if anaërobic conditions for the bacillus are provided by the substitution of nitrogen for air, the growth of the organism is not impaired, and spores develop as freely as under ordinary conditions. If, however, the air be replaced by hydrogen, no spores develop providing the nutritive medium is of a character which permits of the gas being in intimate contact with the culture. It is not, therefore, as supposed by so many investigators, the absence of oxygen which is responsible for the non-production of spores in so-called anaërobic cultivations of anthrax, and this view is also supported by Dr. Weil's experiments on this subject. The mystery of the phenomenon remains still to be solved; meanwhile Dr. Klett has provided a new method for the production of sporeless or asporogène anthrax, and in future it will be advisable to supplement the term anaërobic as applied to a micro-organism by referring to the conditions under which the latter was deprived of air.

THE Zoological-Botanical Society of Vienna will hold its Jubilee meeting on Saturday, March 30. Representatives of the various learned societies with which the Society is in correspondence are invited to the meeting. Information from those intending to be present is requested by the secretaries not later than the middle of February.

TWO communications have reached us from the U.S. Department of Agriculture (Division of Vegetable Physiology and Pathology). The first (*Bulletin* No. 25), by H. Von Schrenk, deals exhaustively with the diseases caused by fungi to which conifers are liable in New England, the symptoms of the disease, the nature of the injury inflicted, and the remedies. The parasitic fungi to which attention is specially directed are *Polyporus Schweinitzii*, *P. pinicola*, *P. sulfureus*, *P. subacidus*, and *Trametes Pini*. The second (*Bulletin* No. 23) describes a disease, known as the spot disease, to which violets grown in America are liable, so virulent that the cultivation of the flower has been abandoned in many parts of the country. It is due to a parasitic fungus, probably of American origin, which the author, Mr. P. H. Dorsett, describes as a new species under the name *Alternaria Violae*. Both papers are very well illustrated.

PROF. STRASBURGER has recently published, in the *Biologischen Centralblatt*, an account of his observations on certain diœcious plants, especially *Melandrium* (*Lychnis dioica*). It is well known that the flowers of this plant are normally unisexual, and that there are also certain correlated differences, *e.g.* the elongation of the internode between the calyx and the corolla, which are likewise characteristic of the staminate flowers. But whereas the stamens are, as a rule, reduced to minute rudiments in the female flowers, they are stimulated to develop, in a normal manner, if the plant happens to become infected with the smut fungus, *Ustilago violacea*. The stamens then grow and advance so far as to form the pollen mother cells in a manner indistinguishable from the process as it occurs in the ordinary staminate flowers; but the fungus, perhaps owing to the abundant supply of available nutrition, then becomes virulent, it kills and consumes the cells, and the anthers are finally filled with the purple spores of the parasite. Nor is this all, for the ovary becomes arrested in its development, the ovules hardly advancing beyond the embryo-sac formation. Moreover, the lengthening of the calyx-corolla internode referred to above also occurs, and these facts have given rise to the mistaken impression that the fungus merely castrated the stamens of a male flower, causing the female organs to develop. This is not the case, for when the male flowers are attacked there is no development of the pistil to be seen. Prof. Strasburger utilises these results as the basis for a treatise on the possibilities of artificially interfering with, or determining, the sex of unisexual organism, and the whole paper is well worth careful reading for the wealth of illustration and critical exposition which it contains. The conclusion is reached that it is not possible, at least in the higher plants and animals, to influence the sex of an individual either by nutrition or by modifying the normal physical environment. The organism in this respect develops on predetermined lines, and only an extraordinary stimulus can surprise the latent potentiality into active development.

A CATALOGUE of the recent marine sponges of Canada and Alaska is contributed by Mr. L. M. Lambe to the *Ottawa Naturalist* (vol. xiv. No. 9).

PROF. E. RICHTER has issued the fifth report on the periodic variations of glaciers (*Archives* des Sc. phys. et nat. Genève, tome x. 1900). References are made to glaciers in Europe, the Polar regions, North America and Asia.

MR. R. E. C. STEARNS publishes some revisions of the nomenclature of Tertiary land shells of the John Day Region in Western North America (*Proc.* Washington Acad. Sc. vol. ii. December 1900). Thus the species named *Helix* (*Aglaia*) *fidelis*, Gray (Stearns) now becomes *Epiphragmophora fidelis antecedens*, Stearns. Truly multiplication becomes vexation in the case of zoological names.

WE have received the annual report of the Geological Commission of the Cape of Good Hope for 1898 (Cape Town, 1900). It is a record of arduous but highly interesting work, hampered to some extent by the want of good maps, but of acknowledged advantage to the inhabitants of Cape Colony. The field-work has been carried out by Messrs. A. W. Rogers and E. H. L. Schwarz under the superintendence of Prof. Corstorphine, and they furnish detailed reports on the districts examined, including the country around Worcester.

THE Geological Survey of India has lately issued several important scientific works. In the Memoirs (vol. xxviii., Part 2) there is an essay on "The Charnockite series, a group of Archæan hypersthenic rocks in Peninsular India," by Mr. Thomas H. Holland. The history of the naming of this series is interesting. A hypersthene-granite, regarded as a new type, and composed of hypersthene, microcline, quartz and accessory iron-ores, was

discovered in 1892; and it was afterwards found that the tombstone of Job Charnock, the founder of Calcutta, was made of the same rock, so the name Charnockite "was suggested for it in honour of the man who was the unconscious means of bringing the first specimen of this interesting rock to the city which ultimately became the capital of India." The members of the Charnockite series are now fully described and illustrated. They are regarded as igneous in origin, and as intrusive in the older schists and gneisses.

In the "Palæontologia Indica" we have (in series xv., relating to Himalayan fossils, vol. iii. part 2) a monograph on the Trias Brachiopoda and Lamellibranchiata, by Dr. Alexander Bittner, a work translated by Dr. and Mrs. A. H. Foord. About sixty species are described. The genera are all well known and generally distributed in the Alpine Trias. Identical species, however, are only sparingly represented in India. Another monograph (belonging to series ix., Jurassic Fauna of Cutch, vol. ii. part 2) is on corals, by Dr. J. W. Gregory. A magnificent collection of corals from the Peninsula of Cutch was made by Wynne and Fedden and Stoliczka between 1867 and 1872. It was sent to England in 1890 in the hopes that the late Dr. Duncan would undertake the task of description. Owing to failing health he requested Dr. Gregory to carry out the work, and this the latter has now done with conspicuous ability, but not without much anxious consideration. The author was reluctant at first to treat as mere individual variations differences which in the case of the corresponding European corals are regarded as of specific value; but he was driven, and happily so, to this course, as the alternative was the creation of some 3,000 new species or varieties. The bulk of the collection comes from the Putchum Beds (Bathonian) to the north-west of Jumara, and they represent a coral bank rather than a reef. Some corals were obtained from the Chari Beds (Callovian and Oxfordian), and some indicate higher geological horizons. In all seventy-one species are described, and illustrated in a series of excellent plates.

The question of Hindu castes is treated by Mr. Tribhovandas Mangaldas Nathubhai in the *Journal* of the Anthropological Society of Bombay (vol. v. p. 74). He points out that "the present castes did not strictly adhere to their original distinguishing characteristics," and that the spirit of the original laws "not being rightly understood and followed, they yielded not the advantages intended, and produced evils never contemplated." The author makes some sensible remarks on the remarriage of widows; and with regard to the caste system he advocates, not abolition of caste or the raising of the status of the lower castes, but a reversion to the teaching of the Shastras. In the same number of the journal are some notes on the folklore of the lizard and ominous birds in India.

An article upon Huxley's life and memoirs appears in the January number of the *Quarterly Review*.

The meteorological observations made at the Adelaide Observatory and other places in South Australia and the Northern Territory during the year 1897, under the direction of Sir Charles Todd, K.C.M.G., F.R.S., are tabulated and discussed in a volume just published by the Government of South Australia.

A new volume of "The Fauna of British India, including Ceylon and Burma," edited by Dr. W. T. Blanford, F.R.S., has been published under the authority of the Secretary of State for India. The author of the volume is Mr. R. I. Pocock, who mentions in the preface that it "contains descriptions of all the species of Arachnida of the orders Scorpiones (scorpions), Uropygi (whip-scorpions), Amblypygi, Solifugæ, and of most of the larger and otherwise conspicuous species of Araneæ (true spiders) known to occur in British India, Burma and Ceylon, together with diagnoses of the genera, families and sub-orders into which they fall."

Popular Astronomy for December 1900 contains the address delivered by Mr. J. A. Brashear at the ceremony of laying the foundation stone of the New Allegheny Observatory at Riverside Park, Allegheny, Pa. The history of the institution is reviewed since its incorporation in 1860. Prof. F. L. Wadsworth is the present director of the Observatory. The existing fine equipment is to be considerably augmented, and a special feature is that one department is to be open day and night to the students in the high schools and higher grades of the common schools, and also to citizens—a proposal first suggested by the late Prof. J. E. Keeler, a former director.

Messrs. Iliffe, Sons and Sturmey, Ltd., have sent us the fourth edition of Mr. John A. Hodges' "Practical Enlarging." This edition, we find, has not only been thoroughly revised and brought up-to-date, but much additional matter has been included. The worker is provided with a sound and elementary practical handbook, and it is interesting and important to note what the author states in the preface, that "no formula is given, nor any method of working described, which I have not personally thoroughly tested and proved to be trustworthy." With the introduction and general use of hand cameras and lenses giving flat fields, the process of "enlarging" the originals is now so widely adopted that such a serviceable handbook as this will be found most useful.

"Willing's Press Guide" is a handy index to the press of the world. The newspapers and other periodicals included in the lists are classified alphabetically according to title, and are also arranged in other groups according to place of publication and subject. We notice a few curious entries in the various classes of scientific publications of the United Kingdom. Under Astronomy the reports of two observatories are included, and "Astronomical Leaflets" which are not known to us. Under Science also several unimportant publications are named, while others are omitted. For instance, the *Journal* of the City of London College Science Society is given, but the *Philosophical Magazine* does not appear in the list, though it does appear under Philosophy. Reports of local scientific societies are also mentioned under Science and other heads, but the "Year-Book of Scientific Societies" shows that the number of omissions far exceeds that of societies included. If space cannot be found for the reports of all important local societies concerned with natural history and other sciences, it would be better to omit such societies entirely. At present the lists do not give a correct view of the publications of societies of this kind.

Some interesting measurements of the electromotive force of concentration batteries containing non-aqueous solutions are communicated by L. Kahlenberg in the *Journal of Physical Chemistry* (vol. iv. p. 709). Whereas the E.M.F. of batteries containing aqueous solutions has been shown in very many cases to agree quite well with the potential difference calculated on the basis of Nernst's osmotic theory, the author's experiments indicate that the difference between the observed and calculated electromotive force is very considerable in the case of solutions in non-aqueous solvents. In view of the discrepancies, it is suggested that Nernst's formula should be subjected to a rigid test for the case of non-aqueous solutions.

A course of lectures on electro-chemistry to a large audience is only with great difficulty capable of being illustrated by quantitative experiments. The usual methods of measuring current, resistance, voltage, &c., cannot readily be adapted in a completely satisfactory manner to the exigencies of the lecture-

table. A measuring instrument to remedy the defects associated with the use of the ordinary apparatus is described by Messrs. Miller and Kenrick in the *Journal of Physical Chemistry* (vol. iv. p. 599). Provided with a dial two feet in diameter, and "dead-beat" in its action, the instrument is so arranged that ohms, mhos, volts and amperes can be read off directly, and it can be changed from any one use to any other without delay. A series of fifteen quantitative experiments, chosen so as to illustrate the various principles of electro-chemistry, and which can be shown to a large class by means of the instrument, are described by the authors.

THE additions to the Zoological Society's Gardens during the past week include a Stanley Crane (*Anthropoides paradisea*) from South Africa, presented by Mr. J. E. Matcham; a White Pelican (*Pelecanus onocrotalus*), a Lesser Black-backed Gull (*Larus fuscus*), European; a Yellow Hangnest (*Cassicus persicus*), a Common Boa (*Boa constrictor*) from South America, two Japanese Greenfinches (*Ligurinus sinicus*) from Japan, a Yellow-winged Sugar-bird (*Coereba cyanea*) from South America, a Three-striped Boa (*Lichanura trivigata*), a Chained Snake (*Coluber catenifer*), a —— Snake (*Zamenis taeniatus*), a —— Snake (*Rhinochelus lecontii*) from North America, deposited; an Axis Deer (*Cervus axis*), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

NEW VARIABLE STARS.—Two more variables are announced in the *Astronomical Journal*, vol. xxi. No. 487, as having been detected by Mr. R. T. A. Innes, at the Cape Observatory.

24.1900. *Arae.* This star is C.P.D. – 49° 10361, and has the position

	h.	m.	s.	
R.A. =	17	49	32	(1875).
Decl. =	– 49°	24′·9		

The range in magnitude is from 8·9 to 9·75, and the period very short—about 7h 28m. 36s.

25.1900. *Octantis.* This star is No. 9192 in Gillis's Polar Zones, and has the position

	h.	m.	s.
R.A. =	13	9	32
Decl. =	– 83°	34′·1	

The variation in magnitude is from 7·7 to 10·3.

THE ALMUCANTAR.—The Case Observatory, Cleveland, Ohio, has recently been equipped with one of the new type of instruments invented by Dr. S. C. Chandler in 1879, and in the *Astronomical Journal*, vol. xxi. No. 488, Mr. C. S. Howe gives a description of its construction and working, illustrated by photographs of the instrument in position. It is adaptable for all determinations usually made with the transit circle, as time, latitude, right ascensions and declinations, &c., but has several advantages. As the name implies, the instrument is inclined at a fixed elevation, generally equal to the latitude of the station, and being free to move in a horizontal plane, the times of passage over the parallel of altitude are observed in exactly similar manner to meridian transits; in general both transits may be observed, east and west. The advantages claimed are (1) elimination of flexure; (2) elimination of refraction errors depending on zenith distance, leaving only those produced by variations of pressure and temperature; (3) greater precision of fundamental plane of instrument; (4) greater extent of sky available.

The Case almucantar has an object-glass of 6 inches aperture and 60 inches focus, by Brashear, and instead of the telescope being inclined, the light is reflected from a mirror inclined at the proper angle, outside the object-glass.

The whole of this optical apparatus rests on a massive hollow iron ring 57 inches in diameter, which floats in mercury, means being provided for preventing lateral movement. The float, telescope tube and frame weigh about 1800 pounds, and additional weights are provided for adjusting the position of the centre of gravity. Preliminary experiments show that, although the instrument weighs about 2300 pounds, the oscillations after it has been moved die out in slightly over one minute, so that stars can be observed at intervals of three minutes. Another of these instruments, of about the same size as the above, has been erected at the Durham Observatory, and is described by Prof. R. A. Sampson in *Monthly Notices*, vol. lx. pp. 572–579.

THE ETHNOLOGY OF ANCIENT HISTORY DEDUCED FROM RECORDS, MONUMENTS, AND COINS.

SERIOUS students of ancient history are fully aware that the narratives which have been preserved by professional historians are usually so eclectic and so meagre in many important details that they require to be largely supplemented by other data before the full significance of the events can be appreciated. The spade of the archæologist has provided innumerable documents of the greatest historical importance which serve to supplement the imperfection of the written record, and the observations and measurements of the physical anthropologist have to be called into evidence as well as the comparative studies of the ethnologist. The historian who ignores archæology, physical anthropology and ethnology deprives himself of the most voluminous of historical documents which lead, when carefully studied, to accurate conclusions. Thus alone can written records be established.

As in the distribution of animals, so in that of man, it is impossible to draw a line of demarcation between Europe and Asia. The pure Northern European type is as distinct as possible from the true Mongol, but there is such a chain of links between these two primary human races that they pass insensibly into one another.

It is now generally admitted that the fair dolichocephalic European race (*Homo Europaeus*, the Northern or Nordic race of some authors, the Aryan of others), stretched in Neolithic times far away into Asia, where they mixed to a variable extent with the Mongols, more so to the eastward, less so to the westward. To portions of this hybrid population have been applied such terms as Allophylian, Turanian, Finno-Turki, Ural-Altaic, Ugro-Altaic, Turko-Tatar, Mongolo-Turkic, Tatar, Turki. Part of this spectrum of mixed peoples was spoken of by ancient historians under the collective name of Scythians, those in Europe being "Aryans," those in the extreme east being largely Mongolised.

A short, dark, brachycephalic race (*Homo Alpinus*, Alpine or Slavo-Celtic race) which wandered into Central France in Neolithic times still persists in a central zone across Europe and into Asia, and there can be little doubt that this element also entered into the population of Western Asia in very early times. But at whatever period they arrived, their descendants can be found amongst the Tadjiks, who are brown brachycephals and quite different from the brachycephals of the yellow race whose point of origin appears to have been towards Tibet, whereas Lapouge and Ujfalvy believe the former to have followed the dolichocephals either from Asia Minor or from Europe.

A third race, of medium stature and dark complexion, is the dolichocephalic Mediterranean group (*Homo Mediterranensis*). This was located in Neolithic times in Western and Southern Europe, Northern Africa, South-Western and Southern Asia. The Dravidian peoples of India do not now concern us, and attention need be drawn only to the Semitic branch of the Mediterranean race, with its various offshoots. It is possible that the rise of Babylonian culture was due, as Keane points out, to the influence of Semites on the indigenous Akkado-Sumerians, who were almost certainly of Finno-Turki origin.

The typical Mongols (*Homo Mongolicus*) are a short, brachycephalic people with a yellowish skin, high cheekbones, very characteristic eyes, lank, black hair on the head, and sparse hair on the face. This race is as purely Asiatic as the negro is African.

The easterly drifting of tall, fair, long-headed peoples speaking dialects of the Aryan group of languages took place, perhaps, about 2000 B.C. The migrants to India had scarcely attained the agricultural phase of culture, and it was not until the conquests of Alexander in 327 B.C. that a true civilisation flourished in the Panjab. The Persian branch advanced much more rapidly, owing to their proximity to the ancient civilisations of Mesopotamia.

Few portions of the world have had so complex a history as the region between the Caspian Sea, the Persian Gulf and the

Himalayas. Streams of migrations have passed through this district, to be caught up into ethnological eddies of which written history is incompetent, by itself, to unravel their intricate movements and blendings.

There is insufficient evidence concerning the physical type or types of the ancient inhabitants of Persia, but one predominant primitive Persian type resembled that of the ancient Hindus, that is, both were long-headed (dolichocephalic), narrow-faced (leptoprosop), with long, thin noses (leptorhine). They also had skulls of but slight height, which were flattened above. In all these respects these Persians of the time of the Achæmenian dynasty resembled the Macedonians of the time of Alexander the Great, and these traits are also represented on Greek coins of the archaic style.

Nearly two hundred years later we again meet with this ancient form of skull, but with slight modifications. On the very beautiful sarcophagus from Sidon is represented a battle (? of Arbele) between Macedonians led by Alexander and Persians under Mazaïos, one of the bravest of the generals of Darius. The main differences between the physical characters of these two nations consist in the head of the Persians being higher and the forehead broader and more vertical than that of the Macedonians. The latter were still characterised by a rather low, flat head, by a rather retreating forehead, and often with prominent supra-ciliary ridges and a well-marked nasal notch. The nose of the Persian is very delicate, but inclined to be arched. Their beautiful eyes are more sunken, but less widely open than those of the Greeks. This superb monument has the inestimable advantage of retaining some of its original coloration, and all the Persians, like the Macedonians, had fair or red hair.

FIG. 1.—Coin of Kadphises II., King of the Kushans; circ. 55 A.D.

On the road from Nineveh to Ecbatana is a most interesting bas-relief, carved on the face of a rock by Darius to commemorate his victories over ten kings and princes, whose portraits are carved, and we have portraits of Semites, Persians, a Mede, Magian, Armenian and Sacian. Behind Darius are represented two Achæmenian Persians, who have a gently-curved cranial vault, a high forehead and a curved nose with a slightly flattened tip. The Magian, who is also a Western Persian, is broad-headed. Dolichocephalism is predominant among the Iranians of this period, and more so among the Eastern Iranians.

A gradual transformation of the Persian type was accomplished in the interval between the downfall of the dynasty of the Achæmenids and the accession of that of the Sassanids (*i.e.* from 328 B.C. to 240 A.D.). The heightening and shortening of the head, amongst other characters that affected the old Iranian type, was due either to the slow substitution by a very brachycephalic pre-existing population or to infiltration from neighbouring countries. Ujfalvy points out that the first of these hypotheses is without any historical foundation, although one would expect to find representatives of the alpine race in Iran at that period, so for the present we must rely on the second alternative. We know, from de Sarzec's excavations, that in Babylon in very remote times there was a mixture of races in which a "Turanian" (Ujfalvy) element was present. This transformation of the Iranian type was helped by the arrival of the Arsacian Parthians, who brought heterogeneous peoples in their train.

A study of the coins of the Parthian kings of the dynasty of the Arsaces also reveals an interesting series of changes. The aryanised tatar type of the first three Arsaces was transformed in the fifth Arsace (Mithridates I., 174–136 B.C.) by a mixture of races of which we have historical evidence, and the skull became elongated and flattened; but we find Mithridates III. (Arsace XI.), 60–56 B.C., with a very short and excessively high skull, which was retained till the end of the dynasty in 227 A.D. Nevertheless, all through the series the face was practically unchanged. The Chinese annalist, Ma-touan-lin, says of the A-si (Parthians), "they marry their elder and younger sisters and even their mothers in the same manner as animals," and Lucian uses an identical phrase.

Other alterations of the physiognomy of the Persians were shown in the very aquiline nose, widely open, sunken and almond-shaped eyes. One very typical characteristic of some of the Sassanidan warriors is the great height of the chin, which is still to be seen among the Hadjemis of Persia.

Among the living Tadjiks and Sarts of Central Asia, as among some stocks of Afghanistan and Western Himalaya, we meet, after some 2000 years, with individuals in whom the facial characteristics, and in some cases their crania, remind one of the portrait heads of the Grecian kings of Bactria and India. The low height of the head among the Afghans, of the natives of Kafiristan and of the Dards, the noble profile of the Pandits of Kashmir, are all heirlooms from a remote time. Also the long, well-formed nose of the Tadjiks, their wavy beard and crafty expression of face recall the typical coins of Persian satraps. These latter, as well as the Arsaces and Sassanids, appear to have been leptoprosopic brachycephals, as the unmixed survivors of the old Persians in India are to this day, for, after twelve centuries of exile, the Parsis of Bombay retain these ancestral traits.

When the portrait coins of the Greek kings of Bactria and India are compared, there is no difficulty in seeing a racial resemblance. In the first Bactrian princes the head is low like that of the typical Macedonians, in the later kings it is higher till eventually the head was almost high. The prominent brow ridge of the Macedonians was very persistent, but it, too, was diminished in the last Bactrian kings; the same held good for the marked notch between the forehead and the nose. The prominent, delicate nose of the early Greco-Bactrian kings became short and thick; these princes were almost exclusively leptorhine, and only, last of all, became mesorhine, but were never platyrhine. The chin of the Greco-Bactrian princes was round and full, but less prominent than in the Macedonians or Syrians. There is a fairly regular gradation among the Greco-Bactrian kings when placed in chronological order, not only in the increase of the height of the head, but also in the decrease of the head-length. The face, too, had a tendency to broaden and shorten, for while leptoprosopy was the rule, chamæprosopy was sporadic and was found in only a few of the later Greco-Bactrian kings. Thus it is evident that the purity of the royal family had been impaired by marriages with women of a different stock.

Allusion has been made to Scythians. Certain Asiastic so-called Scythian nations have played an important part in Western Asia, and we must now see what light monuments and coins can throw on the relationships of these much-discussed peoples. The three Scythian groups known as the Sacæ, Kushans and Epthalites constitute an instructive series.

At the time of the Achæmenian kings, the Sacians (Sakas) occupied all the regions between the lower course of the Silis (Iaxartes) and Lake Balkash. "They," says Herodotus, "were in truth Amyrgian Scythians, but the Persians called them Sacæ, since that is the name which they give to all the Scythians." They were renowned for their bravery and wealth and were recognised tributaries of Persia, and formed the advance guard of the empire against the east, as they were settled in the plains of Turkestan almost at the confines of China.

It would appear that even at this time the Sacæ were a mixed race, as, according to the *Chinese Annals*, the Ssé or Sek (who are identified with the Sacæ) originally inhabited Southern China, but they occupied Sogdiana and Transoxiana at the establishment of the Greco-Bactrian monarchy. Towards 165 B.C. they were dislodged from Sogdiana by the Yué-tchi, who themselves were flying before the Hiung-nu. The Ssé thus dispersed invaded Bactriana, chased in their turn from Bactriana by the Yué-tchi in 120 B.C., the Sacians passed over the Paropamisus (Hindu Kush) and directed their steps towards Southern Afghanistan, occupying Sakastan (Seistan to Arachosia); but a century later they were again harassed by

the Yué-tchi, and a part of them, under Maues, founded a kingdom in the Panjab, where they quickly appropriated Hellenic culture.

The Sakas appear to have been mesaticephalic; the height of the head was rather low, they had straight eyes, a well-formed nose, straight, projecting chin. Ujfalvy remarks that they were not true Scythians, as the Aryan element was outweighed in them by another strain. They are nearer to the typical Parthians, but they are not Tatars.

For two thousand years they have persisted, and in the Balti of to-day Ujfalvy recognises the direct descendants of the Sacæ who, about 90 B.C., invaded India from the north over the Karakoram passes, since, in their physical features, the Balti strikingly resemble the effigies on the rock carvings or on the coins of the kings of the Sacæ. The Pamir countries of the Chugnan and Sirikol still retain Sacian linguistic traces.

The Chinese annalists inform us that the Yué-tchi were located in eastern Turkestan, south of the Celestial Mountains, but being invaded by the Hiung-nu in 201 and 165 B.C., they fled to the west and spread over Sogdiana and Bactria, and dispossessed the Ta-hia (Tadjiks). The annalist thus speaks of the inhabitants of Sogdiana: "Sunken eyes, prominent nose and bushy beard, they excel in trade," just like the living Tadjiks. The primitively nomadic Yué-tchi became sedentary and prosperous in this fertile country. In B.C. 25 Kieu-tsieu, or Kudschula, whom the Greeks called Kadphises, the prince of the Kuei-schuang (Kushan), one of the five tribes of the Yué-tchi, conquered the four other tribes, and, crossing the Hindu Kush, invaded

FIG. 2.—Coin of Jayatu Mihirakula (Mo-hi-lo-kiu-lo of the *Chinese Annals*), last King of the Hûnas; 515–544 A.D.

Kophen (Ki-pin of the *Chinese Annals*), the country of the Asascides, and took possession of Kabul. His son Kadaphes conquered most of Northern India, and this empire lasted till towards the commencement of the fifth century of our era. The *Chinese Annals* tell us that Ki-to-lo (Kidara of the coins) chief of the Great Kushans, yielded before the incursions of the Ephthalites, crossed the Paropamisus and settled at Gandhara, in the Valley of Kabul. Towards 475 A.D. the Ephthalites, or White Huns, conquered Gandhara, forcing the Kushans to retire in the Chitral and up to Kashmir. After the defeat of Mihirakula, the last Huna king, the Kushans preserved their power in these regions till the ninth century of our era.

The Kushans appear to have been a brachycephalic folk with a normal head, high forehead, straight eyes, powerful Semitic nose, full mouth, with a somewhat Semitic cast of countenance, but not in the least Mongolian; there was a full beard. These, according to Ujfalvy, are Tatars and not Mongols, the true Scythians of Hippocrates; with Keane ("Man, Past and Present," p. 322) we may call them a Turki people.

They were a gifted and powerful people, and, in consequence of their high political endowments and their adaptability, they played a predominant part alike in Bactria and North-west India, and to a large extent contributed to the formation of the present racial type north and south of the Hindu Kush, and especially so among the Dards of the Himalayan Valleys.

The Hoa or Ye-tha, originally a small people located to the north of the Great Wall of China, were hunted from their territory by the Yuan-Yuan (or Avars?) and fled to the west, and eventually invaded Transoxiana (425 A.D.) and founded a great empire as far as North-west India. The invasion of Europe by Attila (430 A.D.) and that of the Caucasus by the Kidarite Huns were the result of the same pressure of the Yuan-Yuan.

The Hoa sovereigns had the family name of Yé-ta-i-li-to (Ephthalites) which became the name of the dynasty; this was abridged to Ye-tha. Unlike the Yué-tchi they remained nomads, and, as the Chinese annalists inform us, they practised polyandry. Their empire lasted till 557 A.D., when the Tu-kiu (Turks), profiting by the troubles that had fallen on the Hoa or Huna, seized the government. After their defeat, the Ephthalites did not disappear from Turkestan but retired to the east, while another portion mixed with Kushans south of the Oxus.

The Chinese annalists give various interesting accounts of this people. The Hoa migrated with their flocks and did not live in towns. The women took a good standing; brothers took a wife in common, and the women wore a horn on their headdress for each husband that they had. The people were cruel, valiant and bellicose, and had strict laws.

According to the coins the three kings of the Hûnas (the White Huns or Ephthalites of India) were absolutely hairless, the face has a savage expression, the eyes appear somewhat oblique, the nose is large, jaw powerful, neck fleshy, ears immense and in two of the kings recall the legendary pointed ears of Attila. The occipital region of the head is deficient, the vertex being produced into a truncated cone; this remarkable shape must have been the result of artificial deformation, which greatly exaggerated the natural brachycephaly. They are still Tatars, but approach the Mongolian type.

Polyandry was one of the most characteristic traits of the Hoa, and it still persists in the regions which formerly belonged to their empire. The employment of the horned headdress, which was formerly associated with polyandric practices, still exists among the inhabitants of Kafiristan.

There are still many problems awaiting solution among the intricacies of Asiatic ethnology, and it may be that some of the foregoing conclusions will require emendation, but there can be little doubt that the brilliant researches of C. de Ujfalvy have paved the way to a clearer comprehension of the ethnic affinities of various ancient historical peoples, and his papers in *l'Anthropologie*, Tomes IX. (1898) and XI. (1900), and in the *Archiv für Anthropologie*, Bd. XXVI. (1899), are full of references to the labours of his distinguished fellow-workers, Drouin, Percy Gardner, de Lapouge, Maspero, Rapson, Specht, Stein and others.

ALFRED C. HADDON.

THE CURRENTS IN THE GULF OF ST. LAWRENCE.

THE result of investigation of the currents in the Gulf of St. Lawrence, by the Survey of Tides and Currents, has been issued recently in the form of a pamphlet by the Department of Marine and Fisheries, Canada. These investigations were carried on by Mr. W. Bell Dawson, in charge of this Survey, and were made during the summer months of 1894, 1895 and 1896; and they are supplemented by information collected personally by him from captains of vessels, fishermen and others having a long experience in the Gulf. The examination of the currents was made chiefly along the lines of the leading steamship routes which traverse the Gulf. It thus comprises the more open area of the Gulf rather than the estuaries and straits in which stronger tidal streams occur locally.

In the investigations a steamer was employed. It was anchored in positions carefully selected for the purpose in view. These were in all depths, up to 250 fathoms. The steamer thus served as a fixed point from which to observe the behaviour of the current. The observations of the current and of the force and direction of the wind were continuous day and night. Both the surface current and under-currents were investigated, current-meters, registering electrically, being chiefly used for the purpose. Temperatures and densities were also obtained at all depths, to 200 fathoms; and these indications were found of much assistance in tracing the movement of the water. For fuller descriptions of the methods and appliances employed, some of which were specially adapted to the conditions in the Gulf, the reports of progress issued from year to year by this survey must be referred to.

With regard to the general circulation in the Gulf area, the investigations point to its being, broadly speaking, a movement

of rotation in a left-handed direction. It has been proved that there is no great influx of cold water into the Gulf area through Belle Isle Strait, as was formerly supposed. On the contrary, the chief interchange of water between the Gulf and the ocean is at Cabot Strait, the wider entrance to the Gulf south of Newfoundland.

We cannot enlarge further on these interesting results, as the information as now published is in as concise a form as it can be put. We desire, rather, to draw attention to some points which the investigations themselves emphasise, and which are of general application elsewhere in similar work.

The most important of these is the relation of the under-currents to the current on the surface. These were examined everywhere, to a depth of 30 fathoms at least, as this depth extends almost uninterruptedly over the whole Gulf area. It may be thought, at first sight, that the direction of the under-current has no bearing upon the movement of the water as it affects navigation. In such a region as the Gulf of St. Lawrence, however, the currents in the summer months are all very moderate in their speed, usually ranging from half a knot to one knot per hour; and their direction on the surface is accordingly much influenced by the wind. It was found in these circumstances that the movement of the under-current at 20 or 30 fathoms often showed more definite characteristics; as, for example, a tendency to make constantly in some one direction, or to vary with the tide. The wind is thus a disturbing element; and the under-current, being more in accordance with the normal conditions of the locality, will come up to the surface as soon as the disturbing influences which have been acting on the surface of the water cease to operate.

It may be unfortunate, from the point of view of the navigator, that it is the surface of the water to a depth of 5 or 10 fathoms which is so readily and so frequently disturbed; but, on the other hand, it is clear that it is essential to make a careful investigation of the under-current in order to understand the surface current itself. The study of the under-current is also necessary, if any hope is entertained of arriving at the general circulation in the Gulf or the true relation of its currents to the causes which influence them.

When a period of some length is considered as a whole, and the under-current is also taken into account, it becomes possible to trace the general circulation of the water; which depends upon a greater movement in some dominant direction rather than in other directions, when long averages are taken.

The primary tendency in the surface current is thus to follow the direction which the general circulation has in the locality in question; but this tendency is disturbed and often overcome by the influence of the tide and wind. The tidal influence shows itself chiefly as a veer in the direction of the current, which is either through a limited range or completely around the compass; and it is also probable that the tides themselves are irregular in some localities, owing to interference. When the wind remains in one quarter and has any considerable strength, the drift which it gives to the surface water soon extends to a depth of five fathoms or more, and its influence thus makes itself felt throughout the thickness of the surface layer which affects shipping. As a rule these influences are all acting at the same time; and it is their combined effect which gives rise to the actual behaviour of the surface current.

A knowledge of the general circulation is also important to mariners, as it includes all the more constant currents, and it shows the direction which the surface current tends to take when undisturbed. Although there are few instances of currents in the Gulf area which run steadily enough to be termed constant, we have yet found it possible, from continuous observation or long experience, to arrive at a dominant direction for each locality; or the direction in which the current runs more frequently, and in which, therefore, the water makes on the whole.

With regard, also, to the drift of ice as an indication of the set of the current, a superficial view may readily be taken; but it is here pointed out that to infer correctly the set of the current it is necessary to distinguish between the different kinds of ice met with and their relation to the movement of the surface of the water and to the under-current, respectively.

This is illustrated by the character of the ice met with in the Gulf of St. Lawrence, which is of three kinds:—(1) Berg ice, or true icebergs, found in the vicinity of the straits opening into the ocean. (2) Flat or pan ice, forming fields or in broken pieces, usually not more than 6 feet in thickness, but sometimes as thick as 10 feet. This often jams or shoves along the shore or between islands, and may form masses 20 feet or more in thickness, but it can never be mistaken for berg ice. (3) River ice, from the St. Lawrence River and its estuary. This is also flat ice, but it can be readily distinguished by its appearance from the Gulf ice.

The berg ice, from its great depth in the water, will evidently move with the under-current; and it will not be appreciably affected by the wind. These bergs do not necessarily indicate the direction of the current as affecting shipping, except when the surface current has also the same direction. They show in reality the average direction the current has between the surface and the depth of their draught. This draught is limited to about 30 fathoms by the depth of the Belle Isle Strait. They are thus of much value as an indication of the general movement or circulation of the water.

The relation of the flat ice to the wind and current requires some little consideration. It is, of course, just as true of this ice as of the berg ice, that the greater part is under water; but, as it is almost always in broken pieces, more or less piled and with upturned edges, the wind has a much greater hold upon it, in proportion to its total weight, than on the berg ice. Even when this is allowed for, its depth in the water still gives the current a greater hold upon it than the wind has. For example, if such ice is drifting with a current in a given direction, and the wind is blowing across that direction at right angles, the ice will seldom be set more than two points, or three at the most, off the true direction of the current. When the ice becomes soggy or water-soaked and loses its edges, as it does later in the spring, it will set still more correctly with the current.

When the surface current itself is moving in the direction of long-continued or prevalent winds, as it often does in the Gulf, the flat ice naturally follows the same direction too. Also, in regions where the current is tidal, and the ice in calm weather would drift as far in the one direction with the flood tide as in the other direction with the ebb, the direction in which it makes, on the whole, will depend upon the wind. It is probably for these reasons that it is so often said that the ice drifts with the wind; although this merely expresses the fact, without distinguishing between the relative influence of the wind and the current upon it.

There is also a direct effect which the ice has upon the strength of the current in regions where the direction of the surface drift is under the influence of the wind. The broken and upturned edges of the ice give the wind a much greater hold upon the water than it otherwise would have. Hence during long continued winds the speed of the current is appreciably greater than if the ice were not present. This is undoubtedly the explanation of the common belief which is expressed by saying that "the ice makes its own current." It may be well to recall that the weight of the ice itself is the same as the water which it displaces; and, therefore, the wind has no greater mass to set in motion in producing a surface current than if the ice were to melt and refill the hollow which it makes in the water; yet the presence of the ice gives the wind a better hold than it would have upon the surface of open water free from ice.

There is one condition of the ice which may prevent it from showing correctly the movement of the water. When it is set against an island or headland and packed together for a long distance out, with open water beyond, it may circle round as on a pivot. The outer edge of the pack may thus make a long sweep very different in its path from the true set of the current; and its movements also become irregular, as vessels caught in such ice which are near together in the evening may be ten or fifteen miles apart in the morning.

The influence of rivers flowing into such a land-locked area as the Gulf of St. Lawrence is also discussed, with approximate measures of volume which show how small the volume of even such a river as the St. Lawrence is, relatively to the water in motion in a costal current, which is more nearly comparable with an ocean current.

The probable balance of flow between the Gulf and the ocean is also explained, but measurements of volume of even an approximate kind are wanting to give precision to the results. The importance of such investigations with regard to the movements of fish, which must be influenced by the temperature of density of the water, is also emphasised, in view of the large annual value of the Canadian fisheries.

The further investigation of the currents has been discontinued since 1896 for reasons of economy; but the tides themselves are receiving careful attention, and already trustworthy tide-tables

are issued by the Survey for the more important Atlantic harbours, as well as for the Pacific coast of Canada. The tides are complicated by a great variation in range, and the observations secured will serve also as a basis for future investigation of the currents, many of the strongest of them being tidal in their nature.

THE ABSORPTION SPECTRA OF SALINE SOLUTIONS.

IN the *Scientific Transactions* of the Royal Dublin Society (vol. vii. series ii. pp. 253-312), Prof. W. N. Hartley gives the results of a long series of experimental investigations which he has undertaken to determine the action of heat on the absorption spectra and chemical constitution of saline solutions. After reviewing previous researches by Schœnbein, von Babo, Schiff, Gladstone, Bunsen, Melde, Burger, Vogel, Landauer, Morton, Bolton and Russell, the author gives a description of his mode of experimenting. Wedge-shaped cells containing the liquids under examination were heated in an air-bath with glass sides. The sources of light used were sunlight and an argand burner fed with oxygen.

Then the absorption spectra of solutions of the salts of nickel, copper, cobalt, chromium, uranium, didymium, and various permanganates are described, with details of the measurements, accompanied by drawings from, or reproductions of, the photographed spectra. Much of the discussion is directed to the bearing of the spectral evidence as to the constitution of the solutions, and the following conclusions indicate the results arrived at :—

(1) The absorption spectra of different salts of the same metal, whether solid or in solution, are not identical, even when the spectrum is a marked characteristic of the metal.

(2) When a definite crystalline hydrate dissolves in a solvent which is not water, and is not a dehydrating agent, the molecule of the salt remains intact.

(3) In any series of salts which are anhydrous, and which do not form well-defined crystalline hydrates, the action of heat up to the temperature of 100° C. does not cause any further alteration in their absorption spectra beyond that which is usual with substances which undergo no chemical change by such rise of temperature. The change is usually an increase in the intensity of the absorption, or a slight widening of the absorption bands.

(4) As a rule the crystallised metallic salts, in which water is an integral part of the molecule, dissolve in water at ordinary temperatures without dissociation of the molecule.

(5) Crystallised hydrated salts, dissolved in a minimum of water at 20° C., undergo dissociation by rise of temperature. The extent of the dissociation may proceed as far as complete dehydration of the compound, so that more or less of the anhydrous salt may be formed in the solution.

(6) The most stable compound which can exist in a saturated solution at 16° or 20° C. is not always of the same composition as the crystalline solid at the same temperature, since the solid may undergo partial dissociation from its water of crystallisation when the molecule enters into solution.

(7) Saturated solutions of hygroscopic and deliquescent salts combine with water when diluted to constitute molecules of more complex hydrated compounds in solution.

(8) When a saturated solution of a coloured salt undergoes a great change of colour upon dilution, or any remarkable change in its absorption spectrum due to the same cause, the dilution is always accompanied by considerable evolution of heat.

CONFERENCE OF SCIENCE MASTERS IN PUBLIC SCHOOLS.

WHILE carrying out the important work of spreading scientific instruction in this country, our educationists should make themselves quite sure that the teaching already inaugurated is what it claims to be. Care must be exercised in order that a training in habits of exactness and observation is imparted, as well as an appreciation of the principles of science quite apart from a mere knowledge of facts. By intelligent practical work upon the part of the individual scholar this alone can be attained, and under present circumstances such exercise is difficult to successfully organise in schools.

Expensive laboratories and able masters are of no avail if the necessary conditions be not introduced. The scientific staffs of our large public schools are fully aware of their responsibility to the nation, and what is lacking to enable them to fulfil it. It might, therefore, be thought that they would have been the very first to advocate the necessary changes, but their position, it will be seen, is such a peculiar one that, without strong general feeling behind them, their trouble would be all thrown away.

With the dawn of the new century, however, and in view of the present agitation for an improved system of scientific education, the public school science masters have combined all their energies for the attainment of that end. On January 19, therefore, a conference was held at the rooms of the University of London, and was attended by a thoroughly representative body of men. Sir Henry Roscoe, Vice-Chancellor of the University, and a member of the governing body of Eton College, occupied the chair, and explained the importance of the action taken.

Among the papers read, that by Mr. Oswald H. Latter, of Charterhouse, contained perhaps the most general observations. "Science teaching," he told us, "was first introduced into our public schools as a sop to a growing public opinion, and with a desire to impart a gentlemanly acquaintance with scientific matters. The broad-minded persons who ventured on this new departure imagined, unfortunately, that the admirable mediæval methods of classical and mathematical teaching were equally well suited to the new comer, who, however, had to be content with a very small portion of the temporal possessions of its elder bretheren." Mr. Latter then urged the necessity of a scientific education for future legislators, and our commercial and professional men, and from a national point of view. Form teaching would do much, he considered, to remove the incubus of ignorance and apathy in the coming generation, the following being his recommendations with regard to it:—

(1) Science should be raised to the dignity of a "form subject," and no longer be regarded as a more or less negligeable extra. It should enter for at least one hour into the ordinary work of every day, and claim, at any rate, some portion of the time devoted to preparation. There must be some lopping of the old branches of education if good fruit is to be borne by the engrafted scion.

(2) A classification according to proficiency in science throughout the school.

(3) At least half, and with lower forms more than half, of the allotted hours should be devoted to systematic laboratory work in the elements of physics and chemistry.

(4) The teaching should be continued to the sixth forms instead of being deliberately withheld from them as is so often the case, a distinction which at once narrows the intellectual horizon of the ablest boys in the school, and degrades the subject in the eyes of the remainder.

Mr. E. E. Ashford, of Harrow, would with very good reason teach some physics before chemistry, and, if possible, elementary biology before either, for, he said, let us first use the facts a boy knows to teach the methods of science. All boys, he continued, are acquainted with many bits of natural history, and its general laws were more easily appreciated than the more exact ones of the other sciences. The paper by Mr. Ashford concluded with the following resolution, which found favour with the meeting, viz., that "it is essential that every boy before leaving school should go through a course of practical measurement and experiment involving no previous theoretical knowledge."

Prof. Armstrong, who was present, true to his tenets that academic words should not be used in schools, suggested nature-study in place of biology, but the terms were not recognised as synonymous by several speakers, and so he was somewhat misunderstood. Mr. A. Vassall, in describing the work at Harrow, recommended that the biological lessons should form a continuous course, and it must be remembered that the boys (over fourteen and under sixteen years of age) he teaches are not tiny children for whom unconnected object-lessons are best adapted. The list of lessons given to the conference well illustrated Mr. Vassall's plea for the "judicious skipping" of subjects not quite suitable for introductory work. Mr. Cumming, of Rugby, used, he said, to teach all his boys botany; he owned, however, that he had no qualifications but a love of the subject, and it is not surprising that the other sciences he has since substituted have succeeded better.

Mr. W. D. Eggar, of Eton, pointed out that, owing to external pressure, many public schools had started elementary

physical measurements for small boys, following Board School methods ; but that in the latter institutions mathematical and science teaching were continuous, the same master teaching both to the same boys. In public schools the two subjects are kept separate. Much of what is now taught in the laboratory could more usefully be acquired in mathematical class-rooms with all the necessary apparatus. Mathematics would gain enormously, and much valuable science time be saved. Here Mr. Eggar submitted that he was only urging the adoption of practical mathematics which Prof. Perry had long advocated, and without opposition, but also without any visible effect upon the universities, which still, among other things, demanded a modicum of unapplied and undigested algebra. Sir Henry Roscoe bore out what Mr. Eggar had said, and proposed that a meeting of mathematical masters should be held, at which Prof. Perry might possibly convince them. Speaking as a mathematical master, Mr. Hurst, of Eton, cordially agreed with the views of Prof. Perry and Mr. Eggar ; he stated, however, that limited time and the requirements of the universities utterly forbade their adoption in his own case. Another point emphasised by Mr. Eggar was that trigonometry mechanics should be introduced at an earlier stage into the teaching of mathematics, and his resolution that "some knowledge of physics should be required of all candidates for a university degree," was carried unanimously.

The universities came in also for a good deal of criticism, among other examining bodies, from Mr. C. Falkner, of Weymouth. Their entrance science scholarships cause boys to specialise while too young, and before they have got a sound foundation upon which to base their education. No college seems to require the same scope of science, and this necessitates what amounts to the private coaching of every boy in the scholarship class of a public school. Mr. Falkner had some very good suggestions to make for the improvement of these and army examinations, and repeated the plea that is now finding much favour, that teachers and examiners should meet and work together.

The paper by Mr. W. H. Lewis, of Exeter, was not discussed, owing to the author's absence. It dealt with the desirability of longer hours and smaller classes, and larger staffs. The difficulty which a "literary" head-master has of realising the peculiarly laborious nature of science teaching where complicated apparatus has to be fitted up was also alluded to.

An interesting survey of the work of school natural history societies was to be found in the address by Mr. A. Vassall, of Harrow, and the discussion upon it. Many advantages were claimed for the subjects involved, from the education of future landowners and travellers as well as for the boys at school. The sectional system, which divides workers up into groups according to their study, was advocated. Compulsory games very often spoiled matters, and individualism, Mr. Vassall very rightly pronounced, was thereby extinguished. Public opinion among the boys and the standing aloof of those with influence, as well as the apathy of many masters, were also cited as obstacles in the way of field work at schools. Nevertheless, quite a number of successful societies at present exist.

Many suggestive methods of actually dividing up the time for teaching were given by various members of the conference ; but, one takes it, the most useful purpose it will serve is to bring before head-masters, governors of schools, and examining bodies the results of the experience and the serious recommendations of a body of picked scientific men whose hearts are in their work. WILFRED MARK WEBB.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

THE annual meeting of the Association of Technical Institutions will be held on Tuesday, January 29, in the Fishmongers' Hall, London. An address will be given by Sir W. Hart Dyke, Bart., M.P.

WE learn from *Science* that Dr. D. K. Pearsons has given Colorado College 50,000 dollars, promised some time since, and it is reported that he has given Northwestern University 30,000 dollars for the erection of a woman's dormitory, and 200,000 dollars to an educational institution, the name of which is not to be made public during his life time. It is believed that Dr. Pearsons' gifts to educational institutions amount to three million dollars.

SCIENTIFIC SERIAL.

THE *Journal of Botany* for January contains a useful paper by Mr. Arthur Lister on the cultivation of the Mycetozoa from spores. Mr. George Murray and Mr. C. Bucknall contribute a discussion on the question whether the box, *Buxus sempervirens*, is a native of Britain. They conclude that this is unquestionably the case with the locality near Wootton-under-Edge, an adjacent farm having been known as "Boxwell" for at least seven centuries. This increases the probability of the shrub being indigenous also in other localities, including Boxhill, near Dorking. Mr. W. Carruthers and Miss A. Lorrain Smith have a paper on a disease in turnips caused by bacteria. Prof. Potter has named the bacterium *Pseudomonas destructans*.

SOCIETIES AND ACADEMIES.

LONDON.

Geological Society, January 9.—J. J. H. Teall, F.R.S., President, in the chair.—The geology of South-Central Ceylon, by John Parkinson. In this communication the author endeavours to give some account of the relations between the various granulitic rocks of Ceylon. A series of more or less isolated sections were studied, the rocks in each considered under separate heads, and conclusions put forward relative to the whole.—Note on the occurrence of corundum as a contact-mineral at Pont-Paul, near Morlaix (Finistère), by A. K. Coomára-Swámy. The intrusive granite of Pont-Paul, near Morlaix, contains highly altered fragments of sedimentary rock. The minerals found in them are biotite, muscovite, corundum (first recorded by Prof. Barrois in 1887), plagioclase, andalusite, pyrite, magnetite, sillimanite, green spinel, and zircon.

Mathematical Society, January 10.—Dr. Hobson, F.R.S., President, in the chair.—Prof. Love, F.R.S., made a communication on streaming motions past cylindrical boundaries. Mr. Basset, F.R.S., also spoke on the subject.—Mr. Campbell read a paper entitled "A Proof of the Third Fundamental Theorem in Lie's Theory of Continuous Groups."—The President communicated a paper by Mr. E. W. Barnes on the zeroes of Bessel's functions, and a paper on some cases of the solution of $x^{p^n-1} \equiv 1$, mod. p, by Prof. F. S. Carey.

Zoological Society, January 15.—Prof. G. B. Howes, F.R.S., Vice-President, in the chair.—Mr. W. E. de Winton exhibited and made remarks on a skin of the large grey Cynictis (*Cynictis selousi*), obtained by Mr. P. C. Reid on the west bank of the Linyanti River, South Africa. The species had been described from a skull only, from Bulawayo, and the skin of the animal had previously been unknown to naturalists.—Mr. O. Thomas exhibited, on behalf of Mr. R. Lydekker, a specimen of the skull of a common fox (*Canis vulpes*) with two upper canines on each side of the jaw.—In describing the collection of fishes brought home from Lakes Tanganyika and Kivu by the Tanganyika Exploring Expedition, under the leadership of Mr. J. E. S. Moore, Mr. G. A. Boulenger pointed out that the study of this important collection did not modify the conclusions embodied in his first report published in 1898. The exploration of Lake Kivu had thrown no light on the origin of the Tanganyikan fauna ; the smaller lake proved to be very thinly populated with fishes, which all belonged to widely distributed genera, the species showing a mixture of Nile and Tanganyika elements, with two that might prove to be endemic. The list of the fishes from the two lakes comprised 91 species, 74 of which had been named by the author. The collection now described consisted of examples of 50 species, 26 of which were new to science, 2 being made the types of additional genera of the family *Cichlidae*.—Mr. G. A. Boulenger read a paper on a collection of freshwater fishes made by Dr. W. J. Ansorge in the Niger Delta. The collection was described as one of exceptional interest. One of the two new genera, for which the name *Phractolaemus ansorgii* was proposed, constituted the type of a new family (Phractolæmidæ), intermediate between the Osteoglossidæ and the Clupeidæ. The second new genus, *Polycentropsis*, belonged to the Nandidæ, a family new to Africa ; its position was regarded as near the South American *Polycentrus*. A new *Gnathonemus* and three new *Pelmatochromis* were also described.—A communication was read from

the Rev. O. Pickard-Cambridge, F.R.S., containing an account of some new and interesting spiders collected in South Africa by Mr. G. A. K. Marshall, and in the Malay Peninsula and Borneo by Mr. R. Shelford.—Mr. F. E. Beddard, F.R.S., contributed a fourth instalment of his notes on the anatomy of Picarian birds, which contained an account of the skeletons of the ground-hornbills (*Bucorvus cafer* and *B. abyssinicus*) and notes on other species of hornbills.—A communication from Dr. A. G. Butler contained notes on and a list of the butterflies recently collected by Captain H. N. Dunn on the White Nile.—Dr. F. G. Parsons read a paper on the muscles and joints of the giant golden mole (*Chrysochloris trevelyani*), based on an examination of three specimens of this animal. The author found that previous observations, which had been made on less material, though mainly correct, were somewhat inaccurate in details.

Entomological Society, January 16.—Annual Meeting. Mr. G. H. Verrall, the President, in the chair.—It was announced that the following had been elected officers for the session 1901–2. President, the Rev. Canon Fowler; Treasurer, Mr. R. McLachlan, F.R.S.; Secretaries, Mr. Herbert Goss and Mr. H. Rowland-Brown.—The President referred to the losses the Society had sustained during the past session by the deaths of Mr. Spence, the Baron de Selys-Longchamps, Mr. Blatch, Major G. Cockle, Mr. P. Crowley, Lord Dormer, Mr. J. H. Leech, Dr. W. H. Lowe, Prof. Joseph Mik, Prof. Emile Blanchard, Dr. Staudinger, and other entomologists. He then delivered an address, in which he dealt chiefly with the abuses and errors which have crept into entomological nomenclature and the reckless manner in which types of various genera are described from single specimens, without careful study of the many forms which a single insect may assume even in a limited locality. He especially deprecated the publication of supposed new species or varieties before their identity had been certainly established, where the object of the author was to claim something more than a contribution to material for determination. In the vexed problem of priority in nomenclature, he expressed himself all in favour of retaining distinctive names only when such names were neither offensive to good sense nor grammar, and cited instances in which a printer's error was still received as orthodox, while the obvious and original name given by the inventor was rigorously discarded. Lastly, in reply to those who have questioned the value of entomology as a science, he mentioned several amusing instances of what an experienced entomologist might do in the way of turning his knowledge to practical account. Commentators on the work of the late Robert Louis Stevenson were unable, but anxious, to discover whether the notes made by him in a certain book were written before or after he had taken up his residence in Samoa. A fly which had been squeezed between the pages settled the question, for Mr. Verrall at once pronounced the remains as those of an insect peculiar to the Polynesian islands.

Institution of Mining and Metallurgy, January 16.—Mr. A. G. Charleton, Vice-President, in the chair.—Notes on mine surveying, by G. A. Troye. In this paper the author refers chiefly to the practice in the Transvaal, and briefly describes the methods employed there. He aims at a high standard in a mine surveyor, who, he thinks, in addition to essential requirements, should be expected to be a competent geologist, with a thorough knowledge of the occurrence of ore deposits, their dislocations, &c. He considers that it is to him the management should appeal in cases of disturbed ground, and he, more than any one, should be able to quickly find a lode lost through displacement, and should be held responsible for the proper development of a mine. Numerous examples explain the different forms of calculation. Stress was laid upon the necessity of checking all survey work most carefully, and to attain this the co-ordinates are always calculated by the author from two sides of a triangle in order to obtain independent results. The traverses are calculated by inverse multiplication of the natural sines and co-sines of the angles of direction or bearings. A strong point is made in the paper of the desirability of having substantial permanent bench-marks both above and below ground, the latter being labelled with a numbered tin ticket. This, the author says, has proved of great advantage to the mine-manager, sampler, &c., and facilitates work of all kinds, especially when a change of staff takes place. Many useful hints are given as to conducting a survey, keeping the field-book and calculating results.—Paper on electro-silvered *versus* plain copper plates, by Edward Halse. In this paper the author deals with the question of the use of electro-silvered plates in gold milling in preference to plain copper plates, and quotes in support of his view various works on the metallurgy of gold. An important question to the millman is whether silvered plates extract more gold from the crushed ore, and the author is convinced from experience that this is the case and that therefore silvered plates should supersede plain copper plates in gold milling. He gives numerous tables of results in support of his view, and the paper contains much useful information. In the discussion it was pointed out that in many cases the percentage of gold extracted was low in consequence of the failure of the millman to keep his plates clean, and the importance of the increased use of "elbow-grease" rather than chemicals was strongly emphasised.—Note on an improved native gold-mill, by the same author. The note gives details of an improved mill worked by overshot water-wheel erected by the Colombian Mines Corporation at Antioquia, Colombia, where the water supply was much in excess of requirements.—Note on the geology of Lake Nyasa, by Alexander Richardson. The author describes Lake Nyasa as a sheet of clear water some 360 miles in length by from 14 to 40 miles in width, lying at an altitude of 1500 feet, its deepest part being 1000 feet below sea-level. After describing the geological formations he goes on to say that whilst as yet no valuable minerals have been discovered in British Central Africa, half-caste Portuguese at one time worked alluvial gold between the Angoni country and the Zambesi, and gives it as his opinion that workable gold will be found in the mountainous region to the west. For half the year the climate is wet and malarious and for the other half dry, cool and healthy.

Royal Meteorological Society, January 16.—The President, Dr. C. Theodore Williams, in the chair.—Annual General Meeting.—Reference was made to the celebration of the Society's Jubilee on April 3–4 last, and also to the death of Mr. G. J. Symons, F.R.S., who had amongst other things bequeathed to the Society about 2200 volumes and 4000 pamphlets from his valuable library.—Dr. C. Theodore Williams delivered the presidential address, taking for his subject the climate of Norway and its factors. He considered that its meteorology should prove an attractive study for the Society as having much in common with that of our country, both the Norwegian and the British shores being influenced by the same Gulf Stream, and having their winters and summers tempered by the same equalising agency. The factors which influenced the climate were: (1) the insular character of the country; (2) the distribution of the mountain ranges, which explains to a large extent the rainfall; (3) the waters of the ocean, which, from a variety of circumstances, come into close connection with much of the country and thus temper extremes of climate; and (4) the sun, which in this latitude remains in the summer long above the horizon, and in the winter long below it. The address was illustrated by a large number of lantern slides of Norwegian scenery, embracing mountains, glaciers, fjords, &c.—The election of officers and council for the ensuing year then took place, Mr. W. H. Dines being appointed president, and Dr. C. Theodore Williams treasurer.

Linnean Society, December 20, 1900.—Prof. S. H. Vines, F.R.S., President, in the chair.—Mr. B. Daydon Jackson exhibited two editions of Hill's "Flora Britannica," the earlier, of 1759, being apparently unknown to bibliographers. This edition differs from the usual issue of 1760 in having a different title-page, and publisher's name: the copy exhibited wants the plates mentioned on the title. The species ascribed to the genus Statice are three in number; in modern nomenclature one species of Armeria and two of Statice.—Prof. Howes, F.R.S., exhibited a couple of pigeon's egg-shells, cast up at the mouth by the tropical African egg-eating snake *Dasypeltis scabra*, now living in the Zoological Society's Gardens, and called attention to the presence of a series of spiral and longitudinal fracture-lines, pointing to an elaborate co-ordinate muscular activity in the "crushing" process, the probable nature of which he discussed, in the light of the recent investigations of Katheriner into the anatomy of the animal and the observations of Miss Durham upon its feeding habits.—Prof. Poulton, F.R.S., exhibited a living specimen of the death's-head moth (*Acherotia atropos*), and proved with a stethoscope that the late Prof. Moseley was correct in stating that the sound comes from the proboscis. He also showed that all sound ceased the moment the tip of the

straightened proboscis was dipped in water, and could not be resumed until the organ was withdrawn; thus supporting Prof. Moseley's opinion that the sound was produced by forcing air through the proboscis. Prof. Poulton also exhibited projected photographs of *Acraea unicolor* var. *alcippina* recently received from Sierra Leone by Mr. Herbert Druce, together with specimens of *Limnas chrysippus* var. *alcippus*, which they closely resemble. He showed that this Acræa is represented in the South and East Central regions of Africa by varieties which correspond to the respective forms of *L. chrysippus*; that in fact the geographical coincidence between the two is much closer than with the forms of the female of *Hypolimnas misippus* and those of *L. chrysippus*. The former is one example of Müllerian mimicry, both forms being independently distasteful; while the female Hypolimnas is generally regarded as a Batesian mimic.—Mr. Arnold T. Watson read a paper on the structure and habits of the Ammocharidæ, a group of marine Polychæte worms which inhabit sandy localities and are protected by tubes of unique structure.—Mr. I. H. Burkill read a paper on the flora of Vavau, a little known island of the Tonga group, on which some remarks were made by the President.

PARIS.

Academy of Sciences, January 14.—M. Fouqué in the chair.—The President announced to the Academy the death of M. Ch. Hermite, member of the Section of Geometry, and of M. Adolph Chatin, member of the Section of Botany.—On the theory of precession, by M. H. Poincaré. The secular variations of the terrestrial equator, as determined by Stockwell, lead to an entirely different coefficient from that obtained by Backlund using the method of Gylden. It is shown on analysis that the coefficients obtained by Stockwell are correct, there being a fundamental error in the method of Gylden.—Researches in the formation of organic sulphur compounds, by M. Berthelot. A study of the thermal properties of the mercaptans, the heats of combustion and formation of ethyl mercaptan, ethyl sulphide, amyl mercaptan, amyl sulphide, and allyl sulphide being given.—New researches on the isomerism of the sulphocyanic ethers, by M. Berthelot. Measurements of the heats of combustion and formation of phenyl isosulphocyanide.—The gaseous products disengaged by the action of heat from some igneous rocks, by M. Armand Gautier. Granites from different sources were heated in a vacuum with syrupy phosphoric acid, the gas evolved measured and analysed. The quantities found were very considerable, varying from 560 c.c. to 5438 c.c. per kilogram. The gases found consisted of sulphuretted hydrogen, carbon monoxide and dioxide, methane, hydrogen, nitrogen and argon. From analyses of the gases given off at different stages, it is shown that the gases are not simply stored up in the rock, but result from reactions at the temperature of the decomposition.—On the effects of the substitution of alcohol for sugar in food upon muscular action, by M. A. Chauveau. The question as to how far alcohol can replace sugar in a mixed diet is of considerable physiological interest, the question being attacked by means of the respiratory coefficient. As a net result of a lengthy series of experiments upon a dog, it is concluded that the alcohol introduced, although very rapidly absorbed by the organism, only participates to a very small extent, if at all, in the combustions from which the muscular system draws the energy necessary to its working. The alcohol is not an energy producing food, its introduction into a food having rather the opposite effect.—On the new Giacobini comet, by M. Perrotin.—On quadruply periodic functions, by M. Georges Humbert.—On orthogonal systems admitting of a group of Combescure transformations, by M. D. Th. Egorov.—On the correlation of the experiments made at Dijon in 1894 for the application of the idea of a common return for telephonic circuits, and on experiments made since 1894 on telephony without wires, by M. Rheins.—Action of hydrogen upon bismuth sulphide, by M. H. Pelabon. The action between hydrogen sulphide and bismuth is a reversible one, and has been studied experimentally by the author at a temperature of 610° C. Three reactions were studied, hydrogen and the sulphide of bismuth, hydrogen sulphide and bismuth, and hydrogen with a mixture of sulphur and bismuth.—On the chlorobromides of thallium of the type TlX_3TlX, by M. V. Thomas.—On the combinations of the chlorides of phosphorus with boron bromide, by M. Tarible. Bromide of boron in presence of the chlorides of phosphorus react with great facility to form double compounds. These bodies, which are well crystallised, are decomposed by cold water, by chlorine, and by ammonia.—On the new mode of preparing hydrated sodium peroxide, and their properties, by M. George F. Jaubert. Although sodium peroxide when treated with water is decomposed into oxygen and caustic soda, if treated with moist air free from carbonic acid, no decomposition takes place, water being absorbed and hydrates formed. Hydrated sodium peroxide is stable in the cold, and may be kept for six months without appreciable alteration.—Determination of the latent heats of vaporisation of some substances in organic chemistry, by M. W. Louguinine. Figures are given for aniline, methylethylacetoxime, anisol and butyronitril.—Study of uranium nitrate, by M. Œchsner de Coninck. Determinations of the densities of solutions of uranium nitrate in nitric and sulphuric acids.—The oxidising action of ammonium persulphate upon some immediate principles of the organism, by M. L. Hugounenq. A study of the oxidation of uric acid, bilirubin, hematin and blood by ammonium persulphate.—On the structure of the vascular plants, by M. G. Chauveaud.—On the occurrence of a mineral smelling of free fluorine at Beaujolais, by M. Jules Garnier.—On the Neomylodon and the mysterious animal of Patagonia, by M. André Tournouër.

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