THURSDAY, MARCH 25, 1909.

## TIDAL RESEARCHES.

*Manual of Tides.* Part V., Currents, Shallow-water Tides, Meteorological Tides, and Miscellaneous Matters. By Rollin A. Harris. Appendix No. 6: Report for 1907 of U.S. Coast and Geodetic Survey. Pp. 231–545. (Washington: Government Printing Office, 1908.)

THE author is to be congratulated on having brought to completion in the present volume a full and exhaustive study of existing knowledge relating to tides and tidal phenomena, previous instalments of which have appeared in similar form from time to time since 1894. The subject-matter dealt with is of a miscellaneous character, summarising those parts of the subject which could not be previously introduced without undue diversions.

The early chapters deal with the nature of the horizontal flow in steady streams or pipes, and seek to establish simple laws governing the action of friction in such streams. Various formulæ are derived or quoted which appear to accord well with the results of observation, and in which for the most part the action of the cross-eddies set up is found to be well represented by a term proportional to the square of the velocity of flow of the main current.

In applying these results to tidal phenomena, doubtless the direct action of viscosity is insignificant, and it is through the medium of such cross-eddies that friction is chiefly effective. If, however, this is the case, it would appear that the sensible effects of friction in modifying ocean tides would be localised in those regions where the configuration of the land or of the ocean bed gives rise to a magnification of the tidal flow large enough to be accompanied by such eddies, and that the principal phenomena of the tides in the open ocean will suffer practically no disturbance from frictional causes other than those which may be attributed to pure viscosity. We are thus unable to accept the author's conclusion, arrived at in the second chapter, as to the paramount effects of friction in determining the phases of ocean tides, a conclusion based on wholly unwarranted assumptions as to the quantitative effects of friction (*e.g.* "Suppose $\mu'=\frac{1}{2}$," p. 281), and, further, on an almost complete disregard of its laws of action as exemplified in the preceding chapter. The author, in fact, reverts to the analogue of the simple pendulum subject to purely viscous dissipation.

The conclusions, as we have elsewhere pointed out, are of vital importance [1] for the establishment of a theory of the tides put forward by the author in previous volumes which has not proved acceptable to ourselves, and, in our opinion, has vitiated much of the otherwise excellent work presented. Fortunately, the influence of this defective theory does not appear to extend further into the present volume, which contains much for which students of the tides, whether from a practical or a theoretical aspect, will be grateful.

In the theory of river tides the author follows Airy's treatment, which, while admittedly inadequate, serves to elucidate some of the more pronounced phenomena indicated by observation, and draws interesting conclusions with regard to the form and dimensions of estuaries.

The chapters relating to the distribution of tidal currents in various phases throughout the world constitute perhaps the most important contribution contained in the present volume. Besides giving a comprehensive summary, amply illustrated by diagrams, from all available records, the author has included much material dependent on observational data specially worked up for the present publication.

Among other matters dealt with, we may refer to the subject of seiche oscillations in lakes, the general circulatory system of the ocean, and many matters which will prove of interest to marine engineers.

In relation to a work where so much is praiseworthy, it is with reluctance that we have felt it again necessary to emphasise these points on which we differ from the author. Were the work addressed to mathematicians alone, this would not have been considered necessary, but a word of warning seems to be desirable to a large class of readers to whom it will appeal who, without following out the intricate mathematics involved, might otherwise be disposed to accept the results as authoritative. The work as a whole can scarcely fail to stimulate further researches into the more recondite problems connected with tidal phenomena. S. S. H.

[1] NATURE, vol. lxxiii., p. 249. "Of course it may be contended that in the case of the tides the conditions necessary to render friction the controlling factor exist, but this contention is nowhere put forward explicitly by the author, and we are of opinion that it could not be substantiated."

## THE MORPHOLOGY OF ASIA.

*The Face of the Earth.* Vol. iii. By E. Suess. Translated by H. B. C. Sollas. Pp. vii+400; 7 plates, 23 figures. (Oxford: Clarendon Press, 1908.)

THE Oxford translation of the third volume of Suess's great geomorphology will be welcomed as warmly as its predecessors, though this part of his work is perhaps of less educational value and a smaller proportion of it interesting to general readers. Most of this volume is occupied by a detailed account of the stratigraphy of central and northern Asia. Much of the literature is so inaccessible that Prof. Suess's summary of the researches of the Russian surveyors will be of permanent value as a work of reference, and as he interprets and correlates the facts with his usual genius, the work is of the highest value as an original contribution to the tectonic geology of Asia. It is accompanied by a most valuable map of the structural geography of Central Asia.

The main thesis of this volume is Suess's statement of the essential structure of Asia and of its relations to Europe. He maintains the fundamental unity of Eurasia, and shows that it has been built up, around, or upon a vast sheet of ancient rocks, which form the Russian platform of Poland and south-western Russia, and most of Scotland and Scandinavia; the old rocks are buried beneath recent

deposits in Western Siberia, but they reappear and form the surface of wide areas in central and eastern Siberia. This northern section of Eurasia forms Prof. Suess's primitive "Scheitel." It forms the foundation of Asia, and is bounded along its southern edge by concurrent mountain chains. The Ural mountains might be considered the western member of this peripheral series, but Suess regards it as a mountain line lying on this continental block which extends beyond them into western Europe; and he describes the Variscan Mountains of southern Germany and the Armorican Mountains, the worn down fragments of which form the hills of Belgium, Brittany, Devonshire, Cornwall, and southern Ireland, as the westernmost preserved parts of the marginal chains. It is, therefore, obvious from the broken ends of the Armorican Mountains that Eurasia must once have extended far westward into the Atlantic. Scotland and Scandinavia, however, are now the westernmost portions of this ancient continent. Prof. Suess briefly re-describes them, in reference to the great overthrusts that have been demonstrated during the past twenty-five years; and he considers why the overthrusting was westward in Scotland and eastward in Scandinavia. This section of the book even now requires revision, since Björlykke's monograph shows that Scandinavian opinion is not as unanimous as to the existence of the overthrusting as is represented, while the trend of opinion in Scotland for some years past has been against the view that the Scottish schists include altered Silurian rocks.

The second fundamental element in the structure of Eurasia was the long inland sea, the Tethys, that once separated northern Eurasia from the lands to the south. The Tethys is still represented in the western area by the Mediterranean; but in Asia it has been drained by uplift.

The third constituent of Eurasia is the fragments of Gondwanaland left in the Asiatic peninsulas. The union of the ancient continent to the north with the southern peninsulas by the disappearance of the eastern Tethys has formed the existing continent of Asia.

Even more care has been taken over the translation of this volume than of its two predecessors, and the accurate translation by Dr. Hertha Sollas has been revised by a group of distinguished geologists as a tribute of respect for Prof. Suess. The whole was then revised by Prof. Sollas. The French translation of this volume has the advantages of a fuller series of maps and sections which M. de Margerie has added to the rather scanty series supplied with the original; and the geographical terms in its sections are translated. A student might easily be confused by seeing Wasserschiede, Pass, and place-names in German transliterations all on the same section. It would have been an advantage to English-speaking students if the proper names had been given in English instead of in German forms, as it is sometimes difficult to identify them in British atlases or indexes. With this mass of foreign names occasional misprints are inevitable; thus, on p. 393, Sjörgen appears instead of Sjögren, and the Ekne schists are said to be possibly of Devonian instead of Caledonian age.

British geologists will be so grateful for this scholarly translation that they will be little disposed to criticise the rendering of Suess's geological terms; but it would be convenient if the original term were sometimes, as in the French translation, given in a footnote. Thus what Suess calls the "Scheitel" is translated the vertex, a term of doubtful suitability for an area extending from Scotland to eastern Siberia and from the Arctic Ocean to the Black Sea. Occasionally we find the other extreme and a German word retained where there appears to be an established English equivalent. Thus we read of a Garbenschist as if that were an accepted English petrological term.

The translation of the next volume is promised at the same time as the publication of the German and French editions, and as in it we may expect the general summary of Prof. Suess's conclusions, it will be eagerly awaited. J. W. G.

## INFANTILISM.

*On Infantilism from Chronic Intestinal Infection, characterised by the Overgrowth and Persistence of Flora of the Nursling Period.* By Prof. C. A. Herter. Pp. v+118. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1908.) Price 4s. net.

IN a monograph of a hundred odd pages, the author presents a detailed study of five cases of severe nutritional disorder occurring in children. He regards them as typical examples of a distinct pathological condition, which he calls intestinal infantilism. He claims that this is a definite disease, distinct from, although sometimes associated with, other nutritional disorders, such as rickets, anæmia, marasmus, &c.

The patients were children between the ages of four and seven. They were all healthy at birth and during infancy, but in the second or third year of life they developed symptoms of intestinal disturbance, accompanied by failure of nutrition, which culminated in a state of complete arrest of physical growth for periods of months or years.

When they came under observation, a year or more after the onset of symptoms, these patients exhibited a striking clinical picture. Children of five, seven, or eight years of age weighed less than normal children of two. A boy (case 1), at the age of eight, weighed 31 lb., his development having been arrested since the age of three. Associated with their physical condition, the patients showed a chronic and very marked degree of muscular fatigue, a moderate grade of anæmia, and in some of the cases slight rickets. Their mental powers were retained to a very great extent, although naturally they were backward in comparison with normal children who were able to play games and to go to school.

The disturbance of intestinal function was shown by absolute intolerance of carbohydrates and great difficulty in the digestion of fats and earthy salts. The appetite remained ravenous, but the patients were unable to digest or assimilate food. The stools were

pale, bulky, with abundance of undigested fat, and showed evidence of putrefactive changes. In the fæces and stools obtained by calomel catharsis from the upper intestine, the normal bacilli, viz. gram-negative forms belonging to the *B. coli communis* and *B. lactis aerogenes* group, appeared absent, while the bacterial elements belonged to the gram positive group, the most constant being one which the author named *B. infantilis*.

As improvement set in there was a gradual return to normal bacterial conditions. The author says that the relation of *B. infantilis* to the genesis of infantilism must be left open, but it is certain that in its most extreme form intestinal infantilism is associated with the persistence and dominance of types of intestinal flora which belong to the period of infancy, and the persistence of which, in the third to eighth year of life, must be regarded as pathological.

The author believes that the cause of arrested development is due to serious defect in the power of absorption and digestion of food-stuffs. In treating these cases he found that drugs, purgatives, and intestinal antiseptics, gave little help. With careful hygienic and dietetic supervision the intestinal disturbance was checked, and gradually, although often with the utmost difficulty, an increase of weight followed.

The observations on which this study is based were of a purely clinical nature, and the deductions cannot be accepted as conclusive, but they are suggestive and interesting, and are presented by an investigator of experience. L. G. A.

## *PLASTICITY IN PLANTS.*

*The Heredity of Acquired Characters in Plants.* By the Rev. Prof. George Henslow. (London: John Murray, 1908.) Pp. xii+107; 24 illustrations. Price 6*s*. net.

THE object of Prof. Henslow's book is "to prove that evolution—so far as plants are concerned—depends upon the inheritance of acquired characters." "This was Darwin's contention." See, for instance, the summary statement on p. 424 of the sixth edition of the "Origin of Species"! "Present-day ecologists who study plants in nature are all at one in accepting the fact that evolution in plants is the result, not only of a natural response to the direct action of changed conditions of life, by means of which they evolve new structures in adaptation to their new environments, but that these acquired characters *can* become hereditary." The author calls this, for some strange reason, "the true Darwinism." His general argument, which is backed up by many very interesting facts, may be illustrated by taking the following instance:—"A certain plant of a Trichosanthes, happening to have its tendrils touching the wall of the glass frame in which it grew, instantly developed a number of minute pads which adhered to the wall, though such a structure is not known to exist in the cucumber family at all." A common sea-weed, *Plocamium coccineum*, makes similar pads if a tip happen to press against another sea-weed. Mere mechanical force produces through response hereditary structures. In the American Virginia creeper the tendrils form adhesive tips when they touch the wall. These are not hereditary, but the power to form them is. In the Japanese Virginia creeper they are partially developed before there is any contact with the wall. "They are hereditary, but quite useless until contact has taken place, when they at once begin to develop into perfectly adaptive structures. Such is obviously a result of a response with adaptation to a purely mechanical contact of the soma with the wall, and before any reproductive germ-cells exist." As the author says, "botanists have this great advantage; they have *facts* to deal with, and no theories whatever to maintain."

Prof. Henslow's book is of much value in giving fine examples of the plasticity of plants under external stimulus, *i.e.* of the appearance of new features in unwonted conditions. But it is difficult to decide how far the observed change of structure in an individual plant is a direct result of the environmental influence, and how far it is due to the liberation or inhibition of constitutional possibilities established long ago. The author thinks the first view is the correct one, and he points out that similar modifications are exhibited in similar conditions by many quite unrelated plants. As to the heritability of modifications the individual occurrence of which is recognised by all, Prof. Henslow admits that changed plants may at once begin to change back again when the novel stimulus is withdrawn, but he maintains that the acquisition may last long enough to show that it was hereditary. This is a crucial point, and should have been worked out more precisely. The author gives cases like the following:—Lesage made plants, such as garden-cress, succulent, by watering them with salt water; plants raised from seed of the somewhat succulent salted plants were still more succulent in the following year.

The general conclusion of Prof. Henslow's book is that "the origin of species is due to the joint action alone of the two great factors of evolution—*Variability* and *Environment*—without the aid of natural selection; although we are, and are likely to remain, profoundly ignorant of the mysterious process (of *Response*) within the organism by which it is effected."

## *AGRICULTURAL CHEMISTRY.*

*Elementary Agricultural Chemistry: a Handbook for Junior Agricultural Students and Farmers.* By Herbert Ingle. Pp. ix+250. (London: C. Griffin and Co., Ltd., 1908.) Price 4*s*. 6*d*. net.

TEACHERS at agricultural schools and colleges are placed in the difficult position of having to teach a branch of applied chemistry to pupils who have little time, and often less inclination, to study pure chemistry. The best method of procedure has probably not so far been found, nor has agricultural chemistry as yet fallen into the hands of the text-book writer to anything like so complete an extent as its parents on both sides. It is, however, pretty clear what the agricultural student ought to be able to do. He should have a good working conception of

chemical change, and be able to trace out the broad outlines of the great natural cycles involved in the synthesis of plant substances from carbon dioxide, water, &c., and their decomposition in the animal system or the soil with production once more of carbon dioxide, water, and other bodies. He should study the factors concerned in plant growth, the soil in its relation to the plant, and the plant, considered as food, in its relation to the animal; and, as the subject has a commercial side, he must be able to interpret the analysis of a feeding stuff or manure, and to make simple calculations involving a knowledge of the chemical composition of a few common substances. The scheme of teaching must take account of the rather special nature of the student. A young man commonly chooses agriculture as a profession because he loves the outdoor life of the farm and is of a keenly practical turn of mind, and this temperament is generally incompatible with systematic study of a subject for its own sake; he will work, however, and work hard, when his studies obviously subserve a useful end and fit in with the central idea of his life.

The book before us shows how Mr. Ingle teaches agricultural chemistry, and the record of one teacher's methods and experiences cannot fail to be interesting to others who are engaged in the same work. The student is supposed to have gone through a course of inorganic and organic chemistry, but by way of recapitulation an introductory chapter deals with general chemical conceptions, and another with the composition of the atmosphere. We then pass on to a study of the soil, the plant, manures, feeding, and dairy work. The author tells us in the preface that the book was written whilst he was in touch with South African agriculture, and the illustrations are drawn sometimes from English, sometimes from South African practices.

The chief defect of the book is that it fails to present the subject as a whole, and successive chapters seem to have little connection one with the other. There is no systematic discussion of the relationship between one branch of the subject and another, and the reader gets a sense of much detail but no general principles. In the mass of detail certain things have got left out which certainly ought to have gone in. Chief of these is the physical composition of soil as shown by mechanical analysis, concerning which not a word is spoken, in spite of its fundamental significance in soil work. No mention is made of the loss of nitrogen from soils by aërobic bacterial action. There is also, and perhaps necessarily, a lack of proportion; thus the grasses get no more space than the sweet potato, notwithstanding their enormously greater technical importance.

Indeed, the book is not so much an elementary textbook as a short reference book, and from this point of view it will be found very useful for class work. There is a great collection of data from many sources, the compilation of which must have involved an enormous amount of labour, and for which the teacher will have much cause to be grateful to Mr. Ingle.

E. J. RUSSELL.

## TIMBER.

*Timber.* By J. R. Baterden. Pp. ix+351. (London: Archibald Constable and Co., Ltd., 1908.) Price 6*s.* net.

THIS popular manual undoubtedly contains interesting and miscellaneous information about the uses, preservation, and strength of timbers. The author, who is an engineer, occasionally refers to useful matter in engineering publications, and has compiled extensively from the reports of the forest officers of the various British colonies and of the United States. It is unfortunate, however, that he has attempted to write a general treatise. He is confessedly ignorant of botany; and his account of the structure and origin of the numerous species dealt with is usually meagre and defective, and in many instances almost puerile. His frequent descriptions of trees in the living state are out of place in a small manual, the subject of which is timber, and not forestry. The same remark applies to many of the illustrations, which are irrelevant. Hackneyed pictures of the common oak, beech, larch, &c., growing in the isolated state, only serve to show (but Mr. Baterden and his publisher are unaware of this) how trees ought not to be grown, if they are to be regarded as producers of timber of proper shape and quality.

European timbers, which should have been fully treated, on account of their great importance to the home grower and consumer, are dismissed by Mr. Baterden in a short chapter, which contains some singular errors and omissions. The bibliography at the end of the volume does not include the *Quarterly Journal of Forestry* and the *Transactions of the Scottish Arboricultural Society*, journals from which much useful material might have been extracted. Only three lines are devoted to the cricket-bat willow, the wood of which is the most costly produced in England. No allusion is made to native species, like the white-beam and the service tree. A more glaring omission occurs in the account of home-grown poplars, where nothing whatever is said about the black Italian poplar (usually referred to *Populus canadensis*), which is the most common species in cultivation and the fastest in growth. Nobody will be much the wiser by reading the following article:—"Plum, which is somewhat similar to pear, is also used for turnery. Weight about 40 lb. per cubic foot." The durmast is erroneously considered to be something different from *Quercus sessiliflora*, with which it is identical. The timber of the Turkey Oak, which every forester knows to be of poor quality, is said to be suited for the same class of work as the common oak.

The timbers of North America are dealt with at great length; and Lebanon cedar appears amongst them. The Atlas cedar is never mentioned, though, both on account of its valuable timber in Algeria and its successful cultivation in England, it deserves an extended notice. The beautiful yellow cedar of British Columbia and Alaska, which may be seen growing with great vigour in many of our parks,

is described, on p. 91, as *Thuya excelsa*, a name unknown to botanists. The author is unaware that it is already described in the preceding page under its correct name, *Cupressus nootkatensis*. The note on p. 77 about Douglas fir is misleading. The two kinds of this timber, which are distinguished by the Western lumberman, are "red fir" and "yellow fir," the colour and quality varying with the rate of growth of individual trees of the same species. The statement that only 500 Wellingtonia trees are now living is quite inaccurate, as this species occurs in countless numbers in the southern part of its area in the Sierra Nevada.

Many more instances might be given of the carelessness with which this compilation has been made. These errors detract seriously from the value of the book to the student. The price is cheap, only six shillings for 350 pages and 54 illustrations; and the practical man, for whom the work is intended, may find it worth the money, in spite of its inaccuracies.

## OUR BOOK SHELF.

*Biology and its Makers; with Portraits and other Illustrations.* By Prof. W. A. Locy. Pp. xxvi+469. (New York: Henry Holt and Co.; London: G. Bell and Sons, 1908.) Price 10*s.* 6*d.* net.

THIS is a carefully executed historical introduction to the study of biology, and should prove very useful to students. Its aim is to sketch the broad features of biological progress, "and to increase the human interest by writing the story around the lives of the great leaders." Prof. Locy has shown shrewd judgment and a praiseworthy restraint in his selection of subjects, the result being that the student can get from this book a general view of the development of biology, yet with enough concrete illustration and biographical information to be vivid. The author has evidently gone to the original documents, and he has had his reward; he has given us a book full of fresh interest and suggestion. In the course of years Prof. Locy has made a large collection of interesting portraits of biologists, many of which adorn the walls of his laboratory at Evanston, and point a moral too. Of this collection he exhibits a fine sample in this volume. Some of the rarer ones are unfamiliar even to biologists, and have been discovered only after long search in libraries.

The book is divided into two sections. "In the first are considered the sources of the ideas—except those of organic evolution—that dominate biology, and the steps by which they have been moulded into a science." The succession of chapters is as follows:—Aristotle and his foundations; Vesalius and the overthrow of authority in science; Harvey and experimental observation; the introduction of the microscope and the progress of independent observation; the progress of minute anatomy; Linnæus and scientific natural history; Cuvier and the rise of comparative anatomy; Bichat and the birth of histology; the rise of physiology—Harvey, Haller, and Johannes Müller; Von Baer and the rise of embryology; the cell-theory—Schleiden, Schwann, and Schultze; protoplasm the physical basis of life; the work of Pasteur, Koch, and others; heredity and germinal continuity—Mendel, Galton, and Weismann; and the science of fossil life (a bad title). The second part of the book deals with the evolution theory, and the last chapter contains an interesting retrospect and prospect.

It is difficult to avoid misprints when dealing with many names and titles; we may note in illustration the title of Leydig's treatise of 1864 (p. 102), Weissmann (p. 109), Fleming (p. 256), Carl Pearson (p. 318), Neumayer (p. 352), Downs as Darwin's home (p. 426). Is it the case that Darwin spoke of "incredibly dull lectures" at Cambridge? We doubt if it can be said that Lamarck was the first to use a genealogical tree to express relationship of types, for was not Pallas earlier? But these are trifling blemishes in a wholesome and interesting book, and we offer Prof. Locy our congratulations. J. A. T.

*Psychologie als Grundwissenschaft der Pädagogik.* Ein Lehr- und Handbuch unter Mitwirkung von Seminardirektor Dr. K. Heilmann, herausgegeben von Direktor Dr. M. Jahn. Fünfte verbesserte und vermehrte Auflage. Pp. xii+527. (Leipzig: Verlag der Dürr'schen Buchhandlung, 1907.) Price 7.50 marks.

"THE psychological principles useful to the teacher could be written on the palm of the hand." This dictum of the psychologist who is himself the most brilliant teacher of his subject to the English-speaking world rises in the mind by force of inevitable contrast as one takes up this portentous volume.

Five hundred and six large and well-filled pages are the space which Dr. Jahn demands for the exposition of the psychology that he and his colleague regard as the necessary scientific foundation for the professional studies of German pedagogues—and their estimate has been endorsed by their public to the extent of five editions. No one—at least in this country—could pretend that the knowledge of all that is contained between these covers is necessary to professional salvation. As Mr. Benson has said, "A brisk, idle man with a knack of exposition and the art of clear statement can be a scandalously effective teacher." But if we are to have practitioners of the art of teaching comparable in point of professional culture with our engineers, our architects, and our medical men, there is no doubt that the topics discussed in this volume must become much more commonly studied among us than they are at present.

To the student who reads German with fair facility and is not in a hurry, Dr. Jahn's book may be warmly recommended. It is lucidly, though not brilliantly, written; it is clearly and sensibly arranged, though it preaches no strongly individualised doctrine; it is encyclopædic in range, and abreast of the present development of the subjects it touches. The notes at the end of each section, and the select bibliography at the end of the book, will be found a very useful guide to more extended reading—though the English and French works recommended appear to be confined to those that have been translated into German.

*A Brief Course in Elementary Dynamics for Students of Engineering.* By Ervin S. Ferry. Pp. xi+182. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1908.) Price 5*s.* net.

A WORK on elementary dynamics written especially for engineers gives one reason to expect something rather different from the usual text-book on purely mathematical lines, but the present work does not appear to have any particular interest for an engineering student. We are asked to consider the usual problems of blocks sliding down inclined planes, particles moving in circles, ladders leaning against walls, and, in fact, we find all the usual paraphernalia which the mathematical schoolmaster has invented for teaching the subject.

The work must therefore be regarded quite apart

from the special function which it claims by its title.

It appears to be an orderly, well-written account of the principles of dynamics, but rather over-burdened with formulæ, as, for instance, where a whole page of mathematics, in small print, is devoted to proving that the reading of a weigh beam of an ordinary platform scales is not affected by the position of the load.

Apart from these minor blemishes, and under the limitations mentioned above, the work is a favourable specimen of the American college text-book.

E. G. C.

## 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.]*

### A Crocodile's Nest.

THE accompanying photograph was taken in the bed of the river Rahad, south-west of Gallabat, and only a few miles west of the Abyssinian frontier, in May, 1907. This tributary of the Blue Nile begins to come down in flood in about June, continues to flow until the beginning of winter, and after this the bed is left dry, with the exception of a series of pools in the sandy river-bed.

I came across the nest through finding a depression in the sand about 4 feet above the level of a neighbouring

pool, and a number of sinuous tracks leading down to the water's edge at once suggested a crocodile's nest. The hollow was about 1 foot deep, and the eggs were 2 inches or 3 inches below the sand at the bottom of it. My guide soon pulled out a number of eggs and young crocodiles, which were quite willing, though not powerful enough, to sample one's fingers. The find was of interest, and next evening, on returning to photograph it, I was surprised to find another depression about a yard further along the bank, and, covered with sand at the bottom of this, we found the eggs and crocodiles shown in the picture. The eggs were of the usual cylindrical shape, and about 3 inches long. The crocodile on hatching is about 10 inches long, perfectly formed, and makes a noise like the croaking of a frog. There is generally a blood-like stain about the place that would correspond to the navel in higher animals. For the purpose of photography the eggs were taken out of the sand and laid in the hollow. A crocodile is seen just hatching out, and another is resting on the eggs. The shells are hard, and the dark patches on some of them are due to adhering sand.

About a yard away, again, the presence of another nest was made evident by the croaking of young crocodiles beneath the sand, and it would appear that this enables the parent to know when to release its young by excavating a hollow to such a depth that only a thin covering of sand is left over the eggs.

The first nest of eggs was not counted; a number of crocodiles had already escaped into the water, about eight were hatching out, and there were a good many eggs besides. In the second nest there were thirty-nine eggs, as the photograph shows, and the first probably contained about the same number. The third nest was not uncovered. There is no definite evidence for ascribing all three to one parent, but in view of their being so close together, and the young hatching out within two days in the different nests, there is a strong presumption in favour of doing so. If this is the case, the total number of eggs laid by one individual can hardly have been less than a hundred, and among the two batches seen only one egg was found to be addled.

I do not know whether nesting is confined to a particular period of the year, but in the case of a variable river like the Rahad there is a considerable risk of the eggs being either washed away or left at a distance by the retreating water, except during the late winter and spring months.

Young crocodiles, up to about a yard in length, appear to be far more active than the older ones. They leave the pools, climb out of the river channel, and may be met at a distance of fifty yards away. They are able to run at a considerable pace. The older ones are generally seen floating about or lying on the banks close to the water.

Khartoum, March 3. G. W. GRABHAM.

### A Winter Retreat for Snails.

SOME of the reaction phenomena of *Helix aspersa* would probably account for the presence of thirty-seven specimens in an empty tea-pot as described by Prof. McKendrick in NATURE of March 4.

This species is, as is well known, *negatively phototropic* —"seeks" dark places—and is also, especially at hibernation, *stereotropic*, "attracted by surfaces."

The empty tea-pot lay on its side by an herbaceous border, where many snails would be hidden from view. In November, when preparing to hibernate, these snails would wander restlessly, and by the combined reactions would find their way "with mechanical certainty" into the dark cavity of the tea-pot, and there come to rest. The number collected together in the tea-pot would increase, as, on arriving in the cavity, movement in each individual would cease; and, moreover, the individuals would cling together.

As a result, the tea-pot would act like a trap in which the snails were caught, and where they would remain until metabolic changes in their own bodies made them restless and compelled them to move about.

W. HOSKYNS-ABRAHALL.

### The Golden Fleece.

IN the review of Dr. Bowman's book on "The Structure of the Wool Fibre, &c." (NATURE, March 4), there occurred the statement that the introduction of the domestic sheep into Greece was "probably enshrined in the legend of the golden fleece." Strabo, however, long ago gave a plausible explanation of this legend in stating (Book xi., ii, § 9): "The Soanes occupy the heights of Caucasus above Dioscurias" (the present Iskuria, at the mouth of the Kodor in Abkhasia). . . . "In their country the winter torrents are said to bring down even gold, which the barbarians collect in troughs pierced with holes and lined with fleeces; and hence the fable of the golden fleece."

FELIX OSWALD.

Nottingham.

## THE BOTALLEK CIRCLES.

BORLASE, in his "Antiquities of Cornwall" (p. 199), published in 1769, refers to what he terms "the curious cluster" of circles at Botallek,

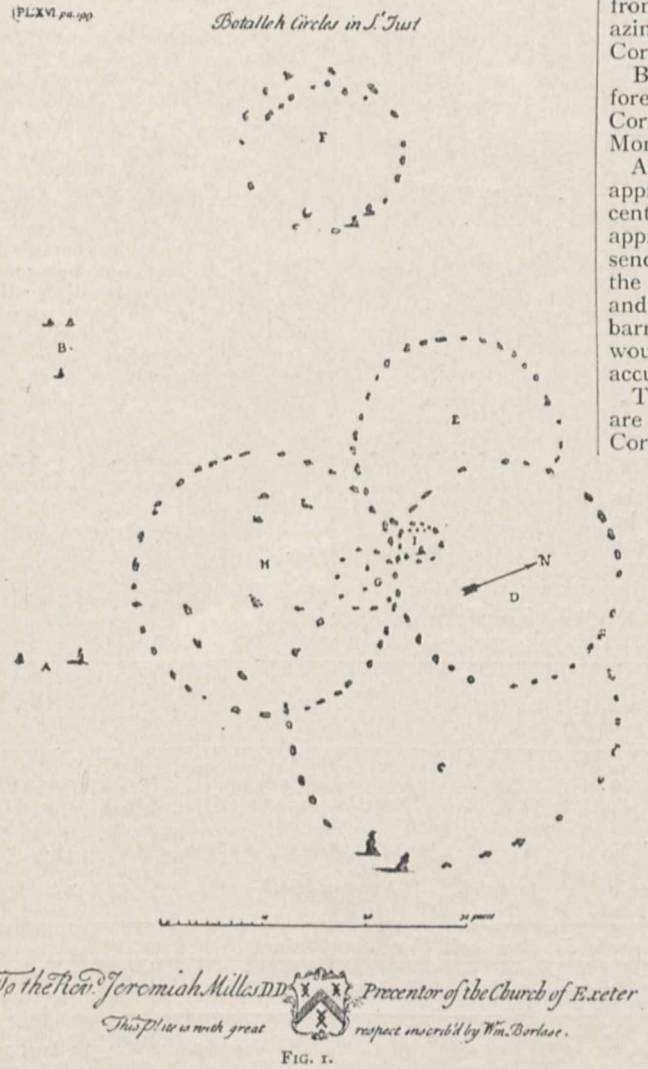


FIG. 1.

the seeming confusion of which led him to write "I cannot but think that there was some mystical meaning, or, at least, distinct allotments to particular uses."

Fortunately for science, he accompanies his account with a plan, evidently carefully prepared (Fig. 1), which is now the only thing that remains; every stone has been utilised in building an engine house, or in other ways. Only the site is shown on the ordnance map.

As the "cluster" of circles exceeds in elaboration anything of the kind with which I am acquainted, it was of great interest to see if anything could be made of it in the light of other researches in Cornwall, and I propose now to state the result in a very abridged form. Fuller details I have communicated to the Royal Society.[1] The first point of inquiry concerned the N. point given on the plan—whether it was true or magnetic. A perusal of Borlase's volume showed that he was fully acquainted with the necessity of referring in such descriptions to the true north, instead of, as he says, "such an inconstant and fluctuating index as the declination of the needle, which is not only different in different places, but varies also at different times in one and the same place" (p. 115).

When this point was settled, it became evident at once, when the circles were completed and lines drawn from centre to centre, that approximately the same azimuths were in question as those met with in other Cornish circles.

Borlase does not give the heights of hills. I therefore asked Mr. Thomas, an active member of the Cornish Society for the Astronomical Study of Ancient Monuments, to observe them for me.

Among the azimuths were two, the first from the approximate centre of the circle F to the approximate centre of E, N. 83° E., and the second, from the approximate centre of F to that of H, S. 66° E. In sending his results to me Mr. Thomas remarked that the former line passes over the Carn Bean barrow and the latter passes $2\frac{1}{4}°$ to the N. of the Goon Rith barrow; thus the azimuth of the Goon Rith barrow would be S. $63\frac{3}{4}°$ E. This enabled me to check the accuracy of Borlase's N. point.

The two alignments to two still existing barrows are common to Botallek and other monuments in Cornwall. On the assumption of identity of object, Borlase's orientation was true, and not magnetic, and, also, was not far from the mark.

The next step was to make a very careful determination of the centres of the circles, and it was found that the line, centre of F to centre of H, coincided with the line S. 63° 45′ E. from the former to the Goon Rith barrow. In other words, the difference between the azimuth we had provisionally determined from the circles and that of Goon Rith barrow was due to an error of centring, and no doubt was left that the line between the centres of F and H was really directed to the barrow. Similarly the line N. 83° E. joining the centres of F and E was directed to the Carn Bean barrow. Both these lines were recognised as familiar, giving, approximately, the November sunrise and the heliacal rising of the Pleiades in May respectively. In the case of the S.E. azimuth there is an alternative explanation of the sight-line. Both in Cornwall and Wales we have found that azimuth-marks (barrows, &c.) were sometimes erected so that they gave the direction of sunrise a fortnight or three weeks before the critical date. I therefore decided to adopt the

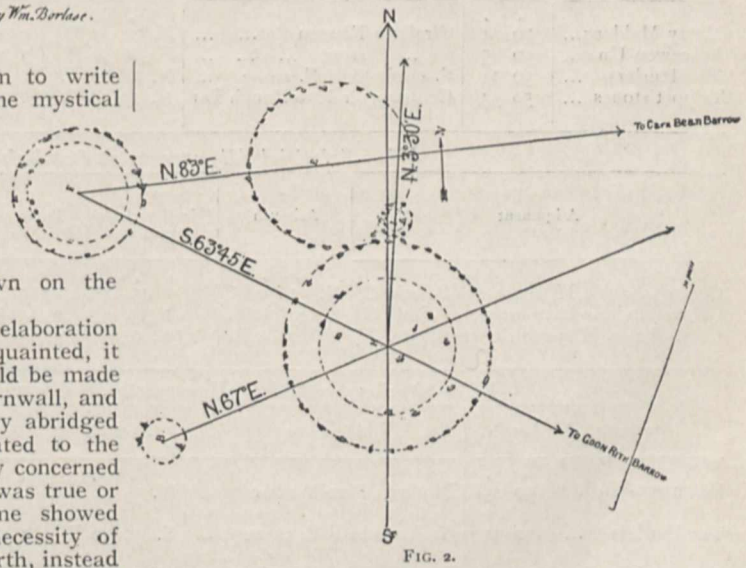


FIG. 2.

Pleiades azimuth, N. 83° E., as the fundamental line by which to fix the N. point, and it followed

[1] Proc. Roy. Soc., March, 1909.

that Borlase's N. point was less than 3° to the west.

Working on this basis, I joined up the centres of the circles, as shown on the plans (Figs. 2 and 3), and carefully measured the resulting azimuths. These I sent to Mr. Thomas, asking him if the slight modifications of azimuths that I had introduced had sensibly altered his values for the corresponding angular elevations. After a second series of observations, he replied that the elevations were the same for the modified azimuths as they were before.

It at once became obvious that the alignments divided themselves into two groups—one erected for the observations of the May-year, the other for solstitial phenomena—and with each group there is associated a clock-star which affords a means of determining the approximate date of each group. For this reason I give two separate plans (Figs. 2 and 3) showing the separate groups of alignments, and two separate tables giving the respective results. I will deal with the May-year circles first, table I. (Fig. 2).

These results agree with the May-year results previously obtained from the study of other Cornish circles, and to illustrate this I bring together a selection of the results previously published (table II.).

An examination of Fig. 2 shows that the azimuths given in the table are exactly those obtained by joining up the centres of the circles and adopting the N.—S. line derived from Mr. Thomas's two measures of direction. The results justify the 3° change of the orientation of Borlase's plan.

*The Solstitial Year.*

Joining up the centres of H, G, D, and C, as shown in Fig. 3, we obtain the results given in table III.,

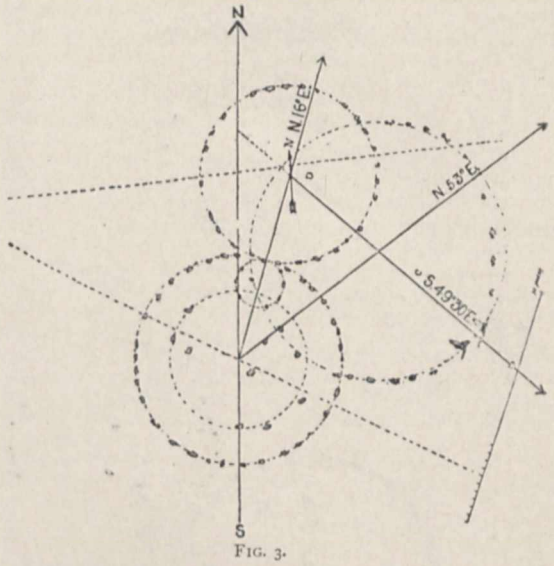


FIG. 3.

results which are obviously connected *inter se* and with the solstitial year.

I.—*May-year Alignments at Botallek (lat. 50° 8′ N.).*

| Alignment | Azimuth | Hill (Mr. Thomas's) measures | Declination | Object | Date |
|---|---|---|---|---|---|
| Centre of circle B to centre of circle H | N. 67° 0′ E. | 3° 0′ | 16° 31′ N. | May sun | May 6; Aug. 7 |
| Centre of circle F to centre of circle H to Goon Rith barrow | S. 63 45 E. | 2 44 | 14 43 S. | November sun (possibly a warner) | Nov. 2; Feb. 10 |
| Centre of circle F to centre of circle E to Carn Bean barrow | N. 83 0 E. | 3 35 | 7 2 N. | Pleiades (warning May sun) | 1680 B.C. |
| Centre of circle H to centre of circle I | N. 3 30 E. | 0 0 | 39 14 N. | Arcturus (clock-star) | 1730 B.C. |

II.—*Similar May-year Alignments in Cornwall (for comparison).*

| Monument | Lat. N. | Alignment | Azimuth | Hill | Declination | Object | Date |
|---|---|---|---|---|---|---|---|
| Merry Maidens... | 50° 4′ | Circle to Fougou ... ... | N. 64° 0′ E. | 0° 30′ | 16° 21′ N. | May sun | May 5; Aug. 7 |
| Boscawen-Un ... | 50 5 | ,, stone ... ... ... | S. 66 30 E. | 1 0 | 14 32 S. | Nov. sun | Nov. 2; Feb. 10 |
| The Hurlers ... | 50 31 | S. circle to N.E. stone ... | N. 78 47 E. | 0 12 | 7 23 N. | Pleiades | 1610 B.C. |
| Trippet stones ... | 50 33 | Centre of circle to Rough Tor | N. 15 0 E. | 1 30 | 39 1 N. | Arcturus | 1700 B.C. |

III.—*Solstitial Alignments at Botallek (lat. 50° 8′ N.).*

| Alignment | Azimuth | Hill (Mr. Thomas's) measures | Declination | Object | Date |
|---|---|---|---|---|---|
| Centre of circle H to centre of circle C | N. 53° 0′ E. | 1° 45′ | 23° 41′ N. | Solstitial sun (summer) | |
| Centre of circle D to centre of circle C | S. 49 30 E. | 1 35 | 23 44 S. | Solstitial sun (winter) | |
| Cent. of circ. H to cent. of small circ. G | N. 16 0 E. | 0 0 | 37 28 N. | Arcturus (clock-star) | 1420 B.C. |

IV.—*Similar Solstitial Alignments in Cornwall (for comparison).*

| Monument | Lat. N. | Alignment | Azimuth | Hill | Declination | Object | Date |
|---|---|---|---|---|---|---|---|
| Boscawen-Un ... | 50° 5′ | Circle to Fine Menhir ... | N. 53° 30′ E. | 2° 23′ | 23° 59′ N. | Solstitial sun (summer) | |
| The Hurlers ... | 50 31 | N. circle to S.E. stone ... | S. 50 50 E. | 1 18 | 24 17 S. | Solstitial sun (winter) | |
| Tregeseal ... ... | 50 9 | Longstone to Chûn Castle... | N. 23 30 E. | 1 35 | 37 9 N. | Arcturus | 1350 B.C. |

As before, I give a selection from previous results, showing that the alignments we are now dealing with have become familiar by reason of their occurrence at the Cornish monuments investigated earlier (table IV.).

From the results given above it is evident that in this "curious cluster" of circles at Botallek we have an epitome of the chief sight-lines used in Cornwall. May-year sun, clock-star, warning-star, and solstitial sun are all represented.

The May-year group was the first, by something like 300 years, to be erected, and it should be noted that the date for the Pleiades circle E is coincident, within our probable error, with the date of the clock-star alignment H—I.

Borlase's plan (Fig. 1) affords us evidence on this point, for it shows that the circles F, H, and I are associated by being made up of two concentric rings of stones.

NORMAN LOCKYER.

## *WESTERN TEACHING FOR CHINA.*

THE meeting which was held in the Mansion House last week, and presided over by the Lord Mayor, shows that at last an interest is being taken in this country in the education of China in Western science and literature. Further proofs of the same interest are given by the movement promoted by Sir Frederick Lugard, the Governor of Hong Kong, for the foundation of a university in that colony, and of another by the German authorities in the province of Shantung. The larger question of Chinese university education, already undertaken by the Chinese authorities, is at present under the consideration of a joint committee of members of the universities of Oxford and Cambridge, so that it looks as if the Chinese are not likely to want for advice and assistance in carrying out the educational development of their country.

The four schemes which have been mentioned in no way conflict with each other, and if there are sufficient means there are no reasons why they should not all be carried out. Their success and usefulness will depend, in great part, on the spirit which animates the work which they do. The interests of China must always be the chief object in view. If the proposed university at Hong Kong be looked upon simply as a means of advancing British interests, and that at Shantung of advancing German interests, they may at first have a certain amount of success, but they would be doomed to failure before long, as nothing touches the spirit of Eastern people so much as any attempt to thwart their legitimate national aspirations. The success of the Japanese has been in great part due to the fact that while they have taken advantage of Western assistance, all their institutions have been moulded according to Japanese ideas, and with the object of enabling Japan to take her due place among the nations of the world. Other causes have been added as things developed, but this has been the fundamental one. No attempt must be made to mould the Chinese into Eastern Britons or Germans.

The medical colleges proposed by the China Emergency Committee are very much needed, as was fully shown at the Mansion House meeting by the present writer's fellow-student of forty years ago, Dr. J. Campbell Gibson, of Swatow, who was supported by Dr. J. B. Paton, of Nottingham. They pointed out

"that the importance of the steps suggested was not measured by the possibilities of the four colleges which were proposed, for the time will come—let us hope speedily —when the Chinese Government must itself take up medical education; and the presence, as models, of institutions on Western lines will then be decisive as to the scientific principles on which the State action must proceed. The cry in China of 'China for the Chinese' will thus be satisfied in the best possible way."

The proposed university at Hong Kong is intended —at least, to begin with—chiefly to train medical men and engineers. Already useful work in the way of training medical men has been done by the Hong Kong Medical College, founded in 1887, and a beginning has been made in technical education in the so-called "Technical Institute," which gives opportunities for instruction in various subjects, but especially engineering and its allied subjects. The proposed university would therefore be a development of existing institutions, and there can be no doubt that Hong Kong would offer many facilities for the practical sides of the studies. Sir Frederick Lugard has pointed out that

"Its dockyards and electrical and other works will afford practical instruction which can hardly be rivalled in China for very many years; while the location of the university in a British colony will, on the one hand, form an attraction to students who desire to obtain opportunities for colloquial English and to acquire something of the Western atmosphere as well as the mere dry bones of knowledge, and, on the other hand, to professors who might less willingly accept an exile in China. In the medical faculty more especially, Hong Kong can offer facilities for practical anatomy in the dissecting-room which Chinese prejudice, at present at any rate, precludes in China."

Of course, other subjects and degrees would be added as circumstances permit, notably an arts degree. The preparation for that, however, should not proceed strictly on the lines of British colleges, but should comprise international law and treaties, geography, comparative history, and, not least, Chinese literature and classics, so that there may be no reproach of dissociating Chinese students from their national sympathies and language.

The colony of Hong Kong will soon be connected with the main railway system of China, so that the university would appeal to a very large area, as the Chinese will not be slow to recognise that here are to be obtained the advantages of Western education at a smaller cost, and under more desirable conditions in various ways, than by sending their sons to the West. More than thirty years ago, when I was in Japan, as principal of the Imperial College of Engineering, Tokyo, I very often discussed projects of this kind with the first Chinese Minister to Japan, and when I suggested a duplicate of our college in China, he said that "the streets of Peking were too narrow for such an institution." This, of course, was simply his way of saying that he did not think China was yet ripe for a fully developed scheme of technical education.

Much has happened since then, and the students of the Imperial College of Engineering have been important factors in the making of New Japan, a fact which has been recognised by the Chinese, and now there are large numbers of Chinese students in Japan and considerable numbers in Europe and America. In Glasgow, for instance, they are almost as numerous as the Japanese students, but, of course, there is not the same necessity for the latter coming here as formerly, as they have such good facilities for study in their own country.

My Chinese friend was a philosopher in his way, and was not unacquainted with the very difficult poli-

tical, economic, and social problems which were to be found in the countries of the West, and he had very great doubts whether it was wise to bring the same problems into China by the introduction of Western science and methods. The Chinese now see that they cannot isolate themselves from the other countries of the world, and they are anxious to accept from them sufficient, at least, to preserve their national integrity, but the forces behind them will make it impossible to draw a limiting line.

For many years I have been watching with interest the great evolution which is going on in the countries bounded by the Pacific area. Japan led the way, and now China follows, probably, however, at a slower rate; but, as my Chinese friend sometimes said to me, "I wonder where you people of the West think you will be as regards trade and industry, as well as other things, when China is fully awake?" This opens up a wide vista for speculation, and I merely mention it in the hope that those who are proposing what seem to be small things may consider their future possibilities and their results on the civilisation of the world.

HENRY DYER.

## *THE ROYAL SOCIETY OF ARTS AND THE LONDON INSTITUTION.*

IN NATURE of April 6, 1905, attention was directed to negotiations that had commenced between the Society of Arts and the London Institution having for their object the amalgamation of the two institutions. A special meeting of the promoters of the London Institution was about to be held to consider the scheme, which was supported by a joint committee of the two institutions; and whilst it was recognised that some opposition on the part of members of the London Institution would have to be reckoned with, it was assumed that amalgamation would be brought about. This expectation was not realised. Whilst there is reason to believe that the members of the Society of Arts would have been practically unanimous in their support of amalgamation, a vigorous minority of the London Institution opposed, with the result that the scheme was never voted upon. It was shelved, and for the time being no more was heard of amalgamation. After the failure to bring about union between the two institutions, no attempt was made to vitalise the London Institution. It remained, as it had been for some years, practically moribund.

Impressed with the undesirability of allowing matters to continue as they are, and as convinced as ever that amalgamation would be for the advantage of both institutions, those members of the London Institution who moved in the matter in 1905 have now renewed their efforts to bring about an amalgamation of the two institutions. They first tested the feeling of members by means of a post-card ballot, which resulted in 526 supporting the proposal for amalgamation and 84 voting against, some 400 remaining neutral. This was a sufficiently decisive vote to warrant the managers of the London Institution in approaching the Royal Society of Arts, but before that could be done certain members of the institution, strong opponents of amalgamation, moved in opposition, with the result that there was a special meeting of members of the institution, and a ballot taken. This ballot resulted in 322 voting in favour of amalgamation, and 218 against it, leaving between 400 and 500 who preferred to be neutral. The managers of the London Institution did not consider that this vote was sufficiently decisive to warrant them in approaching the Royal Society of Arts without further consideration, and accordingly a meeting was arranged for March 10 to consider the position. The result of that meeting has not been made known to the public, but it is understood that it disclosed considerable hesitation in proceeding with the scheme unless, and until, the minority, or some of them, could be induced to waive their opposition.

So the matter stands. It would be rash to predict the upshot. There is no reason to suppose that the members of the Royal Society of Arts are not as willing as they were three years ago to support a scheme of amalgamation approved by the secretary, Sir Henry T. Wood, and the committee. Nor do the arguments of the minority of the London Institution seem very convincing. One of their objections is that, under the proposed scheme, the institution would be moved from the City to somewhere "east of Charing Cross and west of Chancery Lane." We can understand this objection having considerable weight fifty years ago. Founded in 1805 by merchants and bankers of the City of London, the object of the London Institution was to maintain, in what was then a central position, an extensive general library of reference, and to promote the diffusion of knowledge by lectures and *conversazioni*; for at that time, and for many years afterwards, the City contained a large residential population. This population has now practically disappeared, and the number of proprietors who use the institution is small, and every year becomes smaller. To remove the institution to a building just outside the City boundaries, at or near the east end of the Strand, would not be inconsistent with the objects for which the institution is intended. The dissentient minority urge again that the Corporation of the City of London ought to take action to amalgamate the institution with the Gresham Trust. But whatever may be said in favour of this proposal, it means that the Corporation would have to endow the London Institution, and that, there is good reason for believing, they would not do.

The arguments in favour of amalgamation seem to us very strong, and we hope that in the end they will prevail. The history of the Royal Society of Arts has been a highly creditable one. It is under sagacious control. Its financial position is sound, and its services to the community great. Amalgamation with the London Institution would mean for it some sacrifice of sentiment, but the union would be advantageous to it in certain ways. It would give it the permanent local building that it lacks. The site of the London Institution is estimated to be worth at least 150,000*l*., and this would be amply sufficient to provide an adequate building, and might, indeed, supply accommodation for several other societies disposed to join in the scheme of building. The library of the London Institution, joined to that of the Royal Society of Arts, would make one of the best reference libraries in the metropolis, and the combined revenues would enable much more to be done in the interests of science, and provide a better knowledge of scientific work and methods than is possible at present. On the whole, the arguments seem greatly in favour of amalgamation between the two institutions on terms equitable to both, and it may be hoped that when the dissentient minority of the London Institution realise more fully than they seem to do at present that the Corporation of London is not prepared to subsidise their institution, their objections to amalgamation with the Royal Society of Arts will not continue to be pressed.

## AGRICULTURAL EDUCATION.

THERE is abundant evidence that the report of the Departmental Committee on Agricultural Education is receiving the attention it deserves. The Farmers' Club has issued a memorandum on the subject, and we learn from the *Times* of March 1 that the County Councils Association proposes to discuss various matters arising out of the report at its conference at the end of this month. The Central and Associated Chambers of Agriculture are also interesting themselves in the matter. On March 9 a deputation waited on the President of the Board of Education and the President of the Board of Agriculture for the purpose of directing attention to the need for reform in agricultural education.

It will be useful to recall the conclusions and recommendations of the report. The Committee considers that a satisfactory foundation has been laid for a national system of agricultural education, although much remains to be done in the development of details. In particular the facilities for lower-grade agricultural instruction and for itinerant instruction are very inadequate. There is a shortage of teachers and of experts for higher work, but it is considered that existing institutions could make up the deficiency if only they were better equipped. Increased provision is needed for research work. More money, in fact, is wanted all round. A system of dual control is recommended. The Board of Education should look after elementary and secondary school instruction; the Board of Agriculture should, as now, deal with college and university instruction.

The Farmers' Club agrees with practically all these conclusions, and its memorandum is a most interesting document, showing, as it does, the value set by practical men on agricultural education. The club would probably not claim to represent the whole of the farming community, but it includes many of the best men, and its views may be taken as identical with those of the most enlightened agriculturists of the day. Great stress is laid on the fact that more money is wanted, and must be forthcoming. Winter schools are asked for, where the sons of small farmers may attend for about three months, to leave better equipped for their work. The schools must be staffed by the right sort of men. Itinerant instructors of the right kind are needed to get hold of the little farmer and show him where his methods can be improved. Men are wanted to carry out research work. In some of the existing schools and colleges the standard of the teaching requires raising, but the writers of the memorandum

"cannot attempt to lay any blame on those responsible, for they have made the best use of the small funds at their disposal, and cut their cloth in accordance with their means. The salaries offered are in many cases almost an insult to an educated man, and it is frequently found that no sooner has an instructor settled down in a college, institute, or county than he is offered a better post (generally abroad), and someone else has to be found at the same miserable salary with like results."

All this is beyond dispute. The real difficulty is the lack of men. The agricultural colleges ought to be able to supply all the men needed, but they do not, and no one will deny that the committee of the Farmers' Club has discovered the correct reason. There is small inducement to go on to the teaching staff of the ordinary agricultural college, and still less to remain there. The result is a frequent change and loss of the best men, which is unsatisfactory now and unpromising for the future. Meanwhile, there are not enough of the right men either for the home or the colonial appointments. One of the best of the colonial agricultural departments has been staffed in part by Americans, because competent men were not available here; and it is much to be feared that some who have gone out to colonial appointments as the best we could send have not given a particularly satisfactory impression. This is a subject which demands very serious consideration.

The contentious part of the report is that relating to the control of agricultural education in the various technical schools and colleges which deal with agriculture alone. The Departmental Committee favours a dual control, and the Farmers' Club agrees. It has been said that the Board of Education desires to control the whole system from start to finish. We gather from the *Times* that this question will be dealt with at length by the County Councils Association Conference. Undoubtedly, the ideal arrangement is to have the whole system under one Board, properly coordinated, with no break anywhere from the elementary school to the agricultural college of university rank. But the fact must be recognised that the Board of Agriculture is, and has been for some years, in possession of the field, and it has, on the whole, the confidence of the farming community, some of its officials being actually known to the farmers. The Board of Education, on the other hand, is not in touch with them, and until a few years ago had no official of agricultural standing. The Farmers' Club fears that under the Board of Education agricultural education would never be more than a "side show," and this they most emphatically do not want. Of course, if the Board of Education were prepared to do the big thing, it would no doubt be best for it to take entire control, but if not, the dual arrangement suggested certainly seems more satisfactory. In any case only a few institutions are concerned; the universities and university colleges with chairs of agriculture are, and should remain, outside the sphere of action of either Board, except in so far as they accept grants for the upkeep of the department or farm. It is gratifying to learn, from the replies given to the deputation of March 9, that the two Boards are considering means by which they can have better organisation, and each is prepared to cooperate heartily with the other in finding the solution of the difficulty.

## THE AIR OF COTTON MILLS.[1]

THE latest report on the subject of humidity and ventilation in cotton mills adds considerably to our knowledge of this difficult question, complicated as it has become since about 1870 by the introduction of artificial humidity by means of "steaming." Previous reports have shown that the ventilation of most sheds was far from satisfactory, and that the health of the workers suffered from excessive steaming. As a result an Act was passed in 1901 which prescribed, among other things, the amount of fresh air to be supplied per hour for every person employed, the amount of humidity permitted, and that the amount of carbon dioxide should not exceed nine volumes in 10,000 of air. Experiments carried on in 1906 show that the relative humidity is highest in the morning (79 and 80), and diminishes as the day advances, falling to 70 and 71, also that the common supposition that the relative humidity inside the shed is less than that outside is true only for the winter months.

The table of humidity in the Act of 1901 begins at a wet-bulb temperature of 35° F., and ends with a wet-bulb temperature of 91° F.; but weaving cannot be carried on at the lower temperature, and the operatives cannot endure the higher temperature. There is a

[1] Report of the Departmental Committee on Humidity and Ventilation in Cotton Weaving Sheds. (London: Wyman and Sons, Ltd.)

consensus of opinion among medical men that the wet-bulb temperature should not exceed 70° F. to 75° F., and that operatives should not be called on to work above this limit.

In regard to ventilation, some surprise will be expressed that the report recommends an increase in the permissible amount of carbon dioxide to 12 volumes in 10,000 instead of nine as formerly. Considering the researches of Parkes, Pettenkofer, Angus Smith, Carnelley, and others, all of whom recommend a much lower limit, it is not surprising to find that the committee brings forward a considerable amount of evidence in support of what it evidently considers may be regarded as a reactionary proposal, and it must at once be admitted that there is a good deal to be said in its support. The evidence submitted to it shows that in coal mines the average amount of carbon dioxide is 35 volumes in 10,000, and such air does not appear to have an injurious effect on the miners. No doubt this is explained by the fact that this carbon dioxide is formed by oxidation of carbon, and is not mainly due to respiration as it is in weaving sheds.

Eminent medical authorities, both in this country, in America, and on the Continent, concur in stating their belief that the ill-effects in crowded rooms are due to excessive heat and humidity rather than to the amount of carbon dioxide. Direct experiments by Haldane and Lorrain-Smith showed that the condensed vapour from respired air, when injected into animals, produced no injurious effects, and their further experiments are "distinctly against the theory that a volatile poison, other than carbonic acid, exists in expired air." Flügge has made an elaborate series of experiments on this subject, and comes to the conclusion that "Temperature, humidity and movement are of enormously greater importance for our comfort and health than the chemical composition of the air." Valuable confirmation of these scientific results comes from the practical experience of the operatives in cotton mills. Thus in one mill, where both dry and wet sheds were under the same roof, the health of the workers was equally good in both, but there was a general desire to transfer to the wet shed, in which the carbon dioxide in the air varied between 34 and 41 volumes in 10,000.

Another point to which the attention of the committee was directed was the quality of the water used for the supply of steam. If from an impure source, injurious organic matter may be introduced, and it is suggested that water used for this purpose should be of a certain legal standard of purity. The other recommendations of the committee may be surmised from what has been said already.

## *RETURN OF THE BRITISH ANTARCTIC EXPEDITION.*

THE British Antarctic Expedition ship *Nimrod* has returned to New Zealand with Lieut. E. H. Shackleton and the other members of the landing party safe on board. A long despatch received from Lieut. Shackleton by the *Daily Mail* reports that he himself, with three other members of the expedition, started on an attempt to reach the South Pole from Ross Island, at the western end of Ross's Great Ice Barrier, on October 29 of last year. Ross Island was reached again at the beginning of this month, the explorers having achieved in the interval—122 days—a journey of 1708 statute miles, in the course of which they reached a point in latitude 88° 23′ S. and longitude 162° E., or only about 111 miles from the South Pole.

Pushing beyond the most southerly point reached by members of the National Antarctic Expedition on board the *Discovery* (82° 16′ 33″ S.), Lieut. Shackleton found the high mountains of South Victoria Land trending in a south-easterly direction across his route, and was obliged to ascend a long glacier leading up to a high tableland, on which the explorers eventually reached an altitude of 10,500 feet. Lieut. Shackleton concludes that the South Pole is doubtless situated in this plateau region. The motor-car, though proving useful for transport purposes in the neighbourhood of the winter quarters, was not employed on the southern journey, but the Manchurian ponies were of great assistance.

Another party, under Prof. Edgeworth David, F.R.S., professor of geology in Sydney University, journeyed from the winter quarters northwards along the coast of South Victoria Land to Terra Nova Bay, in about 75° S., and then ascended to the high plateau-land which stretches inland, and journeyed at an altitude of more than 7000 feet to the south magnetic pole, the position of which was fixed, in the neighbourhood of latitude 72° 25′ S., longitude 154° E.

On the return voyage, Lieut. Shackleton caught sight of the mountainous northern coast of South Victoria Land, stretching at least forty-five miles south-west and west of Cape North, the previous limit of observation.

Throughout the expedition numerous and varied scientific observations were recorded.

Special interest promises to attach to the geological studies of Prof. David, the biological work of Mr. James Murray, and the meteorological and magnetic observations. We shall hope to return to these when more detailed reports have been received. In some fresh-water lakes near Cape Royd, Mr. Murray found abundant microscopic life. Rotifers were found of remarkable vitality, capable of living for years in the ice of the lakes. Large sheets of a fungus-like plant were found in the lakes, and the vegetation on Ross Island included many lichens and a few mosses. Systematic records were kept of all the appearances of the Aurora australis. An ascent was made of Mount Erebus, 13,120 feet high, by a party under Prof. David, and the old crater of the volcano, which was reached at an altitude of more than 11,000 feet, was found to be filled with large felspar crystals, pumice, and sulphur. The south magnetic pole seems to have been located with much exactness.

Judging from the interesting communication to the *Daily Mail*, a large amount of valuable work has been accomplished. Lieut. Shackleton and the other members of the expedition are to be congratulated upon their remarkable achievements.

## *UNIFORMITY IN MATHEMATICAL NOTATION AND PRINTING.*

THE subject of establishing a better understanding between mathematical workers and printers has for some time engaged the attention of the council of the Royal Society. It is desirable that the amenities of printing should be considered by authors, so that when there are several ways of writing a formula that one should be employed which is easiest printed and looks best in the published work. It is especially undesirable that different ways should appear at random in the same volume, or even on the same page.

In his anniversary address to the Royal Society on November 30, Lord Rayleigh incorporated a memorandum on this subject, drawn up in the first instance by Prof. Larmor, as an appendix. After recounting earlier efforts in this direction made by a committee of the British Association in 1875, the paper offers the

following suggestions, which are here reprinted with a view to their being of use in a wider field :—

*Recommendations regarding Mathematical Notation and Printing.*

Always,
instead of

$$\frac{x}{3} \quad \frac{a+b}{2} \quad \frac{a+\frac{b}{2}}{\frac{c}{3}+\frac{d}{4}} \quad \frac{a}{b+\frac{c}{d}} \quad \sqrt{x} \quad \sqrt{-1} \quad \frac{1}{x} \quad \frac{1}{x^n}$$

write

$$\tfrac{1}{3}x \quad \tfrac{1}{2}(a+b) \quad \frac{a+\frac{1}{2}b}{\frac{1}{3}c+\frac{1}{4}d} \quad \frac{a}{b+c/d} \quad \sqrt{x} \text{ or } x^{\frac{1}{2}} \quad \iota \text{ or } i \quad x^{-1} \quad x^{-n}$$

instead of

$$x.\overline{x+a} \qquad \sqrt{x-y} \qquad e^{\frac{n\pi x}{a}} \qquad \int_0^{\frac{\pi}{2}} \qquad \lfloor n$$

write

$$x(x+a) \qquad \sqrt{(x-y)} \text{ or } (x-y)^{\frac{1}{2}} \qquad e^{n\pi x/a} \qquad \int_0^{\frac{1}{2}\pi} \qquad n!$$

In current ordinary text,
instead of

$$\frac{x}{a} \qquad \frac{a+b}{c+d} \qquad \frac{x}{y+\frac{t}{2}} \qquad x/y+\frac{a}{b+c}$$

write

$$x/a \qquad (a+b)/(c+d) \qquad x/(y+\tfrac{1}{2}t) \qquad \frac{x}{y}+\frac{a}{b+c}$$

Excessive use of the slanting line, or solidus, is, however, undesirable; it may often be avoided by placing several short fractions or formulas, with the intervening words if any, on the same line, instead of setting out each one on a line by itself. The last of the examples given above illustrates an improper use, in which symmetry is spoiled while nothing is gained; either both fractions should be written with the solidus, as $x/y+a/(b+c)$, or else neither as above.

The solidus should be of the same thickness as the horizontal line which it replaces; in some founts of type it is too thick and prominent.

Irregularities in the spacing of letters and symbols in the formulas as printed are often the cause of a general unsatisfactory appearance of the page.

For centimetres, millimetres, kilometres, grams, kilograms, the abbreviations should be cm., mm., km., gm., kgm. (not cms., &c.), and so in similar cases. Present custom is against the use of the signs $\therefore$ and $\because$

Symbols which are not provided in the usual founts of type are, as a rule, to be avoided. Compounded symbols such as $\dot{a}$ or $\bar{a}$ usually involve justification, and are thus liable to become deranged or broken. The two examples here given have, however, become so essential that separate founts should be provided for them.

The use of a smaller fount for numerical fractions is now customary; thus always $\frac{1}{3}a$ instead of $a/3$. The use of negative exponents often avoids a complex fractional form; as also the use of the fractional exponents, such as $\frac{1}{2}$ and $\frac{1}{3}$. In the latter case $x^{\frac{1}{2}}$ is usually preferred to $x^{1/2}$, notwithstanding that the latter is more legible.

Much is often gained in compactness and clearness by setting out two or more short formulæ on one line, instead of on consecutive lines; in that case they should be separated by spaces, indicated by the sign $\#$ on the MS. This would apply with even greater force to expressions such as $x=a, =b, =c$.

In the preface to his "Mathematical and Physical Papers," vol. i., 1880, the late Sir George Stokes successfully introduced the limited use of the solidus notation, obtaining the assent and support of Lord Kelvin, Prof. Clerk Maxwell, Lord Rayleigh, the editors of the *Annalen der Physik*, and many other mathematicians. He defined its use as restricted to the symbols immediately on the two sides of it, unless a brace or stop intervenes; thus $\sin n\pi x/a$ is to mean $\sin(n\pi x/a)$; but $\sin n\theta./r^n$, in case it is used, would mean $(\sin n\theta)/r^n$.

## NOTES.

PROF. CLEVELAND ABBE, of the U.S. Weather Bureau, Washington, Dr. J. R. Sutton, of Kimberley, South Africa, and M. Léon Teisserenc de Bort, of Paris, have been elected honorary members of the Royal Meteorological Society.

AT the meeting of the Royal Geographical Society on April 5, Sir Harry Johnston, who has just returned from his journeys through the southern States and the West Indies, will give a lecture on the scenery of Cuba, Haiti, and Jamaica, with many illustrations from photographs taken by himself.

THE death is announced, at the age of sixty-four years, of Prof. J. W. Moore, professor of physics in Lafayette College at Easton, Pennsylvania, since 1872.

SIR ROWLAND BLENNERHASSETT, whose death at sixty-nine years of age we announce with great regret, was not only distinguished in his political career and historical studies, but also by his influence upon education in Ireland. For about seven years he was H.M.'s Inspector of Industrial and Reformatory Schools in Ireland. From 1897 to 1904 he was president of Queen's College, Cork, and in 1905 he was appointed a visitor of the college. He was a senator of the Royal University of Ireland in 1897, and was a member of the standing committee of the Senate. He was also one of the Commissioners of National Education in Ireland, and took an active part in the administration of that department down to the time of his death.

IT should have been mentioned last week in the article on the Imperial Bureau of Ethnology (p. 73) that the Sirdar, Sir Reginald Wingate, is so impressed with the necessity of a thorough study of native conditions as the basis of good government that he has provided a grant for an investigation of the ethnology of the Sudan, especially from the sociological side. This work, which will extend over at least two winters, has been entrusted to Dr. C. G. and Mrs. Seligmann, who have recently made a joint investigation on the Veddas. Some of our colonial Governments also appreciate the value of such studies. For example, the expedition of the Seligmanns was financed by the Ceylon Government, and Mr. N. W. Thomas has been appointed Government ethnologist to Southern Nigeria, and is at the present time engaged in collecting information concerning the sociology and religion of that district.

THE honorary secretaries of the Zoological Society of Scotland (42 Frederick Street, Edinburgh), which has recently been founded, inform us that the society has been formed for the purpose of establishing a living zoological collection and garden at Edinburgh. The garden will be arranged on the system adopted by Herr Hagenbeck, of Hamburg, and will be conducted on scientific lines. When the society has developed sufficiently, it is within its scope to establish branch gardens in the other large towns in Scotland. In addition to this—its main object—lectures of a popular nature by eminent zoologists will be arranged. The headquarters of the society, and the first and principal garden, will be at Edinburgh. To obtain the necessary capital a garden fund has been opened, to which donations are solicited. The annual subscription is 1*l.* 1*s.*, but members who join the society during 1909 pay 10*s.* only for that year. This will entitle members to all the privileges usual in such a society. The aim of the promoters is to build up a strong society with a large membership, so that a considerable part of the annual sum required for the upkeep of the gardens will be ensured from subscriptions, and less dependence will require to be placed on the receipts from the public for admission.

In a lecture given at the Bradford Technical College on science and the textile industries, Mr. W. P. Dreaper suggested the formation of central trade laboratories to deal with the pressing need for technical research. The laboratories were to be established privately, and subsidised by the trade concerned, any associated firm being at liberty to bring forward technical problems for solution. The plan proposed appears only to be practicable in the case of a highly organised trade, since there would be great difficulty in inducing individual firms to support such a scheme, which they would think might easily be to the advantage of their competitors rather than of themselves. On the other hand, when a trade becomes highly organised and centralised its interests tend to become so amalgamated that a central laboratory will be established almost as a matter of course, and there are already several examples of such a development. Any suggestion for widening the basis of technical research is, however, welcome, and we hope that further discussion and inquiry may show Mr. Dreaper's scheme to be feasible.

The sixty-second annual meeting of the Palæontographical Society was held in the rooms of the Geological Society, Burlington House, on March 19, Dr. Henry Woodward, F.R.S., president, in the chair. The report of the council referred to the completion of the monograph of Cretaceous star-fishes, and to the satisfactory progress of the monographs of Cretaceous lamellibranchs, Chalk fishes, Cambrian trilobites, and British graptolites. Many offers of new monographs had been received, but the council had decided, so far as possible, to complete the works in progress before entering on new undertakings. Sir Archibald Geikie, P.R.S., was elected a vice-president in succession to the late Mr. W. H. Hudleston, and Prof. E. J. Garwood, Mr. C. Fox Strangways, and Mr. F. R. Cowper Reed were elected new members of council. The officers were re-elected, Dr. Henry Woodward as president, Dr. G. J. Hinde as treasurer, and Dr. A. Smith Woodward as secretary.

Much interest has been aroused in Sussex by the discovery of the greater part of a skeleton of a mammoth (*Elephas primigenius*) on the shore of Selsey Bill. The remains were found below high-water mark in the estuarine or fresh-water deposit of black clay, which underlies the raised beach and coombe rock on that part of the Sussex coast. The thick mass of shingle, which usually covers this deposit, was temporarily removed during the recent stormy weather, and the teeth and broken bones were found projecting from the clay. Probably the whole skeleton was originally present, but when found the bones were already much eroded, and they were scattered over an area about 30 feet square. Both upper and lower molar teeth were recovered, and their condition shows that the animal was immature and of small size. Fragmentary remains, both of the mammoth and of *Elephas antiquus*, have been found at various times in the same deposit in Bracklesham Bay, some of these specimens being now in the British Museum. Indications of complete skeletons are rare. They seem to have been recorded only twice in England, the first in the brick-earth of Ilford, Essex, the second in a corresponding deposit at Ealing, Middlesex.

Towards the scientific exploration of Spitsbergen no nation has contributed in a greater degree than Sweden. During the last half-century no less than twenty-four Swedish expeditions have visited it and the adjacent islands, at a cost of at least 75,000*l.*, to which another 25,000*l.* must be added if the expense of publishing the results be reckoned. Signs are not wanting, however, that much of the valuable work accomplished by the Swedes is unknown to the scientific men of other countries. To remedy this, Profs. A. G. Nathorst and G. de Geer, and Dr. J. Gunnar Andersson, have just published in *Ymer* (1909, Häft i.) a brief English summary of the work, occupying ninety pages, and have distributed reprints. This comprises a historical sketch by Prof. Nathorst, illustrated by maps and views of the Swedish stations; a list of men of science, physicians, and officers who have taken part in the expeditions; a classified and annotated bibliography by Mr. J. M. Hulth, containing 376 items; and a list of sixty maps by Prof. de Geer. In 1908 it was 150 years since the first Swedish naturalist, A. R. Martin, instigated thereto by Linnæus, set foot on Spitsbergen; but the true foundation of Swedish exploration was laid by Sven Lovén, when in 1837 he undertook a two months' voyage thither on his own initiative and at his own expense. The subsequent record is one of which any country might be proud, and English geographers and naturalists in particular should thank their Swedish colleagues for abandoning their habitual modesty so far as to publish this concise account.

With great regret we have noticed the announcement of the death of Senhor Joas Barbosa Rodriguez, director of the Botanic Garden and professor of botany in the university at Rio de Janeiro. Barbosa Rodriguez was born in the State of Minas Geraës in 1842. After a varied career as secretary, drawing master, traveller, manager of a chemical factory, and director of a museum at Mañaos he was, in 1889, appointed director of the Botanic Garden at Lagos de Rodrigo de Freitas, near Rio de Janeiro, a post which he held until his death. Numerous and extensive journeys took him over a great part of the Amazon basin, and later on also the southern States, Uruguay and Paraguay. One might have expected that large collections would have resulted from those expeditions; but his artistic inclinations—he handled pencil and brush with considerable facility—and his predilection for studying plants on the spot and from life led him rather to fill his portfolios with sketches and analyses and his note-books with descriptions from the living material. His favourite plants were Orchidaceæ and Palmæ, and his publications on them will always rank among the most valuable contributions to our knowledge of those families, even if we admit the disadvantages of his method, which involved a certain neglect of the documentary evidence accumulated in the herbaria of Europe. He was a fertile writer, and his publications extend beyond botany into the domains of archæology, palæontology, ethnography, and the Indian languages. He intended to publish a complete iconographia of the Orchidaceæ of Brazil. To that end he amassed a large collection of drawings, all from life and by his own hand; however, their publication was beyond his means. Only a volume of descriptions appeared, whilst with great magnanimity he placed his illustrations, amounting to between 500 and 600 sheets, at the disposal of Prof. Cogniaux, who had undertaken to elaborate the family for the "Flora Brasiliensis." He was, however, more fortunate with his great work on the palms of Brazil. Congress having passed a special vote for its publication, it appeared in two huge folio volumes (pp. 140 and 114, with 91 and 83 chromolithographs) in the following year. In him Brazil has lost a good botanist and a man of many accomplishments.

A letter from Mr. Edgar R. Waite, curator of the Canterbury Museum, Christchurch, New Zealand, asking for information as to the length of skeletons of great whales

preserved in museums, was published in NATURE on November 26 last (vol. lxxix., p. 98). It will be remembered that a blue whale cast on to the beach at Okarito, on the west coast of South Island, New Zealand, was measured by Mr. Waite and found to be 87 feet in length. A reply to this letter has been received from Mr. F. A. Lucas, curator-in-chief of the museum of the Brooklyn Institute of Arts and Sciences, New York, in which he states that in 1903 he measured a number of blue whales taken off the coast of Newfoundland. Of twenty-six whales measured, only six reached a length of 74 feet, from the tip of the nose to the notch of the fluke, the tape-line being carried along the side of the body. The six whales ranged in length from 74 feet 4 inches to exactly 75 feet. Adding to this the under-hang of the lower jaw, which is 1 foot 4 inches, and the depth of the fork of the flukes, which is 2 feet 6 inches to 3 feet, a total length for the largest whale of a little under 80 feet was obtained. Mr. Lucas points out that the measurements taken from a mounted skeleton are of little value, as the inter-vertebral cartilage is made too thick almost invariably. Mr. Lucas's letter was submitted to Mr. Waite, who, in his reply, says he is at present unable to give the exact length of the skull of the Okarito whale, but the length of the ramus of the lower jaw in a straight line is 20 feet 8 inches, and round the outer curve 22 feet 6 inches. Respecting the statement that there is the skeleton of a whale in Copenhagen 150 feet in length, Mr. Waite adds he has received a private letter from Prof. Jungersen saying the largest whale in the Copenhagen collection measures 75 feet.

WE have received a copy of the report of the Maidstone Museum, Library, and Art Gallery for 1908. As regards the museum, the year has seen an important advance in the arrangement and display of the collections, more especially those of minerals and fossils. In response to an appeal for providing cases for the Kent county room, the amount available for that excellent purpose is now just more than 174*l*.

A STRONGLY endorsed appeal has just been issued at Berlin for the purpose of obtaining funds for the fitting up of the Phylogenetic Museum recently established by Dr. Ernst Haeckel at Jena. Preparations, models, and diagrams for the proper illustration of phylogeny are urgently needed, and for this purpose a sum of 5000*l*. is required, in addition to the funds already expended or in hand. The appeal is backed by a number of the leading German professors and teachers.

IN vol. xcii., part ii., of *Zeitschrift für wissenschaftliche Zoologie*, Dr. F. Fritz, of Stuttgart, describes the carpal vibrissæ and underlying structures situated on the under surface of the lower part of the fore-arm of the cat. These vibrissæ are connected with a dermal sinus supplied by a relatively large branch of the ulnar nerve. Beneath the sinus occur structures of the so-called "lamellen Körperchen" type, and the vibrissæ themselves contain minute sweat-glands. The whole organ, the details of which are fully described in the paper, is evidently sensory in function. It is suggested that the presence of such vibrissæ in most Carnivora and their absence in Ungulata is connected with the active functions of the claws of the former. In the introduction to his paper the author mentions that these vibrissal organs have an important bearing on the nature of the callosities on the limbs of the horse, and it may be inferred, although this is not definitely stated, that he regards the latter as the degenerate representatives of the former. Several papers on the nature of the equine callosities are quoted, but no reference is made to one by Mr. Lydekker, in which these structures are regarded as degenerate glands—an interpretation not far from the one apparently adopted by the author.

THE advice given by Mr. G. G. Lewis in the *Amateur Photographer*, that tree outlines provide a suitable study for the landscape photographer in spring, can be thoroughly endorsed, but it will be apparent from the snapshots reproduced that photographs should be taken of the whole tree where possible. All the trees mentioned can be found in or around London. With regard to the specific outlines of different trees, it should be the aim of the photographer to evolve these from his own prints.

THE spit of land known as Wilson's Promontory has been reserved by the Government of Victoria as a national park, and the authorities of the Victorian National Herbarium have been deputed to make a botanical survey of the area. The first report by Prof. A. J. Ewart regarding the plants collected on an expedition in 1908 is published in the *Victorian Naturalist* (January). The list consists of 350 phanerogams and ferns, including a dozen naturalised aliens. The rarest species are *Fieldia australis* and *Xanthosia tridentata*. The reserve contains many fine trees, amongst which are specimens of *Eugenia Smithii*, the bright flowering *Coirea speciosa*, *Banksia serrata*, *Prostanthera lasiantha*, *Acacia melanoxylon*, *Hedycarya Cunninghami*, *Eucalyptus globulus*, *E. amygdalina*, and *E. obliqua*.

UNDER the title of "Flora von Paderborn," Dr. M. P. Baruch contributes to the *Verhandlungen des naturhistorischen Vereins der preussischen Rheinlande und Westfalens* (part i, 1908) an account of the general features of the vegetation, and a list of plants collected in the north-east of Westphalia. The scene is a sandy and marshy tract forming part of the Münster inland "bay," where *Scleroderma verrucosa*, *Polytrichum piliferum*, and *Racomitrium canescens* are typical cryptogams in the sand-dunes, and *Myrica gale* grows by the streams. In the neighbourhood of Salzhotten, where salt is worked, *Aster Tripolium*, *Samolus Valerandi*, *Triglochin maritimum*, and other halophytes may be collected. *Aconitum bycoctonum*, *Thalictrum flavum*, *Galium boreale*, and *Serratula tinctoria* are noted as rare plants in the district. The ridge known as the Haarstrang provides chalky soil where many calcicolous plants are to be found.

THE subject of the latest issue—a double number—of the *Vegetationsbilder*, published by Gustav Fischer, Jena, is the volcanic region of Java and Sumatra, including the adjacent island of Krakatau, for which Dr. A. Ernst has supplied the material. The first set of illustrations represents the strubby vegetation in the craters of extinct volcanoes, where the composite *Anaphalis javanica* takes a prominent place. The vegetation of the sulphur and hot springs is too diverse to be discernible in a photograph, but an expanse of *Acorus calamus* on a crater lake is depicted. The next topic is the colonisation of land that has been devastated by eruptions. The photographs taken on Mount Gunung Guntur, the scene of eruptions in the years 1840 to 1847, show masses of *Imperata arundinacea* and *Saccharum spontaneum* in which a few bushes are gradually forcing their way. The last illustrations taken from the island of Krakatau indicate the remarkable growth made since the eruption in 1883. The littoral formation of *Ipomoea pes-caprae* is well established, and behind rises a belt of trees. The author states that he collected 92 phanerogams and 16 ferns; of the former he estimates that about 55 per cent. were sea-borne, 25 per cent. wind-borne, and about 15 per cent. were introduced by birds.

IT is well known that the common crow is omnivorous, and occasionally preys on young birds; two instances are recorded in the report of the Rhode Island Agricultural Experiment Station, where serious losses were caused to poultry-keepers by crows. During the three and a half months from April 1 to July 10 no fewer than 100 chicken are said to have been taken from one farm. The larger ones, some of which were a pound in weight, were killed and eaten where they were caught; the smaller ones were carried away. On another farm 180 ducklings out of 205 were killed. The only effective way of stopping the damage was to shoot a crow and hang up the dead body.

MESSRS. FAGAN AND ALLAN recently issued as Bulletin No. 16 of the Edinburgh and East of Scotland College of Agriculture a useful list of analyses of brewers' and distillers' grains, materials which are largely used as feeding-stuffs in farm practice. The analyses usually quoted in text-books are old, and were probably made before the practice of using light, husky barleys for brewing became common. The average results were as follows:—

| | Brewers' grains | | | | | | Distillers' grains | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 Limits of Variation | | 5 | 6 | 7 | 8 |
| | Old average | 26 recent samples | Max. | Min. | Wet grains | Dried grains | Wet | Dry |
| Oil | 7·72 | 4·99 | 7·00 | 2·70 | 1·20 | 4·56 | 1·42 | 5·45 |
| Nitrogenous matter | 22·76 | 20·61 | 23·12 | 17·56 | 4·98 | 18·85 | 4·48 | 17·15 |
| Nitrogen free extract | 46·77 | 48·87 | 53·22 | 43·30 | 11·83 | 44·74 | 13·02 | 49·77 |
| Fibre | 17·56 | 21·03 | 23·40 | 17·61 | 5·08 | 19·24 | 4·23 | 16·18 |
| Ash | 5·19 | 4·50 | 5·50 | 3·70 | 1·08 | 4·11 | 0·77 | 2·95 |
| Water | — | — | — | — | 75·83 | 8·50 | 76·08 | 8·50 |

Nos. 1, 2, 3, and 4 show the composition of the dry matter, Nos. 5 and 7 represent the average of a number of samples as received from the brewery or distillery, and Nos. 6 and 8 show what these samples would contain if sold as dried grains with 8·5 per cent. of water.

IN the March number of *Man* Dr. Seligmann gives an interesting account of a curious series of canoe ornamental carvings from south-eastern British New Guinea. They are known at Murua under the name of *munkuris*, and represent in one series the reef heron, the wings of which are joined to support a specimen of a variety of fish said to be found in mangrove swamps. In others the cockatoo, with its crests well defined, or the tern is the subject of the carving. The reef heron and the cockatoo are well-known totems in this district; but this is not the case with the tern. The supposed efficacy of these carvings cannot, then, be ascribed to totemism. It looks rather as if this were one of the many cases of mimetic magic. The carving of the fish may denote a desire that the canoe may glide with safety through the water; it is to swim over the surf with the grace, ease, and rapidity of the reef heron or the tern. Needless to say, these things are highly valued, and the specimens collected in the Daniels expedition, which are now in the British Museum, are of exceptional interest.

IT has been asserted by M. L. Sainéan in his "L'Argot Ancien" (Paris, 1907) that we have no knowledge of any artificial language in Europe before the fifteenth century. This view is contested by Prof. Kuno Meyer in the January number of the Journal of the Gypsy-lore Society. He points out that most of the processes in the manufacture of artificial language are described minutely and with examples in the commentary, dated in the eleventh century, on the Irish composition called "Amra Choluimb Chille," a eulogy on St. Columba composed in the ninth century. Much later than this we have another artificial Irish language called Ogham, of which he gives an interesting example in facsimile from the original in the library of Trinity College, Dublin. Of the two living secret languages current in Ireland, one, Shelta, discovered by Mr. G. G. Leland, has been proved by Mr. J. Sampson to be a deliberate and systematic modification of Irish Gaelic at an early period of its growth. Of the second, known as Béarlagar na Saor, the information is still scanty. It seems to be mainly confined to Cork and Waterford, where a few sentences are known by most masons, though they cannot always explain the words. It is to a large extent a borrowed tongue, from genuine archaic Irish, Irish words used in a figurative sense, from foreign languages, such as Hebrew, and it has added many words modified by back spelling. Prof. Meyer promises a further discussion of this question, interesting both to the philologist and the student of social history.

THE Bulletin of the Sleeping Sickness Bureau (No. 4, February) contains abstracts of recent papers on trypanosomiasis and its treatment, notably one by Ehrlich on chemotherapy.

SEVERAL important contributions to medical science appear in the *Philippine Journal of Science* for November, 1908 (iii., No. 5). Messrs. Marshall and Teague discuss the precipitin and complement fixation reactions, especially in their forensic application in the recognition and differentiation of blood stains, and Mr. Garrison describes a new intestinal trematode parasite of man (*Fascioletta ilocana*), for which a new genus is created.

DR. F. EREDIA has sent us a copy of his laborious discussion of the temperature at Rome for the fifty years 1855–1904, being an extract from vol. xxviii. of the Annals of the Central Meteorological Office of Italy. The tables exhibit for each of those years (1) ten-day means; these show that the warmest epoch is the third decade of July, the mean being 77°·4 F., the coldest being 43°·7, in the second decade of January. (2) Mean values of maxima and minima for each decade; the epochs agree with those above mentioned, being respectively 87°·6 and 38°·3. (3) Mean monthly and yearly values; the warmest month is July, average 76°·6, the coldest, January, average 44°·1. The mean annual temperature is 59°·7. (4) Absolute extremes for months and years, with dates of occurrence; maximum, 104°·2, July, 1905, minimum, 20°·8, February, 1885, giving an extreme range of 83°·4 F. The author has grouped the values in various ways to find any relation between them and the frequency of sun-spots, but with a negative result. The discussion contains many interesting details to which special reference cannot be made here.

THE *Geographical Journal* for March contains a very useful paper by Mr. G. B. Williams on the mean annual rainfall of Wales and Monmouthshire. The map which accompanies the paper shows the geographical distribution in that locality in greater detail than in any map hitherto published, and gives the areas having an annual rainfall below 30 inches, and those for each additional 10 inches up to 100 inches, the localities with 100 inches to 150 inches and above that amount. It has been prepared chiefly from the data given annually in "British Rainfall" for a period of thirty-five years, viz. 1872–1906 in North Wales, and 1868–1902 in South Wales and Monmouthshire. A large number of short records had to be "standardised" by comparing them with those of long and trustworthy means. The isohyets, or lines of equal rainfall, bear

obvious relationship to the contour lines, but it is by no means a constant one, owing to the positions of the mountains and the local air currents. The wettest parts include the portion of the Carnarvon mountains within a radius of about two miles from the centre of Snowdon, in which area the average fall is more than 150 inches per annum; at Glaslyn, on the lee side of the summit, and within the Snowdon crater, the mean rainfall is apparently 197 inches. An area of about 167 square miles on these mountains has a rainfall of more than 100 inches per annum. In South Wales, at the Bwlch Pass, the mean is about 130 inches. Over the whole country, the fifteen years 1872–86 had an average annual fall of 110·14 per cent., and the fifteen years 1887–1901 had 91·44 per cent., of the mean. Many localities are still poorly provided with rain-gauges; no record appears to be kept on Cader Idris.

THE *Electrical Review* for March 5 devotes three pages to reports of the discussions at London, Manchester, and Dublin of the paper on the use of large gas engines for the generation of power, read last month before the Institution of Electrical Engineers by Messrs. L. Andrew and R. Porter. In a leading article on the subject it points out how little has been done in this country to make gas engines of more than 1000 horse-power a success, and attributes this state of affairs to a tendency of our fellow-countrymen to leave other countries to do the pioneering work, and to hope to take up the subject when the main difficulties have been overcome. In its condemnation of this practice the *Electrical Review* has our cordial support.

PARTS viii., ix., and x. of vol. xliv. of the Proceedings of the American Academy of Arts and Sciences consist of papers by Mr. P. W. Bridgman, of the Jefferson Physical Laboratory of Harvard University, dealing with high hydrostatic pressures. The first describes a primary mercury gauge in which the pressure of the mercury on a piston, kept in rotation to minimise friction effects, is balanced by weights. By means of this gauge pressures up to 7000 kilos. per square cm. may be determined to an accuracy of one-tenth per cent. The second describes a gauge in which the change of the electrical resistance of mercury under pressure is utilised to determine the pressure. The author finds that at 7000 kilos. per square cm. the resistivity of mercury is reduced to 0·83 of its value at atmospheric pressure. In the third paper the apparatus used in the measurement of the compressibilities of certain solids and liquids is described. For solids, a bar of the material is enclosed in a strong cylinder of steel, and is pressed against one end of the cylinder by a spring. The other end of the bar carries a brass ring which is in contact with a shoulder in the cylinder. When the bar is compressed the ring is forced along it, and the extent of the motion gives the difference between the changes of length of bar and cylinder. The latter is measured by microscopes outside the cylinder. In this manner the compressibilities of steel, aluminium, and glass have been determined by Mr. Bridgman.

A PAPER on hydroplanes, or skimmers, was read by Sir John I. Thornycroft, F.R.S., at the Model Yacht Club on March 4. Any vessel which greatly reduces its displacement at high speeds is generally called a hydroplane, but as the gliding surfaces are not always plane, skimmer is a more appropriate term. Steady gliding on the surface of water is difficult to secure; this may probably be obtained by the use of a number of planes, but at the expense of more power. Mr. Froude was of opinion that a single plane was best, but this must maintain a particular angle to the water surface. In a boat intended for skimming there are a number of elements to be considered, which, unfortunately, do not all lead to the same proportions of design. The lifting force depends on the amount of surface and the speed, while the friction for a certain amount of surface decreases with the length. Again, the speed at which skimming will commence increases with the length; naturally this limit should be kept as low as possible. Below a certain velocity the formation of large waves causes bad performance in skimmer models; this difficulty may be lessened by extending the amount of supporting surface or by reducing the weight of the vessel, the surface remaining the same. A boat very wide and short in shape leads to excessive air resistance—an important factor at speeds of thirty miles per hour. The author gives the results of much of his experience with models. The complete paper, together with the lines and a photograph of the successful motor-boat *Gyrinus* at full speed, the latter, built by the author's firm, having won the International Race for 8-metre boats last year, will be found in *Engineering* for March 12.

IN the issue of NATURE for February 11 last (vol. lxxix., p. 438) a note was published dealing with the general report on the operations of the Survey of India administered under the Government of India during 1906–7. A remark in the note concerning the pendulum experiments carried out states that "the results obtained have been found to agree with those obtained by Prof. Hecker in 1905." Major Lenox Conyngham points out to us that this remark is calculated to give the impression that the Survey of India had merely been going over ground already traversed by Prof. Hecker, whereas the reverse was the case. The words of the report are:—"The results of Prof. Dr. Hecker's observations at Jalpaiguri in 1905 have been received and found to agree perfectly with those of Major Lenox Conyngham."

IT will be remembered that the centenary of the Geological Society of London was celebrated in 1907. Articles dealing with the celebration proceedings appeared in the issues of NATURE for August 1 and October 3, 1907 (vol. lxxvi., pp. 317 and 569). Messrs. Longmans, Green and Co. have now published for the Geological Society a detailed account of the varied meetings, held from September 26 to October 3, 1907, in honour of the occasion. The volume, which runs to 166 pp., and costs 2*s*., has been compiled by the senior secretary of the society, Prof. W. W. Watts, F.R.S., and includes an exhaustive account of the excursions, the reception, the congratulatory letters and addresses, the presidential address, the social functions, and the visits of the guests of the society to the Universities of Oxford and Cambridge. An excellent portrait of Sir Archibald Geikie, K.C.B., president of the Royal Society, forms the frontispiece to what is in every way an interesting memorial of an important celebration.

A FIFTH edition of the late Mr. Catchpool's "Text-book of Sound" has been published by Mr. W. B. Clive. The work has been revised and enlarged by Mr. John Satterly. The revision has consisted more of additions than of alterations, and these include many instructive experiments, with descriptions of apparatus and manipulation.

AMONG the forthcoming publications of the Society for Promoting Christian Knowledge are:—"The Spectroscope and its Work," by Prof. H. F. Newall, F.R.S., and "English Wild Flowers," by Prof. Henslow, with more than 200 coloured illustrations of plants, natural size, drawn by G. Layton.

## OUR ASTRONOMICAL COLUMN.

PHOTOGRAPHS OF MOREHOUSE'S COMET, 1908*c*.—Four excellent photographs showing remarkable details in the structure of comet 1908*c* are reproduced on two plates accompanying Circular No. 148 of the Harvard College Observatory.

These photographs are selected from a series of fifty-three taken, between September 3 and November 29, by the Rev. Joel Metcalf at Taunton, Mass. The instruments employed were two photographic doublets, one of 12 inches aperture and 87·5 inches focal length, the other of 5·8 inches aperture and 20 inches focal length, both constructed by the observer.

As the nucleus of this comet was too indefinite to be "followed" successfully, Mr. Metcalf employed the method by which he has obtained such remarkable success in the photography of minor planets. This consisted in following on an adjacent star and moving the cross-wires, with a micrometer screw, every minute by an amount sufficient to compensate for the comet's theoretical motion as indicated by the ephemeris.

Comet Morehouse (1908*c*), 1908 November 21, 10h. 32m.—11h. 48m. (G.M.T.)

The photographs are reproduced in half-tone from double-contact prints, thus intensifying the fainter details of the tail, although some of the finer structure of the more exposed head has been lost in the process. On the photograph of 1908 November 15, 11h. 6m. (G.M.T.), the main tail presents a twisted appearance more marked than on any other photograph we have yet seen. The second photograph shows a remarkable waviness of the stronger northern edge of the tail with curious interlacings, and, as seen from the configuration of the surrounding stars, it is a connecting link between the November 16 and 18 photographs reproduced by Prof. Barnard in the January number of the *Astrophysical Journal*.

The photograph which we here reproduce was taken with 76 minutes' exposure on November 21, the time of mid-exposure being 11h. 10m. (G.M.T.). It will be noticed that, in addition to that contiguous to the nucleus, there are two constrictions in the main tail, apparently indicating two separate outbursts of activity on the part of the nucleus in the ejection of tail matter; the approximate position of the centre of the plate is 18h. 58m., +1° 30′.

For the benefit of other observers who wish to make a detailed study of comet 1908*c*, Prof. Wolf publishes in *Astronomische Nachrichten*, No. 4311, a list of the photographs taken with ten different objectives at the Heidelberg Observatory.

Between September 6 and November 27, 1908, 147 plates were taken on thirty-three different nights, and the present list gives the date, time, and duration of each exposure, with a note as to the instrument employed.

RELATION BETWEEN THE MAGNITUDES AND COLOURS OF STARS.—In No. 4312 of the *Astronomische Nachrichten* (p. 249) Herren Müller and Kempf discuss the relationship which holds between the magnitudes and colours of the stars of the Potsdam Photometrischen Durchmusterung.

The number of stars included in the discussion is 14,172, and these are tabulated, in tenths of a magnitude from 0·0 to 9·9, under four divisions of colour, viz. white, yellowish-white, whitish-yellow, and yellow, the last-named including the few orange and red stars. A summary table shows that by far the greatest number (6324) of the stars considered are classified as yellowish-white, a little more than half this number are whitish-yellow, whilst the "white" and the "yellow, &c.," stars are equal, 2043 in each case. In another table, showing percentages, the white stars show a tendency to increase as the fainter stars are reached, and this increase is more marked in the yellowish-white class. In the whitish-yellow class the percentage decreases in both directions from the seventh magnitude, although the deficiency is more marked towards the fainter stars. The most striking variation is in the "yellow, &c.," class, where the percentages rapidly decrease between magnitude 4·5 to magnitude 9·0.

A second part of the discussion deals with the relation between colours and magnitudes and the galactic latitudes of the stars. The results show, *inter alia*, that the maximum of the brighter white stars occurs in galactic latitudes −11° to −30°, whilst for the fainter white stars the minimum is not at the galactic pole, but in galactic latitudes +30° to +50°.

A REMARKABLE PROMINENCE.—No. 2, vol. xxxviii., of the *Memorie della Società degli Spettroscopisti Italiani* contains an account of two remarkable prominences observed by Father Chevalier at the Zô-sè Observatory on July 30 and 31, 1908.

Both prominences were observed in about position-angle 80°, and were evidently connected with the fine spot groups which appeared round the limb at the beginning of August last. Their changes of form and their general shapes are shown by a series of drawings given on a plate accompanying the paper, and it is seen that both formed well-marked arches; but it is to the spectrum observations that the greatest interest is attached.

On July 30 not only were C, $D_3$, and F seen reversed, but also the lines of helium at λλ 6678·2 and 7065·5; none of the metallic lines was bright, but between *b* and F two bright lines, probably helium λ 5016 and λ 4922, were found.

In addition to the bright lines, however, there was a continuous spectrum, due to the prominences, strong enough to efface, or weaken, the atmospheric spectrum on which it was superposed. A similar phenomenon was observed on August 3, 1872, by Young, who attributed its appearance to an abnormal pressure on the gases emitting it. In the present case it is difficult to see how pressure could operate, and Father Chevalier is inclined to attribute the bright continuous spectrum to heated solid particles condensed from the metallic vapours carried up by the rush of gases.

A strange bright line at about λ 5872·50 was also seen both on July 30 and 31, and on the latter date a similar, but weaker, line was seen on the other side of $D_3$ at about λ 5879·9.

## THE NATIONAL PHYSICAL LABORATORY DURING 1908.

THE annual meeting of the general board of the National Physical Laboratory was held at Teddington on the afternoon of Friday, March 19, when the report of the executive committee for the year 1908 was formally presented, and the various departments of the laboratory were thrown open for inspection. The fifth volume of the "Collected Researches," which is now ready for issue, was also laid before the general board, and includes the results of the more important investigations recently carried out at the laboratory.

In connection with this year's gathering, the absence of Lord Rayleigh from the meeting cannot be allowed to pass without remark. Lord Rayleigh has always taken the warmest interest in the development of the laboratory; he has been from the first, and is still, chairman of the executive committee, though during his temporary absence abroad his duties have been undertaken by Sir John Wolfe-Barry, and this is the first occasion on which he has been prevented from being present at the annual inspection. His absence was deplored by none more than the staff, by whom his appreciation and his ready counsel on innumerable matters of detail are especially valued. Sir Archibald Geikie, as president of the Royal Society, acted this year as chairman of the general board.

The report of the executive committee gives some particulars as to the expenditure during 1905–8 on new buildings. These comprise buildings for electrotechnics, including photometry, for metrology, and for metallurgical chemistry, as well as an extension of the engineering building. They have been erected at a cost of about 25,000*l.*, and an additional 8000*l.* has been spent on equipment. This latter amount, however, does not include what has been provided out of annual income, nor the many gifts of apparatus. Of the total thus expended, 25,000*l.* has been provided by the Treasury. The grants promised by the Treasury for building purposes have, however, now come to an end; no new buildings have been added during 1908, the funds available being devoted to equipment, which is still by no means complete.

There is thus, unless funds are provided from other sources, no immediate prospect of any considerable extension of existing departments, though the rapid development of the work has shown clearly that the need of further accommodation must shortly become urgent. The department of metallurgy, which is doing work of the greatest value in connection with the most important of British industries, is at present quite inadequately housed in the old kitchen and a few scattered rooms in the basement of Bushy House. Plans have already been prepared for a new building, which would be an extension of that devoted to the Indian railway test-work, but the committee is unable at present to do more than commend the importance of such a department to the attention and generosity of those to whom metallurgical research is of interest and value.

The only development of first-rate importance immediately in prospect is thus the experimental tank for investigations on ship models, building operations for which will be commenced in the spring. The construction of the tank has been rendered possible by the munificence of Mr. A. F. Yarrow, who has placed 20,000*l.* at the disposal of the Institution of Naval Architects for the erection at the laboratory of a tank of the most modern type, under the proviso that a sufficient sum be found to provide for maintenance during the first ten years. The guarantee fund has now reached a total sufficient to warrant the work being begun, and another department of great public interest and utility will thus be added to the laboratory.

Turning now to the details of the work carried out during the year by the several departments, reference may first be made to the re-organisation of the thermometry division of the physics department. Arrangements have been made for transferring to Teddington some of the thermometer testing at present undertaken by the observatory department, and at the same time it has been found necessary to provide increased facilities for the rapid and accurate verification of high- and low-range thermometers, as well as of standards and thermometers of special types.

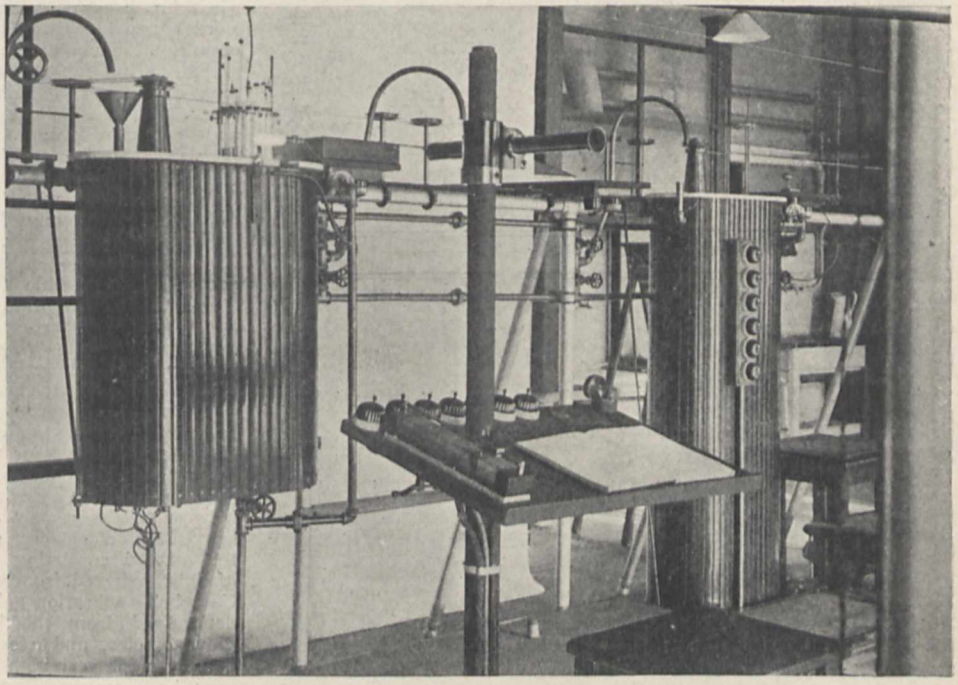

FIG. 1.—Comparison Baths for Verification of Ordinary and Standard Thermometers.

For this purpose the old chemical laboratory, vacated by the transfer of the chemical work to the new building for metallurgical chemistry, has been re-fitted with a new and special equipment for the testing of mercury thermometers, designed by Dr. Harker and Mr. W. A. Price, a description of which is given as an appendix to the report. The chief requisites in connection with baths for thermometer comparisons are efficient stirring, convenient and rapid heating, and satisfactory temperature regulation, with arrangements for avoidance of emergent stem errors. At the same time, suitable provision must be made for the rapid recording of observations. The type of bath and the general arrangements adopted are shown in Fig. 1. The containing vessel of the apparatus consists of two flat boxes of cast brass, the larger containing the thermometers to be tested, while the smaller is occupied by the stirrer above and the electric heating appliances below. The stirrers in all the baths are driven with endless cord and pulleys from an electric motor. The heating is effected by means of special resistance units, each of 400 watts capacity, constructed of "Eureka" strip. The baths are well lagged, and the temperature can be run up very quickly to any desired point. A desk is provided for the observer, above

which is the telescope for taking the readings, while a series of switches allows of temperature regulation. By means of a handle on the left of the desk, connected by a flexible shaft to the cage carrying the thermometers, the cage can be rotated so as to bring the thermometers successively into the field of view.

The bath on the right in the illustration is reserved for the comparison of standards. It is of the same general type as above described, but is being fitted with a telescope carried on a traversing support fixed to the bath itself, giving greater rigidity, and thus allowing the employment of a higher magnification. In addition there are a bath for very long thermometers, oil and nitrate baths for the higher temperatures, zero-point apparatus for ordinary and standard thermometers, and steam-point apparatus. The

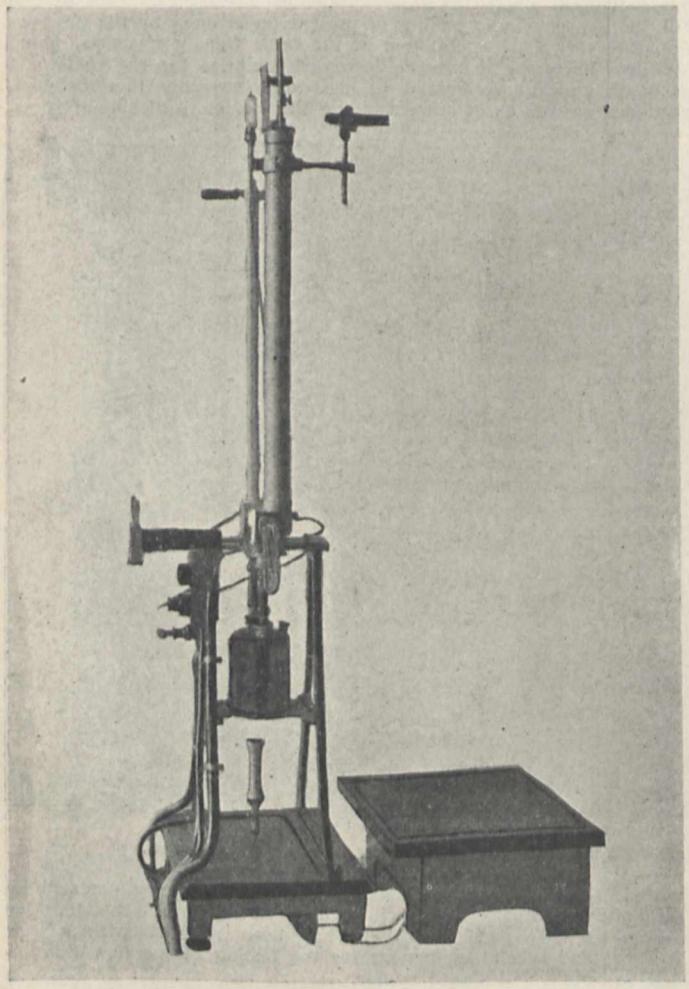

FIG. 2.—Steam Point Apparatus for Standard Thermometers.

steam-point apparatus for standard thermometers is of the form designed by Chappuis, and is shown in Fig. 2. The upper part can be turned into a horizontal position, so that observations can be made with the thermometer either horizontal or vertical, as required for determination of pressure coefficients. A second steam bath of similar form, but not arranged to tilt, serves for ordinary work.

The work of the thermometry division has also included the equipment, for work at very high temperatures, of the new electric furnace room. Much attention has been given to the perfecting of furnaces, and some interesting figures are printed in the report showing the increased efficiency obtained in the ordinary platinum-foil wound type with improved construction and lagging. The power required to maintain a temperature of 1350° C. has been reduced from 3300 watts to 1400 watts, the new furnace being at the same time of greater internal capacity than the old. A new type of spiral carbon-tube furnace has been devised, of which a description will be published shortly, and much preliminary work has been done with a view to the greatly needed investigations into the different methods employed in measuring temperatures up to 2000° C.

The chief item of research work completed during 1908 was an investigation, in which Mr. F. P. Sexton assisted, into the effect of pressure on the boiling point of sulphur.

In the electrical standards division much time was spent in intercomparison of standards with those of other laboratories, and the excellent work accomplished by Mr. F. E. Smith was of great value in connection with the International Conference on Electrical Units, held in London in October. The papers published during 1908 include an account of the secular variations in the laboratory standards of resistance, and of the effect on manganin resistances of atmospheric humidity. Vol. v. of the "Collected Researches" contains also a paper describing an improved procedure for setting up mercury standards of resistance. In addition to this work, good progress has been made in the construction of the Lorenz apparatus for the determination of the ohm in absolute measure, which is being presented to the laboratory by the Drapers' Company in memory of the late Prof. Viriamu Jones.

Mr. Campbell has continued his work on self- and mutual-inductance standards. Of special interest is the method he has devised for the direct comparison of a mutual inductance and a resistance, from which may be made a determination of the ohm in absolute measure. A preliminary account of the method has been published in the Proceedings of the Royal Society, and it seems possible that in the further experiments to be made a high degree of accuracy in the absolute determination may be attained. Valuable work has also been done in setting up standards for the determination of oscillation frequencies in wave telegraphy.

From the optics department, a paper by Mr. Hunter describing an apparatus for determining the intensity curve for the image of an "edge" formed by an optical system was recently read before the Royal Society. Of general interest also is a new apparatus for testing the speeds and efficiencies of photographic shutters, the method consisting in photographing a spot of light reflected from the mirror of one of Mr. Campbell's vibration galvanometers. The time is determined from the known frequency of the galvanometer, and a satisfactory trace is obtainable even for very high shutter speeds, which can thus be determined with considerable accuracy. Work which has been in progress for some time on the standardisation of oculists' cases of trial lenses was completed during the year, and the testing and certifying of such trial cases is now regularly undertaken by the laboratory. The testing of microscope objectives is also under consideration.

In the electrotechnics building the chief addition to the equipment is a 100,000-volt transformer by the Westinghouse Co., which was recently installed, and is now working satisfactorily. This will be employed in the continuation of a research on insulating materials, while an investigation into the dielectric strength of ebonite of various compositions is already in progress. A large amount of test work on alternating-current instruments was dealt with during the year, and the equipment for such work has been greatly improved. A new electrostatic wattmeter, constructed in the laboratory workshop, deserves special mention, as well as a series of manganin water-cooled tube resistances with a device for bringing the voltage drop at their terminals into phase with the current passing through them.

In the photometry section, also, good progress has been made, especially in the arrangements for life tests on glow

lamps. Life-test frames, designed for dealing with large numbers of lamps, have been constructed in the laboratory; the racks can be tilted, so that the lamps may be burnt at any angle, and resistances are provided for each lamp to bring the voltage on the terminals to the value at which the lamp will run initially at the standard watts per candle. A new specially designed photometer bench, by Alex. Wright and Co., is employed for rapid candle-power measurements of lamps under life test.

Following upon a suggestion made by Dr. Glazebrook at the British Association meeting in Dublin, agreement has been arrived at with the standardising laboratories of some other countries in regard to the adoption of an international light unit, and it is hoped that from an early date it may be possible to express light measurements in terms of the international candle. The matter is engaging the attention of the International Electrotechnical Commission.

The metrology division has been much occupied during the year in transferring apparatus to the new building completed in 1907. A special feature of the building is the long gallery, in which 50-metre surveying tapes can be verified, whether on the flat or in catenary. Special apparatus for the measurements has been constructed by the Cambridge Scientific Instrument Co., and the installation is now nearly complete.

One of the rooms in the metrology building will be devoted to the apparatus for ruling diffraction gratings which belonged to the late Lord Blythswood, and which has been placed on loan at the laboratory by Lady Blythswood. After some alterations which were contemplated by Lord Blythswood, the apparatus will be capable of ruling gratings up to a length of 8 inches.

As in previous years, the division has undertaken a considerable amount of work in connection with the Engineering Standards Committee, and in particular diring 1908 important work has been done on the measurement of screws and screw gauges.

In the engineering department Dr. Stanton is still continuing his very valuable and interesting researches with regard to wind pressure. His paper relating to the wind pressure on structures in the open, and discussing the difference in the resultant pressure on large and small plates, is included in vol. v. of the "Collected Researches." The question considered during 1908 has been the possibility of inferring the maximum pressure on a large area during a gale from the maximum pressure registered at a single point of the area. The attempt to measure the mean pressure over a large area of 1000 square feet was made by means of pressure tubes distributed over the area, and some interesting theoretical results were obtained when a self-recording apparatus was set up to register the mean pressure from more than two such tubes. At present continuous records are being taken of the mean pressure at two points 40 feet apart, and will no doubt furnish information of value. Dr. Stanton has also been investigating the resistance of plates and models in a uniform current of water. Some of the results obtained are included in a communication to be made to the Institution of Naval Architects. A research on the heat transmission and resistance of air currents in pipes is also in progress.

The important work on the behaviour of materials under repeated stresses has been very considerably advanced. An ingenious machine has been devised to make a combined abrasion and bending test under conditions approximating to those of a steel rail in practice; the conditions may be varied from pure abrasion to pure bending. A paper on the resistance of materials to impact was read before the Institution of Mechanical Engineers, and Mr. Bairstow has completed a research on the elastic limits of material under alternating stress.

The work on superheated steam has been continued, and in connection with this a research has been carried out on the loss of heat from steam-pipe flanges.

In both branches of the work of the department of metallurgy and metallurgical chemistry material progress has been made. A paper on cooling curves was read by Mr. Rosenhain before the Physical Society; a paper entitled "Eutectic Research, No. 1, the Alloys of Lead and Tin," was presented to the Royal Society and printed in the Philosophical Transactions, and the research on the copper-aluminium-manganese alloys for the Alloys Research Committee of the Institution of Mechanical Engineers was carried on continuously throughout the year. A report on the first section of this work will shortly be communicated to the institution. In addition, a considerable number of important cases of failure were investigated in cooperation with the engineering department, and some account of this work was given in a paper on the study of breakages, read before Section G of the British Association at Dublin.

In the section of this department devoted to metallurgical chemistry, special attention has been given to the improvement of the equipment and to the organisation of the work. The methods of steel analysis and the apparatus employed were described in a paper read by Mr. Rosenhain before the Iron and Steel Institute, which is reprinted as an appendix to the laboratory report. Of special interest are the silica-tube combustion furnaces for the estimation of carbon, a new type of electric muffle furnace, and the apparatus for electrolytic deposition. New methods of analysis have been investigated, and an improved procedure for the estimation of phosphorus, especially in phosphor-tin, has been described by Messrs. Gemmell and Archbutt.

The work done at the observatory department under Dr. Chree, and the allied work at Eskdalemuir under Mr. Walker, are of special character, and cannot properly be dealt with here. Dr. Chree has completed a monumental piece of work in the reduction and analysis of the magnetic records obtained by the *Discovery* Antarctic Expedition, while in addition he has discussed the magnetic observations of the *Scotia* and the temperature and pendulum observations of the *Discovery*. His work on the Kew records has been continued in a paper, "Magnetic Declination at Kew Observatory, 1890 to 1900," Phil. Trans., A, vol. ccviii., 1908, reprinted in vol. v. of the "Collected Researches"; a similar discussion of the horizontal force curves is in progress. Much attention is also being given to the improvement of methods of meteorological observation.

The new observatory at Eskdalemuir was occupied in May, 1908, and the work of installing apparatus was at once commenced. Regular meteorological observations are now proceeding, and the seismographs have been running since September, but the magnetographs have not yet been erected. The delay has been due chiefly to difficulties with damp in the magnetograph houses, which, however, it is hoped are now finally overcome. Absolute magnetic observations have been made three times weekly since October.

The past year has been marked by steady and continuous progress in all branches of the work of the laboratory rather than by any new development of first-rate importance. The construction of the experimental tank will add to the laboratory a new department of special interest, and it is to be hoped that in the near future means may be found of providing the much-needed extensions of existing departments.

## THE AËRO AND MOTOR-BOAT EXHIBITION.

THIS exhibition, which opened at Olympia on March 19 and will close on March 27, is the first of its kind to be held in this country. The exhibition has been organised by the Society of Motor Manufacturers and Traders, Ltd., of which Mr. E. Manville is president, and is under the management of Mr. H. A. Blackie. The society has had the cooperation of the Aëro Club, and has succeeded in presenting a valuable collection of models of aëroplanes, several full-sized complete machines, together with ordinary and dirigible balloons, and motor-boats.

Probably the most striking object in the hall is the inflated Wellman dirigible *America*. This airship, in which Mr. Wellman proposes again to attempt to reach the North Pole this year, is about 184 feet long, 52 feet in diameter, and about 70 feet from the top of the envelope to the bottom of the basket. The ship is suspended from the roof of the hall, and has a capacity of 300,000 cubic feet. The car is 125 feet long, the base forming a petrol tank of

two tons capacity. Provision is made for three explorers, a pack of dogs, two sleds, a boat, &c., and, when completely equipped, the ship weighs about five tons.

Owing to the few opportunities of inspecting aëroplanes in this country in the past, these machines at Olympia are easily first in public interest. Included among them is the aëroplane, of French make, used by Mr. J. T. C. Moore-Brabazon, who was one of the first two Englishmen actually to fly. The machine is a bi-plane, *i.e.* two planes one above the other, built by Voisin, there being 2 metres' distance between the planes, and it is fitted with an eight-cylinder E.N.V. engine. Three flights of from one to two kilometres, and about a dozen flights of from one to five kilometres, at a height up to 50 feet, have been made with this machine.

The Société Commercial des Automobiles Gobron-Brillie show an unfinished Breguet aëroplane of the bi-plane type. This machine is fitted with means of warping the planes differentially, which is intended to produce automatic balancing, to facilitate turning, and to act as an elevating rudder.

A British-made aëroplane, designed by Mr. Weiss, is shown by Handley Page, of Woolwich. The machine is a monoplane, having a span of 34 feet and an area of 150 square feet. There are two propellers driven by a 12 horse-power three-cylinder motor, air-cooled. Steering is effected by means of two flaps placed at the back of the main plane.

The Miesse Petrol Car Syndicate show a machine having wings, which are given a bird-like movement by an ingenious mechanism. Messrs. Short Brothers, of Battersea, show a bi-plane, and also an inflated balloon of 11,000 cubic feet capacity constructed for the Hon. C. S. Rolls. A bi-plane designed by W. Windham, of St. John's Hill, is shown, but, like several of the other machines, has not yet been tried. The Continental Tyre and Rubber Co., of Clerkenwell Road, show an inflated passenger balloon of 49,000 cubic feet capacity.

Mr. Howard T. Wright, of Marylebone, shows a beautifully constructed bi-plane, the main planes being 40 feet wide and 6 feet 6 inches deep. There are two propellers running in opposite directions driven by a 20 horse-power motor. Vertical steering is provided for by a double rudder in front of the main planes, and horizontal steering by a vertical rudder in the tail. Messrs. Lamplough and Son, Ltd., of Willesden Junction, show a compound lifter plane and glider. The design is the first of its kind, and awaits trial.

Mr. Frederick R. Simms shows a Simms-Voisin bi-plane of the type used by Farman, Delagrange, and Fournier in their flights. The main planes are 32·8 feet long, 6·5 feet wide, 5 feet space; the rudder cell or tail is 8·5 feet wide, 5 feet space, and contains a vertical rudder for horizontal steering. Vertical steering is secured by a horizontal rudder in front of the main planes. The total length is 37·8 feet; the weight complete is 1500 lb. The 50 horse-power motor has six cylinders, and weighs 528 lb. complete with water and petrol for a two hours' run. The propeller is 7 feet 5 inches diameter, 5 feet pitch, and weighs 33 lb.

An R.E.P. monoplane is shown by the Établissement Robert-Esnault-Pelterie. This machine won third prize for 200-metre flight last year, the wind having a speed of 6 metres to 8 metres. A Delagrange bi-plane, by Voisin, is shown by the Mass Cars firm. The Cody war kite is on view by permission of the War Office. Messrs. Willows show a dirigible balloon built at Cardiff. Conspicuous among the exhibits of motors are those of the Wolseley Tool and Motor Car Co., Ltd., and also those of Messrs. John I. Thornycroft and Co., Ltd. It is unfortunate that no machine used by the Wright brothers is on view, although a small model of one may be seen.

The exhibition is well worth a visit, and shows that manufacturers in this country are alive to the potentialities of recent developments in France and other countries, and are taking steps not to be left behind in the race for the conquest of the air. It will assist in arriving at a proper estimation of the value of the exhibition if the fact is realised that all is as yet in the experimental stage, even in the case of the most successful of the machines shown.

## *HIGHER EDUCATION IN THE UNITED STATES.*

THE report of the U.S. Commissioner for Education for the year ended on June 30, 1907, has been received from Washington. This is the first report issued by Dr. Elmer E. Brown, who succeeded Dr. William T. Harris as commissioner on July 1, 1906. The two volumes, which together run to 1214 pages, deal exhaustively with every branch of American education, and in addition include valuable reviews of educational progress in many European and other countries.

The carefully arranged and remarkably complete tabulated statistics of the 606 universities, colleges, and technological schools of the United States, contained in the second volume, shows what valuable assistance our own Board of Education could render students and administrators of education if it would provide similar conspectuses concerning British institutions of higher learning.

From this part of the report we learn that the total value of all gifts and bequests reported by the 606 institutions referred to, as having been received during the year under review, amounted to 4,574,000*l.* Of this amount about 1,540,000*l.* was given for buildings and improvements, and 2,540,000*l.* for endowment. The remaining amount was for current expenses. Forty-two institutions each received 20,000*l.* or more. The six institutions which benefited to the largest extent in this way were the University of Chicago, which received some 1,189,000*l.*; the Rensselaer Polytechnic Institute, of New York, with its 215,400*l.*; Yale University, 198,000*l.*; Cornell University, 156,000*l.*; Princeton University, New Jersey, 153,000*l.*; and Harvard University, 139,000*l.*

The report shows that the Washington Bureau of Education received full particulars for the year which ended in June, 1907, from 606 universities, colleges, and technological institutions in the United States. Of these institutions, 150 are for men only, and 330 are open to both men and women. The teaching force of the whole of the institutions aggregated 24,679—an increase of 729 teachers of different grades over the preceding year. The total enrolment of students was 293,343. Leaving out colleges for women only, and dealing with the remaining 480 institutions, tables are provided in the report which show that, in the session 1906–7, 3,399,000*l.* was received by students' fees, 782,000*l.* being for board and other non-educational purposes.

The amount received from productive funds was 1,955,000*l.*; the receipts from State or city for increase of plant were 755,000*l.*, for endowment 45,000*l.*, and for current expenses 1,628,000*l.* From the United States Government certain of the institutions, including agricultural and mechanical colleges, received 533,000*l.* The grand total of the receipts of these 480 colleges from every source was 13,616,000*l.* Exclusive of amounts for endowment purposes, the total sum available for current expenses, improvements, and building was 11,083,000*l.* These institutions had in the year under review in their libraries 12,472,530 volumes, valued at about 3,613,000*l.* The value of their scientific apparatus, machinery, and furniture was 5,639,000*l.*, and of grounds and buildings 48,816,000*l.*, while their productive funds reached 50,238,000*l.*

Some aspects of higher education in the United States are dealt with in an article by Prof. R. C. Maclaurin, president-elect of the Massachusetts Institute of Technology, which appeared in the *Revue scientifique* of January 16 under the title "L'Enseignement technique supérieur aux États-Unis." After referring to the interest taken in France in the progress of technological education, Prof. Maclaurin remarks that the European suspects an excessive development of the utilitarian spirit across the Atlantic, and thinks that America's enthusiasm for her own institutions too often displays some lack of the critical faculty; but it is maintained that a good deal of the right spirit is at work, and that the problems of education in America are being attacked with seriousness and strength of purpose. Referring to the better technological institutions in the United States, the article points out that, judged by French standards, the expense of conducting

them is very great. It is not generally known that all the better institutions are developing so rapidly that their large revenues are inadequate.

It is often thought that in America there is an excessive expenditure on buildings and grounds, but this expenditure has been greatly exaggerated, and as to equipment, many American institutions are far behind the best of those in Europe. The number of professors is large, and in many cases this fact arises from excessive teaching or too much specialisation. In the best schools, however, it is due to an effort to encourage close relations between teacher and student. The administrative side of American institutions is highly developed, and, in fact, in matters of organisation and administration American institutions differ markedly from those in other countries. In the best schools a strong effort is made to avoid an excess either of "theory" or of "practice." The length of the course is usually four years, with a tendency to establish fifth-year courses for post-graduate study. Great importance is attached to means for keeping the schools in close touch with industry. One means of effecting this is the custom of encouraging professors to take an active part in the practice of their profession.

The Massachusetts Institute of Technology is described in detail. The property of the institute is valued at about 800,000*l*.; its annual expenditure is about 100,000*l*. There are about 1500 students, and the annual fee is 50*l*. The teaching staff consists of about two hundred men, of whom nearly half are professors. The programme of studies involves thirteen different courses, each leading to the degree of Bachelor of Science. The student is free to choose whatever course he names, but in any given course most of the work is prescribed, although there is always a considerable number of options. The studies are not purely "professional"; a certain amount of modern languages, literature, history, and even of political economy is provided for. Prof. Maclaurin directs attention to special features of the institution, such as the facility offered for researches in chemistry, physics, and sanitary science. For this research work special laboratories are provided. The chemical laboratories are planned to hold about a thousand students. The chemical department occupies forty-five rooms, including twenty-five laboratories, four lecture-rooms, a library, three rooms for weights and measures, and so on. The laboratory of chemical research occupies six separate rooms, and the chemical library has 10,000 volumes.

Prof. Maclaurin doubts the wisdom of separating science and technology. He thinks that a properly managed institute of technology should be an admirable training ground even for the man destined to devote his life to the advancement of "pure" science. It would avoid that separation of head and hand that is so bad for both. Science is sometimes in danger of becoming preoccupied with abstractions; its detachment from practice deprives it of a much needed stimulus, and makes for the detriment both of science and technology.

## *SOME BIRD-PAPERS.*

OBSERVATIONS made in the neighbourhood of Tunbridge Wells have led Messrs. C. J. and H. G. Alexander to conclude that in the case of many of our migratory species of birds, each pair occupies a definite and restricted area during the breeding-season, into which other pairs of the same species do not intrude. This has led to the formulation of a scheme for mapping the individual distribution of such migratory birds in their breeding-haunts, the details of this plan being explained by the authors in the March number of *British Birds*. In noting on the map the nesting-area of any particular pair of birds, the authors generally relied upon the singing of the cock in one special spot. A reproduction of the Ordnance Survey map on the 6-inch scale of a small district in the neighbourhood of Tunbridge Wells, on which have been marked the nesting-areas of the individual pairs of migratory birds, serves to illustrate the plan.

To vol. vi., part v., of *Annotationes Zoologicae Japonenses*, Mr. M. Ogawa contributes a hand-list of the birds of Japan, arranged on the same plan as the British Museum "Hand-list of Birds."

In a paper on the kingfishers commonly known under the generic designation of Pelargopsis, published as No. 1657 of the Proceedings of the U.S. National Museum (vol. xxxv., p. 657), Mr. H. C. Oberholser proposes to abolish that name, on account of insufficient definition, and to replace it by Ramphalcyon of Reichenbach. If the innovation be adopted, it may be hoped that the spelling of the name will be amended, and also that ornithologists will not follow the author in using the absurd designation *Ramphalcyon capensis capensis* for the typical race of a species restricted to the Malay Islands. Ornithologists have generally considered the sexes of these kingfishers to be externally indistinguishable, but this Mr. Oberholser points out is incorrect, the females being generally larger than the males, with the back and wings, and sometimes also the tail, duller and browner or greener in colour.

The January number, vol. viii., part iii., of the *Emu* contains the second part of a paper, by Mr. A. H. E. Mattingley, on the mallee-fowl (*Lipoa ocellata*), which is largely devoted to the eggs, young, and nesting-mounds of these remarkable birds. The Lipoa does not commence to lay until two years old, and during the first half of the breeding-season the eggs are laid regularly every third or fourth day, after which the intervals between the deposition of the eggs increase according to the disposition of the individual birds and the amount of food available. Hot and dry seasons have a noticeable effect on these birds, which under such conditions lay fewer eggs than usual. Laying usually commences early in September, but may be deferred until December is well advanced, and the total number of eggs laid by the individual hens in a season varies from one to a score. The eggs have unpolished shells of a delicate salmon-pink or pinkish-red colour when first laid, but soon fade to earthy-brown. They are laid in the mound in tiers, with four in the basement tier; between each tier is a layer of sand 3 or 4 inches thick, and the eggs in the same time are separated from one another by from 6 to 12 inches of the same material, and placed near the solid wall of decaying vegetable matter bounding the egg-chamber. The eggs are always placed with the narrow end downwards, so that when hatching the head of the chick, which occupies the larger end, will be uppermost.

In the *Times* of March 3 Mr. P. McKenzie announces the shooting in the Polela district of Natal of a white stork, which bore on one leg a metal band with the inscription "Ornith. Köspont, Budapest, Hungaria, 209." To this letter there appeared in the same journal for March 17 a reply from Dr. O. Hermann, director of the Royal Hungarian Central Bureau for Ornithology, stating that the bird in question was liberated in Transylvania in July, 1908. This, taken with another event of the same nature, serves to settle the disputed question whether European storks cross the equator on their winter migration.

To the February number of the *Victorian Naturalist* Mr. A. J. Nuth contributes notes on the habits of Australian bower-birds. After alluding to the fact that the species of the genera Ptilonorhynchus and Chlamydodera adorn their bowers chiefly with bones, next to which come shells, stones, berries, and fragments of metal, while Prionodura uses flowers alone, and thus approaches the Papuan gardener-bird (Amblyornis), the author points out that the tooth-billed *Scenopoectes dentirostris* forms a connecting link, in the matter of habits, between the more typical bower-birds and the cat-birds (Æluredus). In place of constructing a bower, the tooth-billed species merely clears a space, which it decorates with leaves, usually placed with the under surface uppermost; cat-birds, on the other hand, neither build a bower nor clear a space. Special attention is directed to the bowers of Newton's bower-bird (*Prionodura newtoniana*), some of which are stated to be more than 8 feet in height, and are decorated with flowers, generally orchids. At the larger bowers males alone are usually seen during the nesting-season, as the females are engaged elsewhere.

## SCIENTIFIC WORK OF THE SMITHSONIAN INSTITUTION.[1]

### Explorations and Researches.

THE resources of the Smithsonian Institution are at present too limited to permit of large grants for extensive explorations or investigations, but, so far as the income allows, aid is given in various lines of research work, and it is sometimes found possible to engage in expeditions likely to accomplish important results.

Through the National Museum, the Bureau of American Ethnology, and the Astrophysical Observatory, the institution has been enabled to carry on various biological, ethnological, and astrophysical researches during the year covered by the report.

### *Studies in Cambrian Geology and Palaeontology.*

In the last report reference was made to studies of the older sedimentary rocks of the North American Continent which Dr. Walcott has been carrying on for the past twenty years. This work was continued in the Canadian Rockies during the field season of 1907. Early in July a camp outfit was secured at Field, British Columbia, and work begun on Mount Stephen. Subsequently sections were studied and measured at Castle Mountain, west of Banff, Alberta; at Lake Louise, south of Laggan, Alberta; and on Mount Bosworth, on the Continental Divide near Hector, British Columbia. Upward of 20,000 feet of strata were carefully examined and measured, and collections of fossils and rocks made from many localities. It was found that the Cambrian section included more than 12,000 feet of sandstones, shales, and limestones, and that the three great divisions of the Cambrian—the Lower, Middle, and Upper—were represented in the Bow River series and the Castle Mountain group. Characteristic fossils were found in each division.

### *Aërial Navigation.*

Within the past year there has been a renewed interest in experiments in aërial navigation, to which the institution, through Dr. Langley, made notable contributions. Toward the end of the year the demand for literature on the subject so entirely exhausted the supply of papers on hand that a special edition of some of Dr. Langley's more popular memoirs was issued. It is gratifying to be able to say that his pioneer work in heavier-than-air machines, resulting as it did in the actual demonstration of the possibility of mechanical flight, has now received universal recognition.

Besides numerous popular papers, Dr. Langley wrote two technical works relating to the general subject of aërodromics, which form parts of an incomplete volume of the Smithsonian Contributions to Knowledge. The record of his experiments from 1893 to 1905 was kept by him partly in manuscript form and largely in the shape of voluminous notes and waste-books. These have been turned over to his principal assistant in this work, Mr. C. M. Manly, who has been for some time engaged in preparing them for publication and adding such necessary information, especially on the engineering side, as comes within the immediate purview of Mr. Manly's work.

### *Meteor Crater of Canyon Diablo, Arizona.*

An investigation of the remarkable crater-like depression at Coon Butte, near Canyon Diablo, Arizona, was made in 1907 by Dr. G. P. Merrill, head curator of geology in the National Museum, aided by a grant from the Smithsonian Institution. An article upon studies of this crater by other geologists appeared in NATURE of September 13, 1906. The "crater" is some three-fourths of a mile in diameter and 500 feet in depth in a region of undisturbed sedimentary rocks and remote from volcanoes. The object of the study was to determine, if possible, whether the crater was caused by volcanic action, as assumed by some investigators, or due to the impact of a mass of meteoric iron, as asserted by others.

From the available evidence Dr. Merrill concluded that the crater could not have been formed by volcanic action, all the observed phenomena being of a superficial nature. Some 300 feet of overlying limestone and 500 feet of sandstone have been shattered as by some powerful blow, and the quartz particles in the sandstone in part fused, indicating a very high degree of heat. The deeper-lying sandstone, however, is entirely unchanged. These facts absolutely preclude the formation of the crater by any deep-seated agency, and forces the conclusion that it resulted from the impact of a stellar body.

No record has been found of a meteoric fall comparable with this, the largest known meteorites, such as that from Cape York, Greenland, and the enormous irons from Oregon, having fallen under such conditions as scarcely to bury themselves. The nearest approach to the Canyon Diablo occurrence was that at Knyahinya, Hungary, where a 660-lb. stone penetrated the ground to a depth of 11 feet. No meteoritic mass of sufficient size to have made this enormous crater has been brought to light, but it is thought there still remains the possibility of its having become dissipated through the heat developed by its impact while travelling at a speed of many miles a second.

In his report Dr. Merrill goes very thoroughly into details. He has secured many specimens of the meteoritic irons and their associations from the locality, which are deposited in the U.S. National Museum. The specimens include a hitherto unrecognised type of meteoritic iron and a peculiar form of metamorphism in the siliceous sandstone of the region.

Mining operations carried on in the crater afforded special opportunity for this research. These operations were discontinued during the winter, but their resumption in May, 1908, presented a second opportunity for the observation of the unique phenomena at the crater, and Dr. Merrill was authorised to proceed again to Arizona to be present during this second, and probably final, series of drillings. The greatest depth reached during his stay at the crater was 842 feet, and the results of the examination of the ejectamenta thus secured confirmed the former conclusion.

### *Alaskan Expedition.*

In the last report mention was made of an expedition to be made to the Yukon country in Alaska for the collection of the remains of large extinct vertebrates, particularly mammals. A Smithsonian expedition had been made to this region in the summer of 1904 by Mr. Maddren, the results of which were published by the institution in 1905. The present expedition of 1907 was in charge of Mr. C. W. Gilmore, of the National Museum. The results of the explorations have been published in the Smithsonian Miscellaneous Collections.

Mr. Gilmore was not successful in finding what was most desired, a fairly complete skeleton of a mammoth, but the expedition was by no means barren of results. He found that scattered remains of Pleistocene animals occur throughout the unglaciated region of Alaska and adjacent Canadian territory in the black muck accumulated in gulches and the valleys of the smaller streams, in the fine elevated clays of the Yukon silts and Kowak clays, and in the more recent fluvial and alluvial deposits. Some of the specimens are so well preserved that they could not have travelled far from the original place of interment, while many bones are broken, abraded, and waterworn. Mr. Gilmore gives a list of the various genera and species of extinct vertebrates thus far reported from Alaska, followed by a brief review with a number of illustrations. He believes that when more perfect material is available it will be found, probably in all instances, to be quite distinct from the living forms. The skull of an Ovibos was found sufficiently complete to warrant its separation from the living form *O. moschatus*, to which nearly all musk-ox material from this region had previously been referred.

### *Geology of the Alps.*

The investigation by Mr. Bailey Willis of the current theories of Alpine structure, under the grant approved in 1907, was successful in offering opportunities for consultation with leading European geologists, among whom were Rothpletz, Suess, Lugeon, Margerie, and Saccord. In cooperation with several distinguished students of the great problems of the Alps, Mr. Willis made detailed studies of critical districts, and was thus enabled to compare opposing theories by object-lessons on the ground. Mr. Willis's full report is expected early in 1909.

[1] From the Report of the Secretary of the Smithsonian Institution, Dr. C. D. Walcott, for the year ending June 30, 1908.

*Absolute Measurement of Sound.*

Dr. A. G. Webster announces the approaching completion of his research on the measurement of sound, which has been in progress for two years past. The investigation comprises an exhaustive treatment of the theory of the production of sound, with a description of a standard source, the transmission of sound through the air as modified by the effect of the ground, and its measurement by a receiving instrument. A description of experiments confirming the theory of Dr. Webster will be included in his finished report, with several practical applications, such as the examination of the sounds of speech, the diagnosis of deafness, the improvement of fog signals, and the testing of materials for the insulation of sound.

*Re-calculation of Atomic Weights.*

In February, 1908, Prof. F. W. Clarke, chairman of the International Commission on Atomic Weights, was authorised to begin the preparation of a third edition of his work on that subject, with the aid of a grant from the Smithsonian Institution. The second edition of Prof. Clarke's "Atomic Weights" was published in 1897, since which time the data on this subject have so largely increased as to render a new edition desirable. Some time will necessarily elapse before the completion of the work.

*Properties of Matter at Temperature of Liquid Air.*

In October, 1907, a Smithsonian grant was approved on behalf of Prof. E. L. Nichols, of Cornell University, for the continuation of his experiments on the properties of matter at the temperature of liquid air. Reports of the progress of this research are to be made from time to time in the recognised journals of physics, and, at the completion of the research, a memoir describing the investigation will be submitted to the Smithsonian Institution for consideration as to publication. It is believed that the prompt announcement of results in the way mentioned will be an immediate advantage to students, and that their publication as a whole by the institution will also prove of great service.

*Flow of Air at High Pressure through a Nozzle.*

The inquiry to determine the cooling effect of the nozzle expansion of air for large pressure differences, which has been conducted by Prof. W. P. Bradley, of Wesleyan University, with the aid of a grant from the Hodgkins fund of the institution, is announced as nearing completion. The investigation was intended specifically to determine whether the cooling process is due to the Joule-Thomson effect or to the performance of external work by the expanding air in pushing back the atmosphere from before the nozzle. The results of the inquiry make it clear that pressure is an important factor, and that the cooling effect increases very rapidly indeed as the initial temperature falls. Prof. Bradley is now engaged in an exact mathematical discussion of this research.

As to the apparatus employed, an interchanger of the Hampton type was so constructed, in vertical sections, that the amount of interchanger surface in actual use could be varied at will, from nothing to more than enough to induce liquefaction. In this manner it was possible to maintain the initial temperature constant, within one-third of a degree, at any desired point between $+20°$ and $-120°$, and the final temperature similarly constant between $+20°$ and the temperature of liquefaction. The temperatures were measured by resistance thermometers placed close to the valves in the high- and low-pressure circuits. The pressures employed range from 500 lb. to 3000 lb. The expansion was exclusively to one atmosphere.

The inquiry is of interest as related to the functioning of air liquefiers in which the air is throttled by a valve and expands without performing external work, in the usual sense of that expression.

*Study of the Upper Atmosphere.*

A further grant from the Hodgkins fund was made to Prof. A. Lawrence Rotch, director of the Blue Hill Meteorological Observatory, to aid in the completion of his experiments with *ballons-sondes* at St. Louis. This was accomplished in October and November, 1907, under the direction of Mr. S. P. Fergusson.

The object of these latest ascensions, twenty-one in number, was to supply data for the high atmosphere during the autumn, a season when there are few observations, and also to establish a comparison with the results obtained simultaneously in Europe on the international term days in October and November. Prof. Rotch reports that all but two of the instruments used in these ascensions were recovered, and an examination of the record sheets indicates generally the presence, at an altitude exceeding eight miles, of the isothermal, or relatively warm stratum, which was found somewhat lower in summer. For example, on October 8 the minimum temperature of 90° F. below zero was found at a height of 47,600 feet, whereas at the extreme altitude reached, namely, 54,100 feet, the temperature had risen to 72° F. below zero. Similarly, on October 10 the lowest temperature of 80° F. below zero occurred at 39,700 feet, while 69° F. below zero was recorded at 49,200 feet, the limit of this ascension, showing that the temperature inversion had come down about 8000 feet in two days.

The prevailing drift of the balloons during the autumn of 1907 was from the north-west, while in previous years they travelled more from the west. A description of the methods employed in launching seventy-seven *ballons-sondes* from St. Louis, and a discussion of the results obtained, will soon appear in the Annals of the Astronomical Observatory of Harvard College.

*Air Sacs of the Pigeon.*

For several years there have been in progress under the general direction of Prof. von Lendenfeld, of the University of Prague, aided by grants from the Hodgkins fund, various investigations bearing upon animal flight. The results of one of these investigations, on the air sacs of the pigeon, by Bruno Müller, was published during the past year in the Smithsonian Miscellaneous Collections. The author summarises the conclusions of his studies as follows:—

I do not consider the air sacs, including the air cavities of bones, as organs having a positive and special function, but rather as a system of empty interspaces. Their value lies in their emptiness—that is, in their containing nothing that offers resistance or has an appreciable weight.

Flying is the highest form of locomotion, and as such only possible to a body of high mechanical efficiency. Our most effective machines are by no means compact and solid, but composed of parts as strong as possible in themselves and arranged in the most appropriate manner. The interspaces between the parts are left empty and taken up by air.

The Sauropsida, at the time they obtained the power of flight, became adapted to its mechanical requirements, and thereby similar to the efficient machines mentioned above; they divested themselves of all superfluous material, filling the body spaces thus obtained with air sacs. While the body wall, adapting itself to the mechanical requirement, became a compact, hollow cylinder serving as a support for the organs of movement, the mobility of the parts was assured by surrounding them with air sacs.

The lengthening of the neck, produced by quite a different adaptation, made necessary an increase in the quantity of air moved during respiration. This demand was met by air currents generated through a rhythmical change in the volume of the air sacs. The connection of the air sacs with the lungs is a consequence of their phylogenetic development, which is repeated in their embryological development, and has no physiological significance other than that the air sacs assist in renewing the air in the trachea.

*Preservation of Archaeological Sites.*

Attention has been directed previously to what had been done toward the preservation of archæological objects on the public domain from destruction by vandals and relic hunters, and toward making these antiquities accessible under proper rules and regulations. Under the terms of an Act of Congress approved June 8, 1906, uniform regu-

lations for its administration were prepared by the Secretaries of the Interior, War, and Agriculture, with the cooperation of the Smithsonian Institution, and were promulgated on December 28, 1906, in the form printed in the last report. Under Rule 8, applications for permits are referred to the Smithsonian Institution for recommendation. During the past year several such applications have been acted upon. The conservation of the nation's archæological possessions was regulated by law none too soon to prevent further mutilation or useless destruction of interesting antiquities in many places.

The President of the United States, by executive proclamation during the year, made several additions to the list of national monuments, including three of archæological interest:—(1) the Tonto National Monument in Arizona, where there are two cliff-dwellings not yet reported on; (2) the Gila Cliff-dwellings National Monument in the Gila National Forest in New Mexico, comprising a group of cliff-dwellings; and (3) the Grand Canyon National Monument, which includes a large number of cliff-dwellings, pueblos, dwelling sites, and burial places in the Grand Canyon of the Colorado.

*Casa Grande Ruin in Arizona.*

In 1906 Congress granted an appropriation of 3000 dollars to be expended under the supervision of the secretary of the Smithsonian Institution for the preservation of the Casa Grande ruin in Pinal County, near Florence, Ariz., and for the excavation of the reservation. An account of the work accomplished by Dr. Fewkes up to June 30, 1907, was published in the Smithsonian Miscellaneous Collections under date of October 25, 1907. The work done during the past fiscal year, under a second appropriation, is noted in an appendix of the present report. The largest structure excavated at Casa Grande is a building 200 feet long with eleven rooms, the massive walls enclosing a plaza. In the central room there is a seat called by the Pima Indians "the seat of Montezuma." The ruins at Casa Grande are found to be very much more extensive than was anticipated, and their permanent preservation is of great archæological importance.

In addition to the work of excavation, preservation, and repair of the cliff-dwellings and other prehistoric ruins in the Mesa Verde National Park in Colorado, studies have been made of the prehistoric culture of the Gila Valley, outside the Casa Grande Reservation. Dr. J. Walter Fewkes, who directed the Mesa Verde explorations, has prosecuted this later research also, and will submit an account in detail of what he has done for publication by the institution.

*Bureau of American Ethnology.*

The Bureau of American Ethnology has continued its investigations among the Indian tribes of the country begun more than a quarter of a century ago. Since it has not been possible to study all of the tribes in detail, a sufficient number have been taken as types to stand for all. The work accomplished in securing knowledge of these tribes has been recorded in the annual reports of the bureau, and the results obtained have been published, so far as circumstances will permit, in bulletins of the bureau. Many manuscripts are preserved in the archives of the bureau. To the present time there have been collected data relating to some sixty families of linguistic stocks and upward of 300 tribes. During the past year this fund of knowledge was added to through researches carried on in Arizona, New Mexico, Colorado, Texas, Minnesota, Pennsylvania, and Ontario.

For the first time the study of native Indian music was seriously taken up by the bureau in connection with certain investigations relating to the grand medicine ceremony of the Chippewa on the White Earth Reservation, Minn. The phonograph was employed in recording the songs. Records of songs were also secured from members of various Indian delegations visiting the capital.

This study and recording of the Indian tribes is not only of national importance, but urgent. The native American race, one of the four races of men, is fast disappearing, and the processes of obliteration are sure. If authoritative investigations are not made now, they never can be made with any like degree of accuracy or of thoroughness. It is a work the nation owes to science, to the Indian race, and to itself. It is a work worthy of a great nation, and one which can be carried on systematically only by a nation. Through the researches of the bureau the world is not only securing, while possible, a permanent record of one of the great races of men now dying out, but is gaining a knowledge of the Indian for practical purposes of administration and in the interest of humanity.

*Astrophysical Observatory.*

At Washington the observation of the relative brightness of different parts of the sun's disc has gone forward as there was opportunity. Improved methods of observing and reducing these observations have been adopted. Preparations for observing the absorption of water vapour in long columns of air, for the region of the spectrum where rays are chiefly emitted by the earth, have been carried to such a state that preliminary measurements have been made. The investigation is being carried on with a column of moist air about 400 feet in length.

A bolometric study of the solar corona was made on Flint Island, in the Southern Pacific, during the eclipse of January 3, 1908. The intensity and quality of sunlight was determined within twenty-five minutes of totality, both before and after, and during totality measurements were made at five different regions of the corona and on the dark moon. A general summary of the results of these and other observations follows:—

*Intensity of Rays (observed through Glass).*

| | Intensity for unit angular area |
|---|---|
| Sun near zenith, Flint Island ... | 10,000,000 |
| Sky 20° from sun, Flint Island ... | 140 |
| Sky far from sun, Flint Island... ... | 31 |
| Sky average, Flint Island ... ... | 62 |
| Sky average, Mount Wilson, Cal. ... | 15 |
| Moon at night, Flint Island ... ... | 12 (?) |
| Moon during eclipse, Flint Island ... | 0 |
| Corona $\frac{1}{10}$ radius from sun ... ... | 13 |
| Corona $\frac{1}{4}$ radius from sun ... ... | 4 |
| Corona $\frac{3}{4}$ radius from sun ... ... | 0 |

When we recall the extreme brightness of the sky within a single degree of the sun, as compared with that 20° away, and consider also the figures just given, it seems very unlikely that the corona will ever be observed without an eclipse.

The nature of the radiation of the inner corona has been supposed by some to be principally reflected solar radiation, by others to be principally due to the incandescence of particles heated by reason of their proximity to the sun, by others to be principally luminescence perhaps similar to the aurora, and by some as a combination of all these kinds of radiation.

The spectrum of the corona is mainly continuous, but has some inconspicuous bright lines, and in its outer part has dark solar lines. Undoubtedly there is sunlight reflected by the matter of the corona, and no less surely the corona must be hot. As for the idea of luminescence by electrical discharge, though the streamers of the corona are a reminder of the aurora, one hesitates to recommend an explanation involving a thing so little understood, so that we will here speak only of the incandescence and reflection of the corona as sources of its brightness. The bolometric results indicate that the coronal radiation differs but little in quality from that of the sun, and is, in fact, far richer than the reflected rays of the moon in visible light, although less rich than sky light.

Great advantage having been found in 1905 and 1906 in making solar-constant investigations on Mount Wilson as well as in Washington, and strong evidence having been secured there of the considerable variability of the sun, it was concluded to continue in 1908 the expedition to Mount Wilson in order to secure as many observations of the solar constant as possible for the study of solar changes.

The frequent observation of the solar constant during a period of years at least equal to the sun-spot cycle was regarded by the late director, Dr. Langley, as a research

of great importance. Having proved by the expeditions of 1905 and 1906 that the variation of solar radiation is highly probable, and also that numerous days suitable for solar-constant observations were found in the months from May to November on Mount Wilson, it is now proposed to erect on a small, well-isolated plot of ground leased from the Carnegie Institution a fireproof observing shelter to be occupied by Smithsonian observers each year during the months mentioned.

The annual report of the board of regents of the Smithsonian Institution, showing the operations, expenditures, and condition of the institution for the year ending June 30, 1907, has also been received. As is customary with these handsome volumes, the greater part of the available space, which here runs to 726 pages, is devoted to the general appendix, composed of important papers by men of science of different nationalities. Among papers included in this appendix may be mentioned two Royal Institution lectures, that of the Hon. Charles A. Parsons, F.R.S., on the steam turbine on land and at sea, and that of Prof. J. A. Fleming, F.R.S., on recent contributions to electric-wave telegraphy. Other papers by British men of science include that of Prof. J. W. Gregory, F.R.S., on the geology of the inner earth—igneous ores, being his address as president of the geological section of the British Association at the Leicester meeting in 1907; Mr. G. G. Chisholm's paper to the Royal Geographical Society, on inland waterways; that of Dr. D. H. Scott, F.R.S., on the present position of Palæozoic botany; and Mr. Henry Balfour's, on the fire piston. As is customary with these volumes, the illustrations are numerous and excellent.

## *UNIVERSITY AND EDUCATIONAL INTELLIGENCE.*

THE chair of chemistry in the United College of the University of St. Andrews will be vacant at the end of the summer session on account of the resignation of Prof. T. Purdie owing to ill-health.

THE Senate of the University of Glasgow has decided to confer the honorary degree of LL.D. upon Dr. C. S. Sherrington, F.R.S., professor of physiology, Liverpool University, and Mr. W. H. Maw, editor of *Engineering*, and past-president of the Royal Astronomical Society.

INDUSTRIAL education, says the *Pioneer Mail*, is receiving a considerable amount of attention in the Central Provinces. During the last school year three students were granted State scholarships and sent to England, and one was given a scholarship to study under the director-general of the Geological Survey. As it is difficult to secure qualified candidates for State technical scholarships, tenable in England, scholarships have been instituted to enable students to take the preliminary course in textile industries at the Victoria Institute in Bombay, but the question of establishing similar scholarships at Sibpur Engineering College has been deferred pending the settlement of the scheme for starting a technical college or school at Nagpur for engineering and mining.

AMERICAN universities and colleges continue to benefit from the munificence of wealthy citizens in the United States. A recent issue of *Science* announces that Yale University has received a gift of 10,000*l.* from an unknown donor for the purpose of establishing a memorial to the late Prof. Ely. Hamilton College is to receive a bequest of 10,000*l.* from Mrs. Annie P. Burgess, of New York City, who died about three years ago, leaving for educational and charitable purposes upward of 40,000*l.* This included 2000*l.* to Columbia University and to Barnard College for scholarships. After making some other specific bequests, she left the remainder of her estate to Hamilton College, Columbia University, and Barnard College. Among the bequests left by the late Mrs. Emma Cummings, of East Hampton, L.I., are 5000*l.* to Dartmouth College and 5000*l.* to Bowdoin College. The late Dr. Charles H. Roberts, of Highland, N.J., in his will provided for the founding of five scholarships of 48*l.* annually at Cornell University. Finally, Harvard University has received a gift of 30,000*l.* for the endowment of the University chapel.

THE report of the Board of Education for the year 1907–8 has now been published (Cd. 4566). Referring to the further education required by those who have already taken as full advantage of the facilities afforded in elementary or secondary schools as their circumstances permit, the report states that the position is one of promise; the record of performance in all sections of the work is improving steadily, there is a fairly widespread recognition of existing shortcomings, and much serious effort is being made to overcome the difficulties inherent in the case. The machinery for the education of those who can give their whole time to study, including technical study, until they reach manhood, is already in existence. In particular centres and in relation to particular occupations there is a sufficient supply of adequately prepared students to enable the teaching institutions to develop their power to the full. Others still suffer from the inadequacy of this supply and from the difficulty of retaining their students long enough to complete the allotted courses. In each type of school improvement is observable in several directions; students are coming up better prepared and with several years in hand for study, technical colleges are adjusting their teaching more directly to the requirements of the related occupations, and employers are finding it of advantage to secure the services of young men who have had the technical training the colleges afford. There is, the report maintains, sufficient evidence that the teaching institutions are capable of raising the standard of their work when they have the opportunity. Attention is directed also to some aspects of evening-school organisation. It is a plain duty at the present time, says the report, to increase the number of trained teachers available for work in evening schools who are capable of bringing their teaching to bear directly upon some of the courses of instruction required in these schools in their areas.

ABUNDANT evidence of the growing desire on the part of our educational authorities to adapt the instruction provided in elementary schools to the future needs of the children is given in the latest report (Cd. 4566) of the Board of Education. For instance, the report shows that the tendency to organise rural education so that it may be a real preparation for rural life is a growing one. In one of the eastern counties (Lindsey) a rural education subcommittee has been appointed to report to the Education Committee on the subject. In this district the demand for small holdings under the recent Act has been active, and it is satisfactory that the authority should have recognised in this way the important place that must be given to education preparatory to rural life if small holdings are to be successful. It is clear, as the report points out, that if rural education is to be efficient, the teachers must be trained properly for the work. To meet this need for suitable training, candidates for the preliminary examination of the Board of Education for the certificate can now take a course of nature-study alternatively to the course of elementary science in which botany is optional, and this should provide more inducement to secondary schools to include these subjects in their curricula. Moreover, for the certificate examination, candidates can now either continue their course of botany or follow their nature-study by a course of rural science and gardening. The importance of this is that the summer courses and Saturday classes for teachers held at the agricultural colleges can afford a direct preparation for the certificate examination. The course of rural science, introduced as an optional subject for training colleges, has so far only been adopted by one college, and it is doubtful whether, in view of the already crowded curriculum, many of the colleges will be able to adopt a comprehensive rural course. To provide an alternative method of preparing teachers for work in rural schools, the Board has expressed willingness to approve an agricultural or horticultural college as an institution affording a third year's course of training for students who have completed already the ordinary course. Up to the present little advantage has been taken of this facility, but now that certain education authorities are considering the establishment of special rural schools, and are beginning to recognise that for rural (evening) school work special qualifications are necessary, it seems likely that advantage will be taken of it.

## SOCIETIES AND ACADEMIES.

### LONDON.

**Royal Society**, March 18.—Sir Archibald Geikie, K.C.B., president, in the chair.—An attempt to detect some electro-optical effects: Prof. H. A. **Wilson.** The paper contains a description of some experiments made with the object of detecting possible effects due to electric and magnetic fields and moving matter on the velocity of propagation of light in glass. The results obtained were negative, but it seems worth while to publish a short account of the experiments. The optical part of the apparatus is a simple form of interferometer, which proved very easy and convenient to work with. It consists of a square glass frame made up of glass bars of square cross-section, cemented together with Canada balsam.—The influence of their state in solution on the absorption spectra of dissolved dyes: Dr. S. E. **Sheppard.** In the aqueous solutions of certain dyestuffs—isocyanines, pinacyanols, cyanine—the dye is present partially or wholly in colloid solution, and the absorption spectrum is quite different from that of the true solution. The influence of various agencies, as heat, acid and alkali, electrolytes on the absorption was examined quantitatively. In other dye solutions the change from true solution to the colloid state is accompanied by broadening and diffusion of the absorption curve, consequent on the increase in number and size of the colloid particles. Deviations from Beer's law result. The state of dyes in solid media is comparable with that in liquid, and the absorption spectrum is similarly affected. The absorption of a number of dyes by membranes was studied. The solution of dyes appears to be a combined process of disaggregation of the solute, accompanied by a progressive combination with the solvent. If the same stage of solution is attained in *different* solvents, the absorption maxima are displaced according to Kundt's law.—The ferments and latent life of resting seeds: Jean **White.** The resting seeds of cereals such as wheat, maize, barley, oats, and rye all contain diastatic, fibrin-digesting, and ereptic ferments in appreciable amount. These ferments retain their activity without appreciable change in stored dry seeds for twenty or more years, that is, long after the power of germination has been lost, which takes place in wheat after eleven to sixteen years, barley eight to ten years, oats five to nine years, maize and rye more than five years. No relation was noted between the vitality of seeds and the persistence of enzymes in them, but since the enzymes persisted longer than the power of germination, the question as to whether germination could take place in the absence of any pre-existent enzymes remains to be answered. In any case no otherwise non-germinable seeds could be excited to germination by the addition of any kind of enzyme, and where the germination was feeble the addition of enzymes usually lowered the percentage germination and often delayed germination also to some extent. The erepsin appears to be more abundant than the pepsin, but otherwise in the cases of all three ferments greater differences are shown between different samples of the same age than between different seeds, or between the same seeds of varying ages. Pepsin appears, however, to be more abundant in rye than in any other cereal, and is almost absent from maize. Dry oats, barley, and wheat can in part resist a temperature of 99° C. to 100° C. for 1–4½ hours; after six hours' exposure all are killed, but the ferments are apparently unaffected. All the ferments are destroyed after an hour's dry heat at 130° C. to 131° C. The pepsin appeared to be least (one hour at 124° C.), the erepsin more (one hour at 124° C. to 128° C.), and the diastase, especially of barley, most resistant to dry heat (one hour at 124° C. to 131° C.). Two days' exposure to liquid air, although it delays the subsequent germination, and may also decrease the percentage, did not absolutely destroy any of the seeds tested, and did not appreciably affect the ferments in any of the cereals. The dry diastase of barley is therefore able to withstand a range of temperature of 200° C. to −130° C.; it is therefore thermally a highly stable chemical compound. Many seeds, including all cereals, give off appreciable quantities of carbon dioxide when stored in the air-dried condition, but others show no signs of respiration whatever. The respiration of air-dried wheat is especially pronounced, but in practically all cases every sign of respiration ceases when the seeds are moderately desiccated, although in the case of large seeds like maize minute traces of carbon dioxide may continue to escape for a time.

**Geological Society**, February 19. — Annual general meeting.—Prof. W. J. Sollas, F.R.S., president, in the chair.—Anniversary address: Prof. W. J. **Sollas.** The president dealt with the question of time, considered in relation to geological events and to the development of the organic world, referring, first of all, to recent evidence in proof of the extreme rigidity of the interior of the earth. He remarked that Mr. Strutt's method of estimating the age of sediments by reference to their radio-active constituents was of great promise, but a long series of concordant observations would be required to inspire absolute confidence in its results. Prof. Joly's method of determining the age of the ocean, based on the ratio of the amount of sodium which it contained to that annually contributed to it by rivers, was subjected to a detailed analysis, in the course of which it was pointed out that the sodium contained in river-water existed chiefly as sulphate or chloride, though theoretically it should be in the state of carbonate. The origin of the chlorine was manifold; some was traced to salts borne by the winds from the ocean, some to supplies from ancient desert-lakes and some to juvenile waters escaping as hot springs or impregnating the vadose waters underground. The probable limits for the age of the ocean were 80 to 170 millions of years. An examination of the sedimentary series, where developed to their maximum thickness, gave a period of 35 millions of years, on the assumption that deposition had proceeded at a rate of 1 foot in a century. Explanations of the discrepancy were suggested, and it was proposed to divide stratigraphical time into two moieties, each of 40 millions of years' duration. The earlier or pre-Cambrian moiety was termed the Protæon, the latter, or post-Cambrian, the Neatæon. Using the scale of 1 foot in 100 years as a rough chronological measure, it was applied to illustrate the rate of evolution in the case of the Equidæ and the chief varieties or species of man. Though relatively rapid, when considered in connection with some other groups of organisms, this was shown to be so slow, when measured in terms of years, that perceptible differences in a linear ancestral series would have required tens of thousands of years for their production.

February 24.—Prof. W. J. Sollas, F.R.S., president, in the chair.—Palæolithic implements, &c., from Hackpen Hill, Winterbourne Bassett, and Knowle Farm Pit (Wiltshire): Rev. H. G. O. **Kendall.** Implements are described from the localities mentioned in the title. Trimmed stones of eolithic nature were obtained from fields ploughed in Drift-gravels, together with abraded Upper Greensand chert, quartzite-pebbles, and small flints. Most of the flaked stones were found in shallow pits excavated in Drift-clay, exposed at the edges of the larger hollows. The implements are unabraded, abraded, and striated; evidently some are *in situ*, others were brought with the Drift. The implements are referred to the Chelléen period. While implements and flakes are numerous on the top of Hackpen Hill as compared with trimmed pieces, yet at Winterbourne Bassett plain implements and flakes are scarce, while trimmed pieces are numerous. Many of the latter have been re-chipped, and are of later date. Implements of at least three Palæolithic periods are found at Knowle.—The Karroo system in northern Rhodesia, and its relation to the general geology: A. J. C. **Molyneux.** In 1903 the author described deposits, that have since been recognised as of Karroo age, in southern Rhodesia. Here he traces their extension across the Zambesi, where their boundary follows the foot of the line of escarpments that divide the plateau from the low-lying regions of the Zambesi Valley. Karroo deposits also form the floor of the trench-like valleys of the Luangwa, Lukasashi, and Lusenfwa (or Luano), the walls of which are of rock-gneiss, schist, and granite. The Luano Valley is described, and the Lusenfwa and Molongushi rivers are followed in their courses across the plateau-plains. The Karroo deposits are grouped into basal conglomerates, Coal-measures, Upper Matobola beds, and escarpment series. In the Luano Valley, the conglomerates are made up of

resisting quartz-quartzite boulders and pebbles. Though they form the base of the Karroo system, there is no certain evidence of glaciation. In the Lukasashi and the Luano there is a dip of the strata north-westwards. Nowhere on the plateau in the vicinity of the valley-walls have Karroo beds been found. It is certain that the valleys were at one time filled almost to plateau-level, as the rivers pass through Archæan inliers by deep clefts. The late times in which the Machinga escarpment was laid bare, and the rejuvenation of the Lusenfwa River, suggest a filling of the valleys. It is possible that the Karroo beds extended over a part of the plateau, and were included in folding and faulting movements. Subsequently the surface was planed off to a plateau of remarkable monotony, and on a change of conditions taking place, erosion of the softer Karroo strata set in by which the present valleys are again reaching a plane of denudation. The trough-valleys of clastic rocks probably merely follow the axis of pre-Karroo and post-Karroo movements, trending in three directions. A distance of 800 miles displays movements that commenced in pre-Karroo periods, and have repeated themselves since the Karroo time. Fossils from the areas support the allocation of the deposits to the Permo-Carboniferous and to the Karroo system of South Africa. Palæolithic stone implements were found at separate localities on the surface, about the latitude of 14° 50′ S.—Plant-containing nodules from Japan, considered structurally in their relation to the "coal-balls" and "roof-nodules" of the European Carboniferous: Marie C. **Stopes.** The plant petrifactions are of a type unknown from the Mesozoic. The nodules are of Cretaceous age. They enclose well-petrified marine shells and plant-remains. Unlike the "coal-balls" and "roof-nodules," they are not contained in coal-seams or in the roof thereof, but occur in a thick series of shales below the coals, which appear to be of Tertiary age. Chemically they consist of about 60 per cent. of carbonates, both lime and magnesia being present, with 30 per cent. of silicates; the large proportion of silicates is a point of difference from the Carboniferous nodules. In having plant fragments in a single nodule, and in the type of petrifaction, the nodules are like coal-balls; in having marine shells included in the matrix they are more like roof-nodules. They probably represent fragments of tangled débris.

**Royal Anthropological Institute,** March 9.—Mr. Henry Balfour, past-president, and afterwards Sir Henry Howorth, in the chair.—The Veddas: Dr. C. G. **Seligmann.** A description was given of the manners and customs of these people. An interesting feature of these customs is the cult of the dead, which has given rise to a series of dances, often pantomimic in character, and so perhaps in the nature of imitative magic, and accompanied by offerings of food to the spirits of the departed. These dances are performed especially by men who have been trained to invoke the spirits of the dead. The use of a ceremonial arrow, with a blade more than a foot long and with a short handle, is an indispensable feature of some of these ceremonies, in all of which the chief actor becomes possessed by one or more of the spirits he invokes.

**Royal Meteorological Society,** March 17.—Mr. H. Mellish, president, in the chair.—Wind-waves in water, sand, and snow: Dr. Vaughan **Cornish.** Dealing first with waves of the sea, the lecturer described the gradual evolution of large sea-waves during the passage of a cyclone or other depression across the Atlantic. The great sea-waves are produced at that portion of the cyclone where the direction of the wind coincides with the direction of advance of the depression. Along this line of advance the waves in their gravitational progress are accompanied by a strong wind blowing across their ridges so long as the atmospheric depression maintains itself. Thus the waves are developed until they attain a considerable steepness. The average height attained by these waves (in feet) is about half the velocity of the wind (in miles per hour). Thus a wind of fifty-two miles per hour gives waves of an average height of about 26 feet, although individuals will then attain a height of 40 feet. In the circumpolar southern ocean the height of North Atlantic waves is somewhat exceeded, but the outstanding feature of the waves of high southern latitudes is their greater length from crest to crest. South of the Cape of Good Hope and of Cape Horn there is neither windward nor leeward shore, and the prevailing wind in all longitudes is westerly. Thus, wherever a westerly wind springs up it finds a long westerly swell, the effect of a previous wind, still running, and the principal effect of the newly-born wind is to increase the steepness of the already running long swell so as to form majestic storm-waves, which sometimes attain a length of 1200 feet from crest to crest. The longest swells due to wind are almost invisible during storms, for they are masked by the shorter and steeper waves. They emerge into view, however, after, or beyond, the storm, and Dr. Cornish has found their speed to be approximately equal to that of the wind by which they are created, sometimes attaining, even in the North Atlantic, a velocity of more than sixty miles per hour. Sand-waves are unable to travel by gravitation, as do the waves of the sea; their movements are entirely directed and controlled by the wind, and are therefore much simpler and more regular in form and movement than ocean-waves. When they grow to great size, as in the desert sand-dunes, which attain a height of several hundred feet, the forms become more complicated owing to the partial consolidation of the lower layers of sand by pressure. Nevertheless, the characteristic wave-form can still be distinguished. Mackerel-sky is produced by the formation of an undulating surface where a lighter layer of air flows over a heavier one. The positive and negative of a rippled-cloud photograph were shown, and it was explained that the negative (showing the pattern, not of the clouds themselves, but of the unclouded sky between) was the true aërial "ripplemark," corresponding to sand-waves. Freshly fallen dry snow is drifted by wind in a procession of regular waves, similar to desert sand-waves, but less than half as steep, the wave-length being fifty times as great as the height. The flatness of the wind-formed snow-waves affords a valuable indication of the great distance to which hills give effective shelter from wind, and helps to explain the climatic advantages of certain localities.

**Zoological Society,** March 16.—Mr. F. Gillett, vice-president, in the chair.—Reports of the Grouse Disease Committee:—(*a*) the ectoparasites of the grouse; (*b*) the thread-worms (Nematoda) of the red grouse (*Tetrao scoticus*); (*c*) the tape-worms (Cestoda) of the grouse. Appendix, parasites of birds allied to the grouse: Dr. A. E. **Shipley.** The author gave a general description of the work of the committee, and explained the results of the examination of the parasites of the grouse, exhibiting drawings and specimens to illustrate his remarks.—Fossilised remains of a small passerine bird, from the Lower Pliocene of Gabbro, near Leghorn: W. P. **Pycraft.** The remains most nearly resembled those of the living species known as Berthelot's pipit (*Anthus bertheloti*).—A collection of mammals from western Java, presented to the National Museum by Mr. W. E. Balston: Oldfield **Thomas** and R. C. **Wroughton.** The island of Java had been almost entirely neglected during the last sixty years, while it had been one of the most prolific sources of early described species, and in consequence workers had been much embarrassed for want of modern specimens representing these early species for comparison with their allies elsewhere. Now, thanks to the generosity of Mr. Balston, a very fine collection had been made in the island by Mr. G. C. Shortridge, and presented to the National Museum. It consisted in all of more than 1500 specimens, belonging to seventy-four species, of which six were new.

MANCHESTER.

**Literary and Philosophical Society,** February 9.—Prof. H. B. Dixon, F.R.S., president, in the chair.—Experiments on the ignition point of gases by the method of adiabatic compression suggested by Prof. Nernst: Prof. H. B. **Dixon.** In the first experiments tried the compression was effected in a strong glass tube, and photographs of the explosion were taken on a rapidly moving film. The photographs showed that the ignition was not set up instantaneously throughout the whole mass of compressed gas, but began at one point, which might be varied accord-

ing to the velocity of the piston. In a mixture of hydrogen and oxygen "detonation" is very rapidly set up, but not instantaneously. The later experiments were made in a steel tube, a window being inserted near the lower end of the tube so as to observe the flame produced.

February 23.—Prof. H. B. Dixon, F.R.S., president, in the chair.—A simple method of silvering transparent grating replicas, whether plane or mounted on curved surfaces: T. **Thorp.** The process is a modification of the quick-silver and tinfoil method used for ordinary mirrors before the wet silvering process had been discovered.—A preliminary account of the submerged vegetation of Lake Windermere as affecting the feeding grounds of the fish: Prof. F. E. **Weiss.** Some of the shallow feeding grounds of the trout and char have become overgrown by dense masses of weeds, with the consequence that the young fish cannot feed and are driven into deeper water, where they are devoured by pike and other enemies. An examination of the vegetation, undertaken at the suggestion of Mr. F. Nicholson, showed that it consisted chiefly of one of the brittleworts, *Nitella opaca*, the Canadian pondweed, *Elodea canadensis*, the water milfoil, Myriophyllum, and a large weed, *Potomogeton praelongus*. The first two were the most deleterious. Experiments made indicate that the best method of removal of the accumulated weed is by dragging the bay with fishing nets, such as are used for netting char. Other methods break up the plant, but as some of these weeds have very great powers of rooting from small broken fragments, such methods are not to be recommended.—The use of wind by migrating birds: F. **Stubbs.** The author criticised and combated the opinion very largely held that birds, when migrating, either fly against a head wind or with a side or beam wind. On the assumption of the head-wind theory it is evident that no bird can make headway against a wind that has greater velocity than its own speed of flight. A bird in air, like a swimmer in a strongly flowing river, is wholly in a moving supporting medium, and there is little doubt that, if a bird cannot find shelter, it will be more comfortable on the wing than on the ground during the progress of a storm, the reason being that, in the fiercest gales, the air, as a mass, is at rest. The bird then can fly about in any direction in this wind, but the direction of the wind may or may not coincide with that of the bird's flight. The author believes that birds habitually make use of cyclones as a means of travelling from one part of their range to another under the most favourable conditions for the exercise of flight.

## DIARY OF SOCIETIES.

*THURSDAY*, MARCH 25.

ROYAL SOCIETY, at 4.30.—Liberation of Helium from Radio-active Minerals by Grinding: J. A. Gray.—The Expulsion of Radio-active Matter in the Radium Transformations: S. Russ and W. Makower.—*Sphaerostoma ovale*, n.gen., and *Crossotheca Grievii*, n.spec.: an Account of the Structure and Relations of the Reproductive Organs of *Heterangium Grievii*: Miss M. Benson.

ROYAL INSTITUTION, at 3.—On Aërial Flight in Theory and Practice: Prof. G. H. Bryan, F.R.S.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The Electrical System of the London County Council Tramways: J. H. Rider.

ROYAL SOCIETY OF ARTS, at 4.30.—Native Man in Southern India: Edgar Thurston.

*FRIDAY*, MARCH 26.

ROYAL INSTITUTION, at 9.—Recent Results of Astronomical Research: A. S. Eddington.

PHYSICAL SOCIETY, at 5.—Note on the Production of Steady Electric Oscillations in Closed Circuits and a Method of Testing Radio telegraphic Receivers: Prof. J. A. Fleming, F.R.S., and G. B. Dyke.—The Effect of an Air Blast upon the Spark Discharge of a Condenser Charged by an Induction Coil or Transformer: Prof. J. A. Fleming and H. W. Richardson.—On the Action between Metals and Acids and the Conditions under which Mercury causes Evolution of Hydrogen: Dr. S. W. J. Smith.

*SATURDAY*, MARCH 27.

ROYAL INSTITUTION, at 3.—Properties of Matter: Sir J. J. Thomson, F.R.S.

*MONDAY*, MARCH 29.

ROYAL SOCIETY OF ARTS, at 8.—Steam Turbines: G. G. Stoney.

INSTITUTE OF ACTUARIES, at 5.—On the Annuity Business of British Offices and the Valuation Thereof: H. J. P. Oakley.

*TUESDAY*, MARCH 30.

ROYAL INSTITUTION, at 3.—The Evolution of the Brain as an Organ of Mind: Prof. F. W. Mott, F.R.S.

INSTITUTION OF CIVIL ENGINEERS, at 8.—*Further discussion*: Construction and Wear of Roads: A. Mallock, F.R.S.

FARADAY SOCIETY, at 8.—The Electro-analysis of Mercury Compounds with a Gold Kathode: Dr. F. Mollwo Perkin.—The Relation between Composition and Conductivity in Solutions of *meta*- and *ortho*-Phosphoric Acids: Dr. E. B. R. Prideaux.—A New Electrical Hardening Furnace: E. Sabersky and E. Adler.—Experiments on the Current- and Energy-Efficiencies of the Finlay Alkali Chlorine Cell: Dr. F. G. Donnan.

*WEDNESDAY*, MARCH 31.

ROYAL SOCIETY OF ARTS, at 8.—The Island of St. Helena: J. C. Mellis.

BRITISH ASTRONOMICAL ASSOCIATION, at 5.—Lord Kelvin on the Extent of the Universe: Gavin J. Burns.

*THURSDAY*, APRIL 1.

ROYAL INSTITUTION, at 3.—Aërial Flight in Theory and Practice: Prof. G. H. Bryan, F.R.S.

LINNEAN SOCIETY, at 8.—The Amphipoda Hyperiidea of the *Sealark* Expedition to the Indian Ocean: A. O. Walker.—The Marine Mollusca from the same Expedition: J. Cosmo Melvill.—The Land and Freshwater Mollusca of the Seychelles Archipelago: E. R. Sykes.—On a Blind Prawn from the Sea of Galilee, *Typhlocaris galilea*, g. et sp. n.: Dr. W. T. Calman.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The Electrical System of the L.C.C. Tramways: J. H. Rider. (*Adjourned discussion.*)—The Theory and Application of Motor Converters: H. S. Hallo.

RÖNTGEN SOCIETY, at 8.15.—The Origin, History and Development of the X-Ray Tube: J. H. Gardiner.

*FRIDAY*, APRIL 2.

ROYAL INSTITUTION, at 9.—Electrical Striations: Sir J. J. Thomson, F.R.S.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY, at 8.—Storms, and their Effect Upon the Sea Coast: Dr. J. S. Owens.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Reinforced Concrete on Railways: W. E. R. Gurney.

*SATURDAY*, APRIL 3.

ROYAL INSTITUTION, at 3.—Properties of Matter: Sir J. J. Thomson, F.R.S.

ESSEX FIELD CLUB (at Essex Museum of Natural History, Stratford), at 6.—The Head as an Index of Race: J. Gray.

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