THURSDAY, MARCH 3, 1904.

THE HISTORY OF ELEMENTARY MATHEMATICS.

Geschichte der Elementar-Mathematik in systematischer Darstellung. By Dr. Johannes Tropfke. Zweiter Band. Pp. viii + 496. (Leipzig: Veit and Co., 1903.)

IN his first volume of this work, already reviewed in NATURE, Dr. Tropfke confined himself to the history of elementary arithmetic and algebra. He has now completed his work by giving with equal care, and the same wealth of references, the story of the progress of the other branches of elementary mathematics—geometry, logarithms, plane and spherical trigonometry, series, stereometry, analytical geometry, and a few other topics of minor importance.

To geometry 140 pages are devoted, besides the chapters on conics and analytical geometry; this is not very much, and some paragraphs are so condensed that a large part of them consists of titles. But the arrangement is good, and on several points very interesting details are given. Thus we have side by side, and in the original, the definitions of Euclid and those of Hero of Alexandria. The comparison of the two sets is instructive; thus Hero adds to the bare definition of a line (*i.e.* curve) a statement of its genesis by an ideal point continuously moving in space (*γίγνεται δὲ σημείου ῥυέντος ἄνωθεν κάτω ἐννοίᾳ τῇ κατὰ συνέχειαν*). Similarly he adds to Euclid's definition of a straight line another definition of it as the shortest line joining two points. In translating Euclid's definition of a straight line, Dr. Tropfke renders the very difficult phrase *ἐξ ἴσου* by "gleichmässig (in derselben Anordnung und Richtung)," where, of course, the parenthesis is the translator's gloss, and probably puts more into the definition than Euclid intended. Perhaps "symmetrically," as we use the term, is the nearest equivalent. Whatever is proposed, it must be remembered that the current version in English editions of the "Elements" is a mistranslation. Euclid says nothing about the extreme points of the line; he says "a straight line is one which lies *ἐξ ἴσου* with respect to the points on it," that is, to *all* the points on it.

Two other entertaining sections are those on the construction of regular polygons and on the various approximations to π. It is amazing that the author has made the statement, so often seen in print, that Gauss proved that the circle can be divided by rule and compass into n equal parts *only* when n is a prime of the form $2^m + 1$. Probably it is a slip of the pen in this case, for only seven pages earlier the division into fifteen parts is referred to. Nevertheless, the wrong statement is definitely made, and it really seems as hopeless to try to get this vulgar error corrected as to expect authors to spell the name Bernoulli properly. After all, the practical man, with tools that range from a sixpenny protractor to a dividing engine, cares not for these abstractions. How different it was a few centuries ago! not better, of course, but certainly more amusing. The "divine proportion" or "golden section" impressed the ignorant, nay even learned men like Kepler, with a sense of mystery, and set them a-dreaming all kinds of fantastic symbolism. Even to the Greeks it was *the* section; and their philosophers, doubtless infected by the East, speculated about atoms and regular solids in a way that seems to us childish, but was serious enough to them. At any rate, the man who first found out an exact construction for a regular pentagon had reason to feel proud of his exploit; and the superstitions which have gathered about the *pentagramma mirificum* are grotesque echoes of his fame.

Mathematicians now alive must sometimes feel it a rather mournful privilege to have read what is practically the last chapter in the chronicle of π. The first that is known at present is in the Rhind papyrus (2000–1700 B.C.), where the approximation $\pi = 256/81 = 3{\cdot}1605$ is given; how it was obtained is, unfortunately, quite uncertain. Dr. Tropfke gives in detail Archimedes's very ingenious method, which he carried out far enough to prove that $3\frac{1}{7} > \pi > 3\frac{10}{71}$. It is well known that 355/113 is a remarkably near approximation, which is easily remembered. It appears that this is due to a German mathematician, Valentinus Otho, who is said to have obtained it from $\frac{22}{7}$ (Archimedes) and $\frac{377}{120}$ (Ptolemy) by subtracting numerators and denominators. Shanks's calculation to 707 places of decimals still holds the record. The symbol π for the ratio of circumference to diameter is first used in William Jones's "Synopsis palmariorum matheseos" (1706); Euler made it popular.

Part iv. (pp. 141–186) is on logarithms. It gives a clear account of the methods of Bürgi and Napier, with specimens of their tables; of the later developments of logarithmic series; and of the most noteworthy logarithmic tables. By a curious irony of fate, the expeditious methods of calculation now familiar were not discovered until after the tables of Briggsian logarithms had been computed. The base of Bürgi's logarithms is nearly e, and that of Napier's nearly e^{-1}; but neither of them was acquainted with the true theory of natural logarithms, and "Napierian logarithms" is really a misnomer, when applied to natural logarithms.

Noticeable in the sections on plane and spherical trigonometry are the specimens of early tables, including Ptolemy's, and the account given of the treatise attributed to Nasir Eddin Tusi, of which a French translation was published at Constantinople in 1891. Dr. Tropfke describes this as the first systematic treatise on plane trigonometry, considered as an independent subject; moreover, it discusses oblique-angled triangles after the modern manner, instead of reducing the solution of them to that of right-angled triangles. This part of the book brings out the services rendered to mathematics in the middle ages by Arab, or more precisely Arabic-speaking, geometers. The inventors of the more important formulæ are also indicated. On p. 198 there is a note on Hero's *Μετρικά*, published so recently as last year; in this work occurs a term for the fourth power of a quantity, not previously known to have been used before the time of Diophantus.

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As might be expected, the chapter on stereometry is mainly interesting for the account it gives of Archimedes's great discoveries. The brief section on analytical geometry shows how Fermat really invented the method independently of Descartes. Parent appears to have been the first to publish a treatise on analytical solid geometry; this was nearly seventy years after the appearance of Descartes's "Géométrie."

The only other important section of the book is that on conic sections. It cannot be considered so good as some of the others; it does not deal with projective properties at all, and thus does injustice even to Apollonius, to whom, rightly enough, a great part of the thirty-six pages is devoted.

To profit by this history no advanced knowledge of mathematics is necessary; and it is to be hoped that the author's labours will be rewarded by the appreciation of many readers. G. B. M.

THE PRACTICAL METHODS OF FRACTIONAL DISTILLATION.

Fractional Distillation. By Prof. S. Young, F.R.S. Pp. xii+284. (London: Macmillan and Co., Ltd., 1903.) Price 8*s.* 6*d.*

IN his preface Prof. Young says that he wrote this book in the hope that the solution of the difficulties of fractional distillation might be rendered easier. He has written an eminently practical treatise on the subject and one that cannot fail to be of considerable value.

After an introductory chapter describing the necessary apparatus and the methods of carrying out a distillation process, the vapour pressures and boiling points of liquids are first dealt with. Very little is known of the connection between the vapour pressure and composition of a mixture of two or more perfectly miscible liquids. The simple formula for the vapour pressure of a mixture of two perfectly miscible liquids A and B,

$$P = \frac{mP_A + (100 - m)P_B}{100},$$

where P_A and P_B are the two partial pressures and m the molecular percentage of the compound A, is only strictly applicable when the two components are closely related in chemical composition, when they have the same critical pressures and when the attraction between the unlike molecules is equal to the geometric mean of the attractions between the like molecules. In certain other cases the deviations from the theoretical values are not large, but in the majority of cases the formula gives no approximation to the truth. Is it not possible that the deviations are due to the surface layer having a different composition from that of the bulk of the liquid, as is known to be the case with mixtures of certain alcohols and water?

In the chapter dealing with the boiling points of mixtures the cases of binary and ternary mixtures of minimum and of maximum boiling point are fully treated. There follows next an account of the constitution of the vapour and liquid phases, including the work of Brown, Lehfeldt and Carveth; Brown found that in certain cases with two components the ratio of the masses of the two in the vapour phase was equal to their ratio in the liquid phase multiplied by a constant, while Lehfeldt showed that the logarithms of the ratio in the vapour phase were a linear function of the logarithms of the ratio in the liquid. In another chapter the theoretical considerations worked out by Duhem, Margules and Zawidski are briefly given.

The next section deals with the methods of carrying out fractional distillations of simple and complex mixtures, and also with the various forms of still heads which have been devised at various times. This is undoubtedly the most valuable portion of the book, inasmuch as it is drawn almost entirely from Prof. Young's own work. The methods of fractional distillation are described in detail, great stress being rightly laid upon the graphical expression of results. This may be done most easily by weighing the distillate obtained at various temperatures and plotting the values of dW/dT thus obtained against the temperature; it is in this way only that the distillation of a complex mixture can be properly carried out, for components present in only small quantities may otherwise easily be overlooked. Many forms of still head are described, amongst which the most efficient have been designed by Prof. Young himself. Tables are given of the relative efficiency of the various designs, as shown by the results obtained with mixtures of benzene and toluene, and of other substances. A chapter follows here containing descriptions of the various forms of still heads used in manufacturing processes.

The remainder of the book deals in the main with the application of the methods previously described to certain problems, as, for example, the quantitative analysis of a mixture of liquids and the separation of the components of a constant boiling mixture. Amongst the latter examples occurs the interesting case of the removal of the last traces of water from alcohol by distillation after the addition of a small quantity of benzene. If the correct quantity of benzene has been added then there distils over the ternary benzene-alcohol-water mixture, leaving pure alcohol in the still. It is safer to add a slight excess of benzene, and in this case, after all the ternary mixture has come over, the remainder of the benzene distils as the binary benzene-alcohol mixture, leaving again the pure alcohol.

It is impossible to touch upon all the points of interest in this book. Its chief value lies in the fact that many examples are given of the various processes, mostly from Prof. Young's own work. Moreover, a considerable amount of hitherto unpublished matter is incorporated. Our thanks are due to the author for so useful a work. E. C. C. B.

A FRENCH MANUAL OF FORESTRY.

Traité de Sylviculture. Exploitation et Aménagement des Bois. By Prof. P. Mouillefert. Pp. 476. (Paris: Félix Alcan, 1904.) Price 6 francs.

THIS is the second volume of a manual of forestry the first of which was noticed in NATURE of March 26, 1903. The present volume treats of the utilisation and management of woodlands, 361 pages being de-

voted to the former subject, 102 pages to the latter, and 14 pages to the table of contents, but there is no index. There are 106 plates representing the rates of increment in trees and woods, mature woods of different species, modes of pruning, destructive insects, methods of felling and transport.

The arrangement of the matter differs from that usual in other manuals of forestry; the account of the increment in trees and woods, which occupies the first 38 pages, being properly a part of forest mensuration, should come under forest management instead of under utilisation, and much of the latter subject as treated by Mouillefert is really sylviculture, and belongs, therefore, properly to vol. i. It is a pity that the French use the term sylviculture for the whole art of forestry instead of restricting the term, as we do, to the formation and tending of woods. The word "foresterie," which is sometimes used by French foresters, if employed in the same sense as "forestry" with us, would save much confusion of terms. The French also have no treatise on forest protection, which with us, as well as with the Germans under the title "Forstschutz," is a recognised branch of forestry, and hence in Mouillefert's book some account of damage by insects is given under the heading "exploitation," or forest utilisation.

Under the latter heading a full account is given of the methods of formation and tending of woods of the various species of trees, also of the utilisation of beech nuts for oil, of cork from *Quercus Suber*, of which a very complete account is given, of the cultivation of osiers, and of the production of truffles, to which 43 pages are devoted. It is therefore strange that scarcely anything is said about the production of resin and turpentine from the maritime pine, of which there are about a million acres in Gascony.

The production of poplar wood is largely followed by small landowners in France, and the wood of the grey poplar is preferred to all others, being said to be one quarter more valuable than that of the black or white poplars. Omitting the value of the land and considering only the cost of formation of a grove of poplar trees, Mouillefert states that they pay more than 12 per cent. on the capital expended, or that 80 trees per acre cost 3*l*. 10*s*. to plant, and yield 112*l*. at the end of thirty years, the hay grown under the trees paying for the cost of maintenance, including rates. The part of the book dealing with utilisation terminates with a short chapter on modes of felling and transport.

The last part of the book, on forest management, or the construction of forest working-plans, is short but effective, and includes nine cases of conversion from one system to another, and a chapter on usufruct in forests.

This book, as well as vol. i. of the series, contains some valuable information about French forests which is not included in the more professional treatises on French forestry, and we are promised two further volumes on the valuation of woodlands and on artificial plantations, so that the whole work when completed should prove valuable for reference.

W. R. FISHER.

OUR BOOK SHELF.

The School Arithmetic: being a School Course adapted from "The Tutorial Arithmetic." By W. P. Workman, M.A., B.Sc. Pp. viii+495. (London: W. B. Clive, University Tutorial Press, 1903.) Price 3*s*. 6*d*.

THIS useful volume is an excellent specimen of the work published by the University Tutorial Press. The treatment of the elementary rules calls for no special remark. The plan of explaining the nature of fractions and proving the rules applicable to them by exhibiting in parallel columns a particular arithmetical example and its generalised algebraic form is to be commended, inasmuch as by this means the student is impressed with the generality of the process and reasoning. The diagrammatic representation (p. 116) of the processes of multiplication and division of fractions appeals strongly to the understanding, and the teaching value of the book is much increased by the plan adopted by the author of cautioning the pupil against various errors into which he may be expected to fall. Contracted processes in the division and multiplication of decimals are adequately explained and illustrated. The interest of the schoolboy is secured in the chapter on averages by examples dealing with the cricket performances of the leading batsmen and bowlers of England, and with the various athletic "records" of the public schools.

Every branch of the subject is illustrated by a vast collection of examples. The treatment of compound interest proceeds without the use of logarithms, but to us it appears that an early introduction of the elements of logarithms into a school course is desirable, and that it would present no difficulty to an ordinary pupil. The use of a "log book" would greatly simplify calculations in questions relating to compound interest.

Free-hand Lettering; being a Treatise on Plain Lettering from the Practical Standpoint for Use in Engineering Schools and Colleges. By Victor T. Wilson, M.E. Pp. x+95; 23 full-page plates. (New York: John Wiley and Sons; London: Chapman and Hall, 1903.) Price 1 dollar.

THIS book is not a mere collection of copies which the student is to reproduce slavishly. The author states the object of the volume to be "to cultivate the conception that all lettering is design, that any mathematical or mechanical attempt at treatment is entirely impracticable in ordinary work." The information supplied and instructions given should enable the student to arrive at the end in view.

Junior Country Reader. III. Talks on Country Life. By H. B. M. Buchanan and R. R. C. Gregory. Pp. viii+198. (London: Macmillan and Co., Ltd., 1903.) Price 1*s*. 4*d*.

THESE simply expressed reading lessons should prove of great interest to young children in country schools. After reading what is here told him about the horse, cow, pig, and sheep, a boy should be able to give intelligent assistance in the care of these animals. The sections on rats and the weasel family, on ferrets, on animals met with in the woods, and on birds, should go a long way to develop a real appreciation of country life. The illustrations are numerous and good.

Green Mansions: a Romance of the Tropical Forest. By W. H. Hudson. Pp. 315. (London: Duckworth and Co., 1904.) Price 6*s*.

THIS story enables the author to show his familiarity with the vegetation, animal life, and climatic conditions of tropical South America. Incidents are subordinated throughout to descriptive writing, which, however, will interest many readers as much as the thread of romance running through the book.

LETTERS TO THE EDITOR.

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

The Blondlot *n*-Rays.

SINCE the date of my last letter on this subject, published in your columns on January 21, I have made further numerous endeavours to confirm M. Blondlot's experiments.

It is by no means difficult to obtain some of the effects that M. Blondlot describes, but, so far as my observations go, these effects, when obtained, are in every case due simply to heat.

As mentioned by a previous correspondent, the luminosity of calcium sulphide is considerably affected by minute differences in temperature. For instance, a coin taken from one's pocket and held at the back of a calcium sulphide screen will, in a few seconds, show through the screen as a disc of increased luminosity, the effect being due to the warmth of the coin; or again, when two small calcium sulphide screens are placed upon two pieces of similar metal differing in temperature by only about 2° F., it is easy to discover which of the two pieces of metal is the warmer by the superior luminosity of the screen placed upon it.

This, I think, is the explanation of the experiment described in the advertisement columns of your issue of February 18, where it is stated that "if one of these screens be laid on the floor when it is very feebly fluorescing it will be invisible, but its light will increase when it is placed on the top of the foot and the muscles put into action."

I have repeated this experiment with home-made screens with entire success, my method being to use two screens each about 16 mm. by 2 mm. in size, of normally equal luminosity. When one is placed on the foot it brightens up considerably as compared with the other. This experiment is at first sight most convincing, but unfortunately for the *n*-ray theory I find no necessity for the presence of the foot at all. A boot newly taken off and still retaining some warmth, or any other warm object, acts equally well, while if one screen be placed on the foot and the other upon a can of water heated to the same temperature as the foot, no difference between the luminosity of the two screens can be detected. Again, the foot experiment does not succeed if a good thickness of paper or cardboard is placed between the foot and the screen so as to prevent the transference of warmth to the latter.

Prior to the date of my last letter, I had tried a similar experiment to that described by Mr. J. B. Burke in your issue of February 18. In my case a large calcium sulphide screen was exposed to a high power Nernst lamp, one half being shaded with lead and the other with several thicknesses of black paper, so that only half was exposed to the *n*-rays. Visually no difference could be detected in the brightness of the two halves of the screen, but on exposing a gelatino bromide photographic film in contact with the screen for some three minutes it was found on development that the portion of the photographic film that was in contact with the half of the screen that was shaded by the paper only was considerably more fogged than the other half. Here again, however, the result was clearly due to heat, the black paper being perceptibly warm to the touch, as when, in place of paper, a thin aluminium sheet was employed and the experiment repeated, no difference at all could be noted between the two halves of the developed photographic film.

Since making this experiment I have, when using two very small separate screens, one shaded only by very thin aluminium and the other by thick lead, succeeded in observing some slight excess in brightness in the former over the latter, but this has been discernible only when the aluminium had become appreciably warmed by the heat radiated from the lamp, so that the difference in temperature would, in the light of my other experiments, entirely account for the effect.

It is, indeed, very difficult altogether to eliminate the heat coming either from a Nernst lamp or an Auer burner except by using materials such as, for instance, water, which, according to M. Blondlot, is opaque to the *n*-rays. This in itself is instructive, as is also the point noted by M. Blondlot that the brightening of the screen under the influence of the *n*-rays is not instantaneous but is gradual, as also are most thermic effects.

During the past fortnight there have been published details of some new investigations made by M. Gutton and communicated by Prof. Poincaré to the French Academy of Sciences, according to which the luminosity of calcium sulphide screens is increased by their being placed in a non-uniform magnetic field. It is stated by M. Gutton that only a weak field is necessary, and that the effect is very sensitive.

Having spent considerable time in endeavouring to confirm this observation without the slightest success, it would interest me to know whether anyone else has tried it and with what result.

As everyone who has experimented on similar lines is aware, investigations of these descriptions are full of pitfalls, and it is very easy to see what one expects. For instance, if two or more faintly but equally luminous calcium sulphide screens of small dimensions, placed two or three inches apart, are observed, one will occasionally appear to become dim, and it is quite easy with a little practice, while looking directly at the screens, to make any one of them actually disappear at will, this being due to certain portions of the retina being much less sensitive to these weak radiations than other portions. However, one can scarcely suppose that a man of science of M. Blondlot's antecedents and experiences can have deceived himself or have been deceived by others in regard to the numerous positive results that he has obtained, and those who have unsuccessfully tried the experiments can only imagine that, assuming that the phenomena observed are really objective, they are only visible to certain individuals. Whether the persons who can or those who cannot see these effects have abnormal sight further investigations alone can show.

66 Victoria Street, London, S.W., February 23.

A. A. CAMPBELL SWINTON.

Chalk-stuff Gas.

IN his notice of my "Papers on Education," in taking exception to my nomenclature, Prof. Smithells has touched on a question of much importance to teachers. "Chalk gas seems unnecessary," he says, "even as a temporary name for carbon dioxide. Why not 'Fixed air,' which is both descriptive and historical?" A young student (about eighteen years old) who went through my course two or three years ago, who has read the article, writes to me unsolicited a letter on the subject, from which I may be allowed to quote the following passage:—"One remark struck me. The reviewer wants to know the advantage of calling CO_2 chalk-stuff-gas and suggests that the classic old 'Fixed air' would be better. He does not seem to appreciate that by calling the gas 'Fixed air' you must presuppose that it is fixed and hence all that the word 'Fixed' entails of a knowledge of the gas; whereas, your name is eminently descriptive and entails no knowledge of the gas at all but simply describes the source from which it was first obtained."

I could not state my case more happily. I regard the use of names which are obviously appropriate at the time when the work is done, which do not involve giving the case away, as of extreme importance. In these days we are somewhat spoilt by the use of names which are significant of composition if not of structure; we are too prone to introduce them without consideration when teaching beginners; it is often desirable to give names temporarily. It must not be forgotten that the Germans, even at the present day, openly speak of acid-stuff and water-stuff; we do likewise in using the names oxygen and hydrogen, although our devotion to classics leads us perhaps to disguise the fact. In teaching beginners I advisedly speak of the gas from chalk (or limestone) *stuff*, because chalk has a definite geological connotation: we deal only with the substance of which it chiefly consists.

HENRY E. ARMSTRONG.

IN alluding to the subject of names in the notice of Prof. Armstrong's book, my chief object was to deprecate the excessive violence of the objections which I have so often

heard in reference to his terminology. I agree with Prof. Armstrong that there is some advantage to be gained during early stages of instruction by using names that do not prejudge the chemistry of the problem that is being investigated. But I think history usually supplies a good provisional name, such as inflammable air, calx of lead, spirit of nitre, and personally I should keep to the historical name where possible.

To call carbon dioxide chalk-stuff gas asserts that it comes from chalk, or that, in other words, it is a kind of air fixed somehow in chalk. I confess I cannot see that any greater presupposition is involved in calling it fixed air than in calling it chalk-stuff gas. Historically it was called fixed air, and I value the name because Black's clear perception and proof that a gas could be fixed in a solid and be a weighable material part of it was the means of inspiring Lavoisier with the right view of the part played by air in the calcination of metals, and so led to results of revolutionary importance. ARTHUR SMITHELLS.

Variation in Oat Hybrids.

AMERICAN and English observers have shown that the principles enunciated by Mendel are applicable to hybrid wheats. From observations carried out at St. Andrews, I have been able to demonstrate that the same principles are applicable to hybrid oats.

In 1901 I crossed a few white varieties of oats one with the other, and also black varieties with white ones. The progeny was in all cases characterised by very great vigour and prolificness. The hybrid characters were most easily distinguishable in the crosses between black and white varieties, the unilateral ear and dark grain of the one parent, and the pyramidal ear and light-coloured grain of the other, being so blended in the respective hybrids as to result in a somewhat one-sided ear and rich brown grain. It should be mentioned that by the colour of the grain is meant that of the closely adherent flowering-glume.

The grains of the four hybrids given below, after being classed according to their position in the spikelets, were sown singly in rows of one hundred each. At harvesting the ears of each plant were tied together, and the product of each row made into a separate bundle.

Long continued wet weather had damaged the plants so seriously as to render the working out of certain points impossible, *e.g.* the variation in the ears. From what has been noted in the available examples studied, the form of the ear will no doubt be found to be a constant character in the Mendelian sense. Sufficient material has been secured to show the dissociation of the colour of the grain.

The numbers of plants bearing respectively black, brown, white or yellow grain in the several bundles varied considerably. The totals only are given in the subjoined tables, the brown being classed with the black grain, and the yellow with the white. The distinction between the two classes thus tabulated was in all cases so marked as to offer no difficulty in sorting out, and they are therefore briefly put as black and white.

Goldfinder ♀ × *Black Tartarian* ♂ (*two plants*).

	No. of grains sown	No. of plants saved at harvesting	No. with black grains	No. with white grains	Ratio of black and white
(1)	1000	567	433	134	3·23 : 1
(2)	900	566	415	151	2·75 : 1

Black Tartarian × *White Canadian* (*one plant*).

890	532	379	153	2·48 : 1

Black Tartarian × *Abundance* (*one plant*).

600	274	209	65	3·21 : 1

The Black Tartarian oat is thus shown, in respect of the character in question, to be dominant, whether serving as pollen or seed parent. It is impossible to say whether the destruction done by bad weather affected one type more than another. If all the plants had survived, the proportion of black to white forms shown in the above tables might have been somewhat altered, but for several reasons it may safely be assumed that, at most, the alteration would not have materially affected the conclusion so clearly pointed to, namely, that the dominant and recessive characters in hybrid oats, as in many other self-fertilised plants, assert themselves in the second generation in a ratio closely approximating 3 : 1. JOHN H. WILSON.

Agricultural Department, St. Andrews University.

Visitors from the High North in Central Italy.

THAT *vexata quaestio* the migration of birds presents strange anomalies which confound the best informed theories on the subject. Last winter we had a surprise in the appearance in central Italy of the great white-billed diver, *Colymbus adamsi*, G. R. Gray, two of which were captured, a big ♀ on the Lake Chiusi or Montepulciano on December 2, 1902, and a large-billed ♂ on the 19th of the same month on Lake Trasimeno. Both were adults in autumn plumage, and are now in the central collection of Italian vertebrata in this museum. It is the first time that this sub-polar and eastern species has been noted in Italy.

This winter we have had a considerable invasion of that beautiful northern bird, the waxwing (*Ampelis garrulus*, L.). During December and January last they appeared in hundreds in our northern provinces, and from Vicenza, Padova, and Verona spread in flocks westward and southward. I received the first specimens on December 18, 1903, from Vicenza, and the last from Barberino di Mugello (Florence) and from Fano (Marche) on January 1 and 15. I also heard from Nice that more than 200 specimens, said to have come from Corsica, had been sold in the market.

HENRY H. GIGLIOLI.

R. Zool. Museum, Florence, February 22.

THE NEW BUILDINGS AT CAMBRIDGE.

THE King, accompanied by the Queen and Princess Victoria, visited Cambridge last Tuesday to open the new Law School and Science Laboratories which have recently been completed on the site the university acquired from Downing College a few years ago.

On reaching Cambridge, the royal party proceeded to the Senate House, where, in the absence of the Chancellor, the Duke of Devonshire, who was prevented from attending by illness, the Vice-Chancellor, Dr. Chase, president of Queens' College, presented an address, which was graciously replied to by his Majesty. In the course of his reply, the King remarked that he earnestly desired the well-being of the university and "the extension and development of all branches of study and research which are essential to the maintenance and the greatness and the welfare of my Empire." There must, he added, be "new endowments for education if my realm is to be kept up to its proper standard of efficiency." The Vice-Chancellor then gave a short description of the buildings, and an account of the Cambridge Association, whose benefactions had enabled the university to build them. He also dwelt upon the pressing need for buildings for the department of agriculture, and for proper provision for housing the ethnological and archæological collections of the university.

When the ceremony was over the King and Queen were entertained at lunch by the university in the large gallery at the Fitzwilliam Museum. The royal lunch party was strictly limited in number, and the university entertained a number of distinguished guests in the halls of Gonville and Caius and of King's College.

After the lunch the royal party inspected the new buildings, which comprise the Medical School, the Sedgwick Memorial Museum, the new Botany School, and the Squire Law Library and Law Lecture Rooms.

FIG. 1.—Botanical Laboratory: Elementary Class-room.

Of these the building for medicine lies on the north side of Downing Street and covers the site of the old Anatomical School so well known to the pupils of the late Sir George Humphry. The plans for this building were designed by Mr. E. S. Prior, of Gonville and Caius College, who has shown considerable ingenuity in satisfying the requirements of the several professors on a very awkwardly shaped site. The basement, which is partly beneath the level of the ground, is given over to store-rooms, workshops, combustion and photographic rooms, and engines and a ventilating installation on the Plenum system. On the ground floor are small laboratories connected with the medical and surgical departments and the chemical laboratories of Dr. Bradbury, the professor of pharmacology. Here also is a large lecture room capable of seating two hundred students, and the pathological museum. On the first floor is the spacious Humphrey Museum, the walls of which are lined with glazed tiles, and the library, which is fitted with movable book-cases which can readily be pulled out into the room. Near by is the private room of the professor of pathology, Dr. Sims Woodhead. On this floor also are rooms for Dr. Clifford Allbutt, the regius professor of medicine, and for Dr. Howard Marsh, the professor of surgery, and a class-room capable of holding fifty or sixty students. On the top floor are the spacious pathological laboratories, lighted from above; also rooms for the demonstrators and lecturers, one of which is specially adapted for hygiene, under the supervision of Dr. G. H. F. Nuttall.

In all the rooms the gas-pipes, water-pipes, and electric wires are carried in covered chases, and can be reached at a moment's notice. The walls and the ceiling are of adamant cement, and all grooves and corners are rounded. There are no angles, mouldings, or projections to catch the dust. It is proposed to supply the electricity used in the building by means of two Diesel oil-engines, and the new Medical Schools will be perhaps more self-contained than any other institution of the sort in Cambridge.

Owing to lack of funds the syndicate entrusted with the erection of the medical schools has only been able to carry out two-thirds of the complete plan. In time it is hoped that the building will be connected with the eastern corner of the Physiological Laboratory, and that more rooms, which are earnestly needed, will be provided for the departments of physiological chemistry and pathology, and that a space will be set apart for a proper development and teaching of hygiene.

The Botanical School forms the southern side of the court, which the university is rapidly enclosing, on the site it bought from Downing College seven years ago. Externally the building is simple and without ornamentation, but its proportions are good and architecturally the effect produced is pleasing. The architect is Mr. W. C. Marshall, of Messrs. Marshall and Vickers.

FIG. 2.—Botanical Laboratory: Professor's Room.

The building is entered by two doors, from either of which access is gained to the large central lecture

room designed to accommodate some two hundred students. West of the lecture room is the herbarium, containing a very extensive collection of dried plants which have been accumulated since the chair of botany was founded in 1704, and a special library of systematic monographs. Corresponding with this, but on the eastern end, is a museum in which is exhibited a really remarkable collection of plants in spirit, besides many specimens of economic interest.

On the first floor of the building is a library, which contains more than four thousand volumes and in which nearly forty current scientific botanical periodicals can be seen. Above the herbarium is the morphological laboratory and the chemical laboratory with a photographic dark room.

The professor's rooms and rooms for sterilisers and incubators are over the museum, and other rooms on this floor are occupied by the lecturers in botany, Mr. Seward and Mr. Blackman.

On the second floor the western half of the space is occupied by a large laboratory capable of seating one hundred and fifty students. There are also rooms provided for the demonstrators and small lecture rooms for advanced students. The eastern end of this floor is occupied by a laboratory for plant physiology, connected with which is the dark room and the greenhouse. Mr. Francis Darwin, university reader in botany, has his rooms near by.

The large flat roof is well adapted for certain kinds of experimental work, and there are three greenhouses so arranged as to provide for the plants therein different external conditions throughout the year.

The great care exercised by Prof. Marshall Ward and the architect has resulted in the completion of what is probably the most complete botanical teaching institute in the Empire.

It is gratifying to know that the King's visit to Cambridge is being marked by the foundation of a scholarship of 100*l*. a year for encouragement of research in botany. The generous benefactor, who is already well known to Cambridge as the founder of a studentship at Caius College, is Mr. Frank Smart, of Tunbridge Wells.

FIG. 3.—Sedgwick Museum: West End.

In the year 1727 Dr. John Woodward bequeathed by his will to the University of Cambridge his collection of English fossils with the two cabinets containing them and their catalogues. From this small beginning the geological collections of the university have grown.

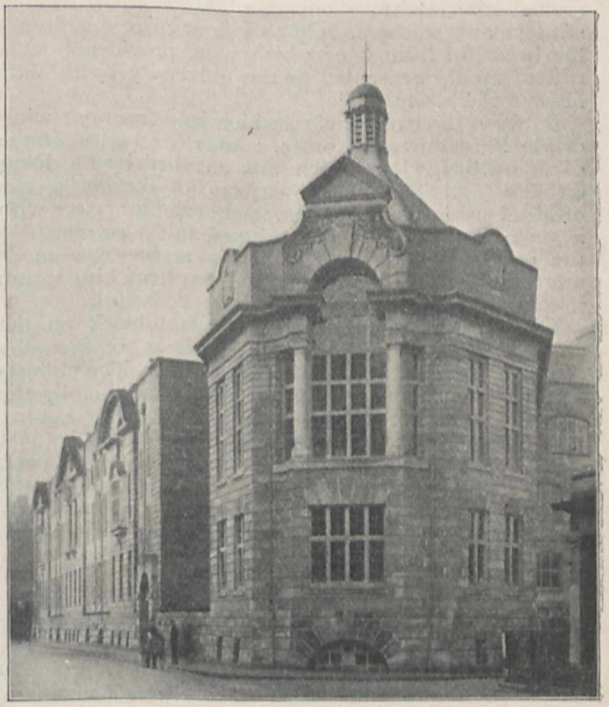

FIG. 4.—Humphrey Memorial Museum.

The magnificent pile of buildings which has recently been erected is partly a memorial to Adam Sedgwick, one of Cambridge's greatest professors, who died at the beginning of 1873 at the advanced age of eighty-eight. In the spring of that year a meeting was held at the Senate House at which it was decided to collect money to build a new geological museum in his memory. So large a sum was collected, and so long a time elapsed before the museum was begun that the trustees, a year or two ago, were able to hand over a sum of money which amounted, with the interest received during the interval, to more than 26,000*l*. The remainder of the cost of the building has been defrayed by the university.

The Sedgwick Memorial Museum was designed by Mr. T. G. Jackson, R.A. Its ground plan is of an "L" shape, one side running along Downing Street, where it adjoins the new Law Library, the other side, at a somewhat obtuse angle, forming the western boundary of Downing Place.

On the ground floor are numerous workshops, a very fine lecture room, and a museum of economic geology. On the first floor the Sedgwick Museum occupies almost the entire extent of the Museum, one corner of which is partitioned off, and

here Woodward's ancient cabinets are piously preserved. Adjacent to them are the rooms of the Woodwardian professor, Prof. Hughes, and a board room.

On the second floor are numerous students' class rooms and private rooms for the various demonstrators and teachers. On this floor also is a library the beautiful fittings of which were provided from a gift of money presented to the university by the late Master of Trinity Hall.

Between the two arcades, which lead from one wing of the Museum to the other, stands the bronze statue of Adam Sedgwick which was unveiled by the King on Tuesday. This statue was one of the last works of Mr. Onslow Ford, and represents the professor with a geological hammer in one hand and a specimen in the other. Considering that this statue was made more than thirty years after the death of him whom it commemorates it is wonderfully successful.

The Law School forms the central block on the north side of the new courtyard. It is, in fact, the centre of Mr. T. G. Jackson's façade. The university has been able to erect this noble building by the generous bequest of Miss Rebecca Flower Squire, who has also endowed certain scholarships to be held by law students in the university. To the 15,000*l.* which the trustees allotted for the purposes of the Law Library the university has been able to add sufficient to complete the Law School by the addition of professors' rooms, lecture rooms, and examination rooms. The main library is a lofty room 85 feet by 30 feet in area, lighted by spacious windows on the north and south, and with book-cases projecting towards the centre of the room between each window. Above these are ample space for storing duplicates and books which are seldom used. Each end of the room is provided with a handsome gallery.

For some time, owing to the wants of the university library, the professor of civil law has been driven out of the old Law School and has been a wanderer through the literary lecture rooms. Miss Squire's bequest has enabled the university to find him a home, and for the first time in the history of the Cambridge Law School, more than five or six hundred years, the students of law will assemble in a handsome and roomy building especially adapted for their very needs and in close contiguity to the ample library.

The illustrations which accompany this article are taken from photographs made by Mr. Palmer Clarke, of Cambridge.

EDUCATION AND PROGRESS IN JAPAN.

IN his address at Southport last September, the president of the British Association, taking as his subject "The Influence of Brain-power on History," traced convincingly and conclusively the intimate relation that exists between the provision made by a nation for the higher education of its people and the position taken by that nation in the ceaseless competition between the great countries of the world. After a searching comparison between the facilities for university education in this country on one hand and in the United States and in Germany on the other, Sir Norman Lockyer said:—"But even more wonderful than these examples is the 'intellectual effort' made by Japan, not after a war, but to prepare for one. The question is, Shall we wait for a disaster and then imitate Prussia and France; or shall we follow Japan and thoroughly prepare by 'intellectual effort' for the industrial struggle which lies before us?" It would indeed be difficult to find a more striking example of the profound and comparatively immediate effect on national prospects which an earnest and thorough attempt to establish a complete system of education can effect. The events of the past few weeks serve to bring into high relief what was before clear enough to students of educational progress, that Japan has succeeded in a little more than thirty years in bringing about a revolution without bloodshed, in changing an eastern people—among whom originality was considered a form of disloyalty—into a powerful nation equipped with western education and possessed of all the resources of modern civilisation.

In the following attempt to trace the leading events of these thirty years of Japanese progress in education, reference has been made to numerous authorities, but most of the facts included are from a statement of the development and present position of State education in Japan prepared by Mr. Robert E. Lewis, of Shanghai, and published in the reports of the United States Commissioner of Education.

The beginning of modern Japanese history dates from 1868. For three and a half centuries before this date, to quote Mr. Lewis, "Confucius was the headmaster of Japan, with Buddhist priests as his understudies." But with the coming of the new learning and with the arrival of English-speaking people from America in 1853 and from England—in the persons of Lord Elgin and his suite—in 1858, in which year the British-Japanese treaty was signed, a change commenced which was destined, as subsequent events have shown, to be a rapid one.

A provisional board of education was established in Kioto in 1868, and three years later the Mombu-sho, or department of education, was established with a Minister of State to preside over it. The first educational code was issued in 1872, and in promulgating it the Emperor said:—"All knowledge, from that necessary to prepare officers, farmers, mechanics, artisans, physicians, &c., for their respective vocations, is acquired by learning. It is intended that henceforth education shall be so diffused that there may not be a village with an ignorant family or a family with an ignorant member." In 1898, that is, in twenty-six years, out of 7,925,966 children of school age in the country, 4,062,418 were being educated in schools modelled on western plans. Moreover, if only the boys are taken into account, there were in that year 82.42 per cent. of the Japanese boys of school age receiving what may be described as education in the European sense.

In 1872 what was known as "the world's embassy," consisting of forty-nine representative Japanese, including Prince Iwakura and Marquis Ito, was at work, and much of its attention was devoted to observations of education in Europe and America. The plan of sending Japanese students to foreign countries for the purpose of studying modern thought and methods has been much employed by the educational authorities of Japan, though in recent years the custom has been largely discontinued, as highly educated Japanese have become available for university and similar posts. For instance, in 1873 there were 250 students studying in foreign countries at the expense of the Japanese Government, while in 1895 only eleven Japanese students were similarly officially sent abroad. The same tendency to dispense with foreign assistance at the first opportunity is noticeable also when the personnel of the staffs of the institutions in connection with the Japanese department of education is examined. Though in the years following the promulgation of the first education code by the Japanese Government the number of European and American professors and instructors was relatively

very large, by 1896 the total number of such foreign teachers in State institutions had fallen to thirty-one, of whom ten were from Great Britain and eleven from the United States. If, however, in addition to State institutions all other public and private educational establishments are included, it is found that the number of foreign instructors is much higher. Thus in 1895, 167 men and 101 women from Europe and America were engaged in teaching in Japan.

A complete understanding of the success of Japan's provision of university and technical education can only be arrived at by first considering the steps which have been taken in the direction of securing a satisfactory system of primary and secondary education. Japan seems to have learnt completely what is now only beginning to be understood in this country, that for complete success a system of higher education must be firmly based upon an adequate and properly coordinated supply of institutions in which a sound preliminary education is given. This seems to have been the idea in the mind of President Ibuka, who, speaking in America, said that when Japan reached out after western ideas she copied her navy from Great Britain and her educational system from America. It is therefore desirable to refer briefly to the conditions of elementary and secondary education in Japan.

The elementary schools of Japan are of two grades, ordinary and higher. It will be sufficient in this connection to refer to them as public elementary schools. In 1898 there were 26,322 of these schools, with an annual cost for maintenance of 1,715,470*l*., to which sum the Japanese taxpayer contributed 1,150,446*l*. Nearly five thousand of these elementary schools provide special supplementary courses of a more advanced character, in which preliminary instruction is provided for boys, in the branches of science underlying agricultural practice and rural economy, and those on which the needs of industry depend, while for girls the special requirements of the household are taken into account, and instruction is given in such subjects as sewing and needlework. It is interesting to notice that a decree of the Japanese Government dating from August, 1900, made the education in all public elementary schools to all intents and purposes free.

As indicating the attitude of the Japanese people towards education, it should be stated that their voluntary contributions towards its support are on a generous scale. In 1896 voluntary gifts to the public school fund amounted to almost 154,000*l*., in addition to which during a single year the people contributed for educational purposes 3,677,000 acres of land, 14,000 books, and nearly 16,000 pieces of apparatus. As Mr. Lewis has remarked, "it may be said roughly that in support of popular education in Japan the gifts of the people in money are more than one-fifth the amount realised from fees, and that the latter are about one-third as much as the amount of the local taxes for education." Before leaving the subject of elementary education, it is significant to remark that in 1896, while the percentage of the population of Great Britain under instruction in elementary schools was fifteen, Japan, with its short experience in educational matters, had managed to bring the percentage up to ten.

Intermediate between the public elementary school and the university, two classes of schools are to be found in Japan, the common middle schools and the high schools. As in some European countries, these schools are made more attractive to the Japanese people because attendance at them exempts from a certain amount of military service. Thus a common middle school course exempts from two or three years of military service, and attendance throughout a high school course excuses the student from conscription until twenty-eight years of age, when a single year as a volunteer with the colours exempts from further military service. The educational authorities of Japan have, too, learnt the importance of carefully coordinating one grade of school with those immediately below and above it. To give an instance, a pupil who has successfully completed the course of a common middle school can claim admittance to a high school without examination, and one who has obtained a certificate showing that he has attended the complete course of a high school may at once enter the university without a matriculation examination, and he is, moreover, considered to be fully qualified for any public post.

In 1898 there were in Japan 169 common middle schools, and in 1896 six high schools. In the former there were 2061 teachers and 49,684 students, and in the latter 290 teachers, of whom only twelve were foreigners, and 4231 students. Of the total number of students who completed the courses of the common middle schools, three-fifths entered high schools, one-eleventh entered the army, and one twenty-eighth became teachers. Of the high school students, 55 were in law courses, 127 in engineering, 1469 in medicine, and 2580 in general courses leading to the university.

It appears, says Mr. Lewis, that the subject most insisted on in the common middle schools is the English language; that the Japanese language and Chinese literature, studied as related themes, are second; gymnastics receives more attention than mathematics or history, and far more than ethics. The explanation of the anomaly is in the fact that by the training of the body Japan hopes to repair the physical defects of the people. The same authority states that the courses of study are not uniform in the Government high schools; in five of them the greatest emphasis is laid on the general preparatory courses for the university. One of them has departments of law and engineering, and its advanced courses constitute the beginning of Kioto University.

Though the foundation for technical education is laid in the elementary, middle and high schools of Japan, we may fairly say that the higher education of the country is given in its universities and technical institutions. It will be convenient to deal with the universities first.

There are two universities, one in Tokyo and the other in Kioto. The former is the more important, and it will suffice to indicate the nature of its work, constitution, and cost. The Imperial Tokyo University was organised in 1877, remodelled in 1886, and enlarged to include a college of agriculture in 1890. For the first ten years or so after its organisation the university followed the American plan, but since then it has been more inspired by German ideals. The university at present consists of a university hall—devoted to the purposes of post-graduate study, including original scientific research—colleges for the study of law, science, engineering, medicine, agriculture and literature, library, botanical garden, astronomical observatory, marine laboratory, and two hospitals.

In 1898 there were 205 professors and 2465 students in the university. Though the distribution of these professors is not available for 1898, the 161 professors attached to the university in 1895 were divided among the six colleges as follows:—law, 22; medicine, 30; engineering, 35; literature, 25; science, 18; and agriculture, 31. The number of students has increased steadily year by year, as the following table shows:—

Number of Students in the Imperial Tokyo University.

College, &c.	1885	1890	1895	1896	1897
University Hall...	0	47	105	146	174
Law	217	301	472	551	737
Science	43	77	102	105	105
Engineering ...	30	106	295	345	385
Medicine	726	188	178	223	297
Literature ...	129	88	219	248	278
Agriculture ...	0	485	249	215	232
Total	1145	1292	1620	1833	2208

In 1898, 30 per cent. of the total number of students were studying law, 9 per cent. medicine, 31 per cent. engineering, 7 per cent. science, and 4 per cent. agriculture.

Mr. Lewis provides interesting particulars of the subsequent careers of the graduates from Tokyo University for the year 1896. Of 308 graduates that year 107 were given administrative or judicial positions by the Japanese Government, 48 were admitted to University Hall there to engage in original research, 45 obtained posts in banking houses and similar important commercial undertakings, 44 remained unoccupied, 42 became instructors in the universities and high schools, 15 remained in the colleges for post-graduate work, and 7 took up various other callings.

As regards the annual expenditure on Tokyo University, the following table shows the amounts spent on the different constituent colleges in the year 1895 :—

Imperial Tokyo University Expenditure for the Year 1895.

	£
University Hall	11,000
College of Law	9,500
College of Science	14,000
College of Engineering	15,000
College of Medicine	52,000
College of Literature	11,000
College of Agriculture	15,500
Total	128,000

Now it must be remembered that the Government department of education is responsible for the maintenance of higher education in Japan, and it is at once seen that in Japan the State found for the Tokyo University in 1895, apart from the University of Kioto, about 130,000*l*. The present State contribution to the whole of our universities and colleges together amounts only to 155,600*l*., and in favoured Germany the State endowment of the University of Berlin in 1891–2 amounted to 168,780*l*., so that with educational traditions dating back only thirty-five years Japan is well on the way to an equal State expenditure on higher education.

The students of the Tokyo University are drawn, says Mr. Lewis, from all classes of society as in America. "There seems to be no special class of men who were predestinated for the university. . . . If the past thirty years might be taken as a basis, one may look forward to the time in Japan when, as in Scotland, the universities may claim one from every thousand of the population; or when, as in Scotland, one man out of each five hundred will have a *bona fide* university degree."

Besides the institutions of higher education which have now been described, there are in Japan, according to the Japanese Government report for 1896, sixty technical schools of various kinds. Thirty-seven of these are devoted to instruction in agriculture, seven to branches of industry, and sixteen to commerce. These sixty schools employ 424 teachers, and are attended by 7600 students. Among the more important of these schools the Tokyo Technical School takes a high place. It gives instruction in electrical mechanics, electrochemistry, dyeing, weaving, and many other branches of technology. The primary object of the school is to train manufacturing experts, and the school has already gained a high reputation for the amount of its original work for the improvement of manufacturing processes. Japan also has sixteen apprentice schools with 1875 students.

Merely to state the number of technical schools in the country is to fail to give a true idea of the Japanese system of technical education, because in both the elementary and secondary schools some attention is devoted to instruction of a technical kind. Though many authorities in this country, in Germany, and in America would disapprove of this approach to early specialisation, it seems probable that the great success of institutions like the Tokyo Technical School may be due to the fact that the early introduction of Japanese boys to technical studies makes it possible to weed out those unlikely to benefit by the advanced courses of the technical schools, and to concentrate attention on those who possess natural aptitudes for such work.

Such is a brief outline of the change which has taken place in Japan since 1868, when its first provisional board of education was formed. If with all the disadvantages under which she laboured Japan has been able by persistent effort and by continuous sacrifice in the way of State endowment and private munificence to effect an educational revolution, it requires little enough faith to believe that if as a nation we set to work to put our educational house in order—to endow adequately our present universities, to establish others where they are required, to level up our secondary education—there would be no need pessimistically to contemplate the future of the Empire, and to imagine for it a possible third or fourth place in the world struggle for supremacy.

A. T. SIMMONS.

THE EVOLUTION OF MATTER AS REVEALED BY THE RADIO-ACTIVE ELEMENTS.

ON Tuesday, February 23, Mr. F. Soddy delivered the Wilde lecture before the Manchester Literary and Philosophical Society. The lecture, it may be explained, is delivered annually, and is provided for out of an endowment by Dr. Henry Wilde, F.R.S.

After referring to the three-fold character of the rays emitted by radium, Mr. Soddy explained that the α-rays contained more than 99 per cent. of the whole energy given off, and were of paramount importance on other grounds, as opening up a new field of research with which the ordinary methods of chemical analysis had no connection. The mass of the particles composing the α rays was about equal to that of an atom of hydrogen; they carried a positive charge, and were deviable, though to a very minute extent, in a powerful magnetic field. Their velocity was about 20,000 miles a second, and they were easily stopped, even by a thin sheet of paper, or a few centimetres of air. All three kinds were detected by their power of exciting fluorescence in certain substances, and by their action on a photographic plate, but their distinctive property was that of ionising the air and other gases through which they pass. Had it not been that their energy effects are out of all proportion to the masses of the bodies concerned, the radio-active property would have remained undetected. Thus uranium and thorium have been known for several generations, yet it is no longer ago than 1896 that Becquerel began the researches which have since proved so fruitful in the hands of M. and Mdme. Curie, Prof. Rutherford, Sir W. Ramsay and others.

As regards the radio-active elements themselves, they are regarded as undergoing a slow spontaneous

change into other elements. The parent form disintegrates and throws off a portion of its substance, leaving a residue which undergoes a further change of a like explosive character, and so on, until a form of matter is reached in which no other change is possible. The explosion differs from that of a body like fulminate of mercury in that it does not gather strength with the mass of matter present, but is confined entirely to the individual atoms. All the effects observable in connection with radio-activity are referable to the α particles: thus fluorescence is excited in certain bodies by impact; the ionisation of a gas is brought about by the collision of these particles with the neutral molecules of the gas, whereby they are torn asunder into ions; the warmth of a mass of a radio-active substance is due to its being bombarded by its own α rays. As the process of disintegration continues, certain stages are reached in which the substances produced are of the nature of chemical elements, though differing from the ordinary conception of an element in that their existence is merely temporary. To these transition forms Prof. Rutherford and Mr. Soddy have applied the term "metabolons," and the duration of these is a specific property, depending on the nature of their aggregation. Thorium, for example, gives off an emanation which changes its character in so short a time as 87 seconds; the form of matter to which radium owes its power of exciting radio-activity in other bodies endures for about 43 minutes; that to which thorium owes a similar property lasts about 16 hours; the radium emanation for 5 days 8 hours; the uninvestigated next product of the disintegration of thorium, called thorium X, has a life of 5 days 19 hours; uranium X of about 4 weeks; polonium of 16 months; radium of 1300 years; uranium and thorium of about 10^9 years.

The atoms of ordinary chemistry represent the forms with longest life, and they exist to-day because they have survived a process of evolution in which those physically unfit have disappeared. The transition forms represent the elementary forms of matter unfitted to survive, but they are brought within our powers of knowledge because they constitute the temporary halting places through which matter is passing in a scheme of slow continuous evolution from the heavier to the lighter forms. During the whole existence of the metabolon, whether long or short, it behaves like an ordinary atom. No indication whatever seems to be given of its approaching end, but suddenly, by some internal cataclysm, the cause of which is at present almost beyond conjecture, it flies to pieces and ceases to exist in the form previously assumed. A new world is thus opened out in which the atom is not the unit, in which the forces are not chemical, and in which common physical conceptions such as temperature are without meaning.

The operation of separating the transition forms from the parent element by chemical means does not in any way affect the progress of disintegration. Left to itself, the parent element steadily accumulates a fresh crop of the transition forms separated, while the quantities originally separated disappear as such by further change. As the activity of the parent element recovers to its maximum or equilibrium value, that of the transition forms decays to zero, and the sum total is always the same as if the separation had not been effected. On this view the products of disintegration must have been steadily accumulating through past ages, and the discovery of helium by Sir W. Ramsay in 1895 was the first definite proof that such was really the case. Helium is only known in association with the radio-active elements, and its inert character is one of the reasons for supposing that it is a final product of disintegration. Sir W. Ramsay and Mr. Soddy, during last summer, examined radium with the view of discovering whether or not it resolved itself into helium, and after weeks of waiting were able to establish that this is really the case. A very minute bubble was all that could be obtained, and its slow disappearance, probably by absorption into the glass, was not unexpected. Indeed, glass which has been subjected to bombardment by the α rays, when powdered and heated, has been shown to give off helium, so that the supposition is confirmed. All kinds of glass, however, do not behave in the same manner, the absorption in some cases being much more rapid than in others.

Viewed in relation to their length of life, it seems probable that radium, actinium, and polonium are merely slow-changing transition forms produced in the disintegration of the parent element uranium. Since the activity of polonium decays to half value in about a year, it follows that its existence in pitchblende at the present time is due to its continuous production in the mineral. Applying the same argument to radium, it must also be in a state of equilibrium, the amount produced in any given time being balanced by its rate of decay to inferior forms in that time. The lecturer had endeavoured to discover whether a quantity of uranium, originally free from radium, would grow a crop of that element, but a lengthy period must elapse before a definite conclusion can be reached. There is also an unknown factor in these considerations, viz. actinium, and until this element has been further investigated even speculation must be withheld. Pushing the matter back to its limits, we are face to face with the question, How and when did the universe originate? According to orthodox notions, it is tending to a state of exhaustion in which all change must cease. If, however, a constructive influence is at work, opposing this process, the whole system may turn out to be a conservative one, limited with respect neither to the future nor to the past, but proceeding through continuous cycles of evolution. This would be possible if a gradual and continuous accretion of atomic mass could take place, such as that by which the stable elements were originally formed. At present, however, all such views belong to the realm of pure conjecture.

LIEUT.-GENERAL C. A. McMAHON, F.R.S.

CHARLES ALEXANDER McMAHON, son of Captain Alexander McMahon, of the East India Co.'s Service, belonged to an old Irish family, and was born near Highgate on March 23, 1830. Educated as a soldier, he went to India in 1847 as Lieutenant in the Madras Native Infantry, and served for eight years in the 39th Regiment. In 1856 he was appointed a Commissioner in the Punjab, and was engaged for thirty years in various districts, including Lahore.

While politics and educational questions occupied much of his time, he became greatly interested in geology, and especially in the crystalline rocks and glacial phenomena of the western Himalayas. In his earlier work he was impressed with the intrusive character of the central gneiss of the great mountain range, and his enthusiasm was so aroused that he took the opportunity, while on furlough in 1879–80, of attending the courses at the Royal School of Mines, so as to be initiated in the latest methods of petrological research. Returning to India he worked with renewed zeal at the igneous and metamorphic rocks, and the results of his observations were mostly published in the records of the Geological Survey of India.

In 1885 he retired from service with the rank of colonel, and settled in London. He had been elected a fellow of the Geological Society in 1878, and he now took an active part in the work of the society, serving

on the council in 1888 and in subsequent years, and for a time as vice-president.

His attention was in 1887 attracted to the geology of the Lizard, and there his observations led him to maintain the igneous origin of many of the foliated crystalline rocks. He dealt also with the granite of Dartmoor, and showed that it presented the ordinary features of an intrusive igneous rock.

In 1894 he was elected president of the Geologists' Association for the usual two years, and in his addresses he summarised the results of some of his Indian work. He sought to dispel the popular notion that the Himalayas were upraised in late Tertiary times—they had, of course, a pre-Tertiary history, although there was a general absence of crushing and contortion prior to the Miocene, and these disturbances were due to the intrusion of the gneissose granite.

General McMahon was elected a fellow of the Royal Society in 1898, and in the following year the Lyell medal was awarded to him by the Geological Society. The president (Mr. Whitaker), in addressing him on that occasion, remarked, "Labouring under the disadvantage of taking to the study of geology comparatively late in life, you have attacked it with the energy of a British soldier, and have fought your way into the foremost rank of our petrologists."

In 1902 he contributed to the *Geological Magazine* (with Mr. Hudleston) an important paper on the fossils from the Hindu Khoosh. In the autumn of the same year he took duty as president of Section C of the British Association at Belfast. Since that date his health had gradually declined, and he died from heart failure on February 21. Personally he was endeared to all who knew him by his sterling character and by his genial and courteous nature. H. B. W.

THE NEW EDUCATION AUTHORITY FOR LONDON.

WE have received the following memorial referring to the proposed constitution of the Education Committee for London. An article upon the scheme adopted by the London County Council appeared in our issue of February 11.

To the Secretary of the Board of Education.

February 22, 1904.

Sir,

Having carefully considered the scheme proposed by the London County Council for the constitution of its Education Committee, which has been submitted for the approval of your Board, we, without bias towards any political party, desire to draw the attention of your Board to certain defects in the scheme which must seriously impair the efficiency of the committee in its work of coordinating and developing all varieties of education in London.

The Education Committee will have to undertake not only the work of elementary instruction hitherto carried out by the School Board, but it will also have the more difficult task of supplying and aiding the supply of secondary, technical, and higher education, and of promoting the coordination of all forms of education in London. The present backward educational position of this country is especially marked in those branches designated "secondary" and "higher." To develop the resources of London in these respects, to raise the standard of secondary education, to provide for the training of teachers for both primary and secondary schools, to organise and support the facilities for university training, and finally to organise a great technical high school in the university and the more strictly technical instruction of the polytechnics, so that the whole may be one educational edifice crowned by the University of London, will be a task of great magnitude, and will require the assistance of persons specially skilled in and acquainted with the needs and conditions of these various grades of education.

Under the scheme sent in by the County Council, it seems to us that no guarantee is afforded that the Council will have at its disposal any sufficient number of persons of experience in education and acquainted with the needs of the various kinds of schools in London. We would therefore urge on the Board of Education the desirability of amending the scheme so that the Education Committee may include persons who would be universally recognised as authorities on the needs of the university, the technical institutes, and the elementary and secondary schools.

While trusting that the Board of Education will take all possible means to secure the improvement of the scheme along the lines indicated above, we would earnestly deprecate any action of the Board that would lead to the postponement of the appointed day, on which, by the provisions of the Education Act, the administration of a unified system of education for London is to begin.

We have the honour to remain, Sir,

Your obedient Servants,

(Signed),

List of Signatures.

Dr. W. H. Allchin, senior physician to the Westminster Hospital, member of the Senate of the University of London; Dr. Henry E. Armstrong, F.R.S., professor of chemistry, Central Institute of City and Guilds; Right Hon. Lord Avebury, F.R.S., president of the Associated Chambers of Commerce; Sir J. Wolfe Barry, chairman of Executive Committee, City and Guilds Institute; Dr. Horace T. Brown, F.R.S.; Sir Lauder Brunton, F.R.S.; Dr. Henry T. Butlin, Dean of the Faculty of Medicine of the University of London; Prof. D. S. Capper, professor of mechanical engineering, King's College; Sir William Crookes, F.R.S.; Prof. Hugh L. Callendar, professor of physics, Royal College of Science; Mr. R. F. Charles, chairman of the Central Branch of the Teachers' Guild; Sir W. S. Church, Bart., president of the Royal College of Physicians; Prof. J. D. Cormack, professor of mechanical engineering, University College; Prof. G. Carey Foster, F.R.S., principal of University College, London; Mr. J. Easterbrook, headmaster of Owen's School, Islington; Prof. Ernest A. Gardner, professor of archæology, University College; Mr. Herbert B. Garrod, General Secretary of the Teachers' Guild; Sir William R. Gowers, F.R.S.; Prof. W. D. Halliburton, F.R.S., professor of physiology, King's College; Prof. M. J. M. Hill, F.R.S., professor of mathematics, University College, London; Rev. Arthur C. Headlam, principal of King's College, London; Sir Henry G. Howse, member of Senate of London University; Prof. W. P. Ker, professor of English, University College; Dean of the Faculty of Arts, University of London; Sir Norman Lockyer, K.C.B., F.R.S., president of the British Association; Sir Philip Magnus, fellow and member of Senate of University of London; Dr. Charles J. Martin, F.R.S., director of the Lister Institute of Preventive Medicine; Rev. J. Arbuthnot Nairn, headmaster of the Merchant Taylor's School; Prof. Karl Pearson, F.R.S., professor of applied mathematics, University College; Sir E. C. Perry, member of Senate, London University; Prof. John Perry, F.R.S., professor of mathematics, Royal College of Science; Sir William Ramsay, K.C.B., F.R.S., professor of chemistry, University College, London, president of the Society of Chemical Industry; Sir Owen Roberts; Dr. R. P. Scott, Incorporated Association of Head Masters; Mrs. S. T. D. Shaw, late lecturer at Newnham College, and at the Training College for Secondary Teachers; Dr. H. J. Spencer, headmaster of University College School; Prof. E. H. Starling, F.R.S., professor of physiology, University College; Miss L. M. Strong, head mistress of Baker Street High School for Girls; Dr. T. E. Thorpe, C.B., F.R.S., director of Government Laboratories, London; Prof. William A. Tilden, F.R.S., Dean of the Faculty of Science, University of London, president of the Chemical Society; Prof. Fred. T. Trouton, F.R.S., professor of physics, University College; Dr. John Tweedy, president of the Royal College of Surgeons; Dr. A. D. Waller, F.R.S., director of the physiological laboratory, University of London; Sir W. H. White, K.C.B., F.R.S., president of the Institution of Civil Engineers; Sir H. T. Wood, secretary, Society of Arts; Mrs. E. Woodhouse, head mistress of the Clapham High School.

NOTES.

THE instructive article on Japanese education, in another part of this issue, serves admirably to show the importance of education, especially higher education, as the chief factor of national progress. In a period shorter than that which has elapsed since the passing of our Elementary Education Act in 1870, Japan has introduced and perfected a properly coordinated system of education extending from the primary school to the university. More than this, Japan has put into practice the policy which has always been urged in these columns, that higher education is a State charge which ought not to depend upon private benefaction for its endowment. Reversing the order of this country, the universities of Japan rely financially upon the national exchequer, while the elementary schools, though assisted by the State, are considered primarily a local charge. The national bureau of education has no responsibility for the support of elementary or secondary schools, which derive the greater part of their funds directly from local sources. The department is, however, responsible for all higher education. As an object lesson of the profound influence which universities can exert upon a nation's development Japan's rapid advancement is perhaps unique, and it is to be hoped that the same enlightened views which have during the past thirty years dominated the rulers of that country may soon direct the educational policy of British statesmen.

IN connection with the King's visit to Cambridge to open the new buildings, a descriptive account of which is given in another part of this issue, the *Times* has published a series of three articles entitled "The New Buildings at Cambridge." The first article details the steps taken to put into practice the recommendations contained in a letter—accompanied by a detailed statement concerning the financial condition and requirements of the university—from the Duke of Devonshire, the Chancellor of the university, to the *Times* in 1897. The second article describes the buildings already provided at Cambridge, and the third institutes a comparison between what has been accomplished by the Cambridge University Association, fostered by the Chancellor, and what there is yet to be done so that Cambridge may be fully equipped in the modern sense. We are glad to notice in the concluding article of the series that the special correspondent to the *Times* follows the lead given by the president of the British Association in his Southport address, and quotes the comparison made by him between what our Government does for higher education and the amount of the State aid for universities in Germany and in the United States. The article is strengthened further by several of the quotations which Sir Norman Lockyer made from public speeches of leading British statesmen showing that they were learning to appreciate the intimate connection between the supply of higher education and national prosperity.

THE Paris correspondent of the *Daily Chronicle* announces the death of M. Henry Perrotin, the eminent French astronomer, and director of the Nice Observatory, at the age of fifty-eight.

AT a meeting of the Bath Town Council on Tuesday the Mayor announced that, as the result of further investigations, the Hon. R. J. Strutt has come to the definite conclusion that there are traces of radium in the Bath mineral water.

AS announced last week, a Bill for rendering compulsory the use of the metric system of weights and measures was read a second time in the House of Lords on February 23. In connection with this subject the historical documents brought together in a contribution which appears elsewhere in this number are of great interest. From these records it appears that toward the end of the eighteenth century a decree of the French National Assembly suggesting the universal adoption of natural units of weights and measures was communicated to our Government. In the year 1790 the confused condition of our weights and measures was brought before the House of Commons, and decimal standards were suggested. A committee was appointed to consider the matter, and the action taken by the House of Commons was one of the reasons urged in favour of the proposition which led ultimately to the adoption of metric weights and measures by France.

IN the course of the debate in the House of Lords last week on the Metric Weights and Measures Bill, Lord Kelvin gave an amusing illustration of the confusion arising from the use of different systems of weights, for in some experiments with a rifle he had put in a charge which might have caused a disastrous accident if the mistake had not been found out in time. The Marquess of Lansdowne also gave an instance of the confusion arising from the use of different weights in this country and on the Continent. A friend of his travelling abroad sent an English prescription to a local practitioner and received a box of pills of the size of small marbles, which, however, he did not take. The chemist came and said that his assistant did not know the difference between a grain and a drachm, and had put 30 grains of calomel into each pill. The illustrations given by Lord Kelvin and the Marquess of Lansdowne of the misadventures that may arise from the simultaneous use of two different systems of weights and measures show the advisability of there being only one international system.

A CIRCULAR was sent from the Colonial Office to the Colonial Governors in December, 1902, asking what action was likely to be taken in their respective colonies with regard to the resolution adopted at the conference of Colonial Premiers in London in favour of the adoption of a metric system of weights and measures. The replies received have now been published in a Parliamentary paper (Cd. 1940), and are thus summarised. The metric system is already used in Mauritius and Seychelles. The following are favourable to its adoption:—Australia, New Zealand, Cape of Good Hope, Transvaal, Orange River Colony, Southern Rhodesia, Gambia, Northern Nigeria, Gibraltar, British Guiana, Trinidad, Leeward Islands, Windward Islands. Also, with a reservation that it must also be adopted in the United Kingdom or in the Empire generally, Sierra Leone, Southern Nigeria, Ceylon, and Falklands. Hong Kong would take common action with other colonies. The States of New South Wales, Victoria, and Western Australia are also favourable, but, together with South Australia and Tasmania, consider that the matter is one for the Commonwealth Government. Fiji is doubtful, but must follow Australia and New Zealand. British New Guinea would go with Australia. Jamaica and British Honduras need the adoption of the system in the United States of America. The practice of India is important to the Straits Settlements, which would be followed by Labuan; and the Bechuanaland Protectorate would follow the rest of South Africa. St. Helena, Cyprus, Lagos, Wei-hai-wei, Barbados, and Bahamas are on the whole unfavourable. The Gold Coast Colony and the State of Queensland are prepared to adopt, but consider that inconvenience would occur. Natal cannot consider the matter until some general lines of legislation have been agreed

upon by His Majesty's Government. No definite answer has been given by Newfoundland, Malta, or Bermuda. Canada has not yet replied.

THE Smithsonian Institution has commenced the publication of a quarterly issue of its "Miscellaneous Collections," "designed chiefly to afford a medium for the early publication of the results of researches conducted by the Smithsonian Institution and its bureaus, and especially for the publication of reports of a preliminary nature." The first number of the quarterly issue is a double one, and contains seventeen articles, ranging in size from one page to seventy-three pages, in addition to interesting and timely notes on the activities of the institution, its collections, &c., the whole accompanied with fifty-six plates and numerous text figures. The scope of the journal is broad, the first issue embodying articles on mammalogy, astrophysics, palæontology, archæology, geology, ornithology, ichthyology, ethnology, &c., thus covering a considerable range of scientific subjects.

PROF. GUIDO CORA writes:—"A slight earthquake occurred in Rome on February 24 at 4h. 53m. 30s.; the amplitude of the undulations registered was between 4 and 5 centimetres; the earthquake lasted ten seconds. Observing it on the hilly part of the town, in the north-west, I noted three slight shocks of undulatory and horizontal character, about west to east in direction. The centre of the earthquake is not yet known, but is supposed to lie in the Sabina, owing to the fact that a more important shock took place on the same day in Magliano dei Marsi, near Avezzano, about 70 km. east-north-east from Rome. A small seismic disturbance was also observed in Rome on February 20."

GREAT damage was done at Magliano dei Marsi on February 24 in consequence of the earthquake shock. In the village of Rosciolo also, buildings were seriously damaged. Fresh earthquake shocks were felt on the morning of February 25 in the neighbourhood of Avezzano, and also at Rocca di Papa and Velletri.

THE *British Medical Journal* states that Prof. Chantemesse has been appointed to the post of general inspector of the Sanitary Service in France, vacant by the death of Prof. Proust, which occurred during the sittings of the International Sanitary Conference in Paris last autumn. The chair of hygiene, also rendered vacant by the death of Prof. Proust, has also been given to Prof. Chantemesse.

WE learn from *Science* that Sir Norman Lockyer's address at the Southport meeting of the British Association, on "The Influence of Brain-power on History," has been reprinted from *Littell's Living Age* by the New England Education League and International Education Conference. Copies may be obtained in large or small quantities at the rate of two cents each (postage extra) from Mr. W. Scott, secretary, 40 Dover Street, West Somerville Station, Boston, Mass., U.S.A.

IT is announced by the *Times* that at the last meeting of the committee of organisation of the International Congress on Tuberculosis in Paris it was decided to postpone for one year the opening of the congress, which had been fixed for the month of October. The congress will take place in Paris, October 2–7, 1905, in the Grand Palais (Section de l'Avenue d'Antin). This decision was taken in consideration of the International Exposition at St. Louis, and in consideration of the International Tuberculosis Congress, which will meet at St. Louis from October 3–5, 1904.

THE following are the prize awards of the Reale Istituto Lombardo for the current session:—Cagnola prizes, for the cure of pellagra; two premiums, one to Dr. Carlo Ceni, of Reggio, Emilia, and one to Drs. Giuseppe Antonini, of Voghera, and Angelo Mariani, of Bergamo; the essay of Dr. Giuseppe Manzini, of Udine, receives honourable mention. For the steering of balloons two premiums have been awarded, the essays dealing in either instance with determinations of air resistances. One premium is given to the engineer Cosimo Canovetti, and the other to Dr. Giorgio Finzi and Dr. Nicola Soldati. For a monographical study of hypophysis, a premium has been conferred on an anonymous competitor. Fossati prize, on the so-called nuclei of origin or termination of the cranial nerves, a premium to Dr. Giuseppe Tricorni-Allegra, of Messina. For the Brambilla industrial prize there has been, as on previous recent occasions, keen competition amongst the Lombardy manufacturers. First prizes are awarded to Baletti and Co. for silk gauzes, and to Lombardi and Macchi for pickles and preserves. Second prizes are awarded to Luigi Spadaccini for wire ropes; Redaelli, Finzi-Perrier and Co. for velvet and plush; Macchi and Passoni for implements for metal work; L. Sconfietti, engineer, for apparatus for producing a moist atmosphere in textile works; and Tommaso Giussani, of Milan, for wood preservation.

THE prizes offered by the Reale Istituto Lombardo for future competition are as follows:—The institution prize for April, 1904, will be given for an essay on the work of Vittorio Alfièri; for 1905 on the so-called "ophiolitic" deposits (of Savi) of the northern Apennines. The triennial medals for industrial and agricultural improvements in Lombardy will next be awarded in 1906. The subjects for the Cagnola prizes on themes proposed by the institution are:—for April, 1904, velocity of kathode rays; for 1905, phenomena of catalysis. The subjects designated by the founder for the other prizes are cure of pellagra, nature of miasma, steering of airships, and prevention of forgery. The Brambilla prize is offered for improvements in the Lombardy industries. The subjects for the Fossati prize are:—for 1904, localisation of cerebral centres; for 1905, neurology; and for 1906, visual centres of higher vertebrates. For the Kramer prize the subject is resistances of structures in cement; for the Secco Comneno prize, the virus of rabies; for the Pizzamiglio prize, influence of socialism on private rights; for the Ciani prizes, popular Italian books; for the Zanetti prize, improvements in pharmaceutical chemistry; and for the Tommasoni prize, the life and works of Leonardo da Vinci.

IN a recent note attention was directed to the conjectured discovery of a new species of Androsace in the Valle Anzasca (Macugnana). From a note contributed by Prof. Ardissone to a later issue of the Lombardy *Rendiconti* it would now appear that the plant in question does not even belong to the same natural order as Androsace, but is a species of Saxifraga, approaching fairly closely to *S. excavata*. We are thus reminded of a somewhat similar mistake which occurred in our own country when the stunted form of *Campanula glomerata* peculiar to short grass pastures was mistaken for a gentian.

THE Engineering Standards Committee has issued a statement of work now in progress. The committee commenced operations in April, 1901, and to it falls the duty of organising the work, considering what subjects shall be dealt with, appointing the chairmen of the various committees,

passing the reports of the committees before they are published, controlling the expenditure, and devising the means of raising the necessary funds to carry on the work. This main committee has appointed twelve sectional committees, and under these again are eighteen subcommittees. The first report issued was that on standard rolled sections for constructional work, and the standard sections are now finding their way into use throughout the Government departments as well as the general trade of the country. Another committee has been engaged in drawing up a standard specification for steel used in the hulls of ships, and a small subcommittee is drafting a specification for boiler steel. The locomotive committee has drawn up and forwarded to the Secretary of State for India a report on the subject of standard types of locomotives for India. The subcommittee on tramway rails has published a series of standard sections and accompanying specification. Subcommittees on telegraphs and telephones and on cables have drafted respectively a standard specification for wires used in the construction of telegraphs and telephones, and standard lists of sizes of cables, &c. The secretary of the committee is Mr. Leslie S. Robertson, 28 Victoria Street, Westminster, S.W.

AT a general meeting of the fellows of the British Academy held on February 24, Prof. T. W. Rhys Davids read a paper on "Oriental Studies in England and Abroad," in which he made an interesting comparison between the facilities for higher teaching in Oriental subjects in this and in other countries. In the University of London there is an imposing array of names, but only one salary. At the old universities there are professors of Arabic whose stipends are nominal. There is the Boden professorship at Oxford, and at Cambridge Sanskrit is endowed out of college or university funds. Small grants are made at Oxford for Assyriology, for Semitic teaching at Dublin, and for Chinese at the older universities. Advanced work in Persian is done at Cambridge, and to the list may be added a few readers in Indian law. Compare this with what is done in some Continental countries. Holland has eight fully paid chairs and eight readerships. Germany has fifty-one professors and fifty readers or teachers of lower grade. In Berlin the Oriental Seminar enjoys endowments of 8000*l.* a year, and is attended by 162 university students and 66 other hearers. None of these pay fees. In France there are fourteen professors, five assistant professors, and five native teachers, a library of 35,000 volumes, and a valuable collection of MSS. In St. Petersburg Oriental learning is more recognised than perhaps anywhere else.

THE Yorkshire Naturalists' Union is to be congratulated on the energy displayed by its members in collecting funguses. As the result of this, the January number of the *Naturalist* contains notices of no less than seventeen species not previously recorded from Britain, nine of these being regarded as new to science. The paper is illustrated with an excellent coloured plate, in which some of the more striking forms are depicted.

HOLLOWS in the stems of oak-trees would apparently be the least likely places in which to find salamanders; nevertheless, such situations are the haunt of the Californian *Autodax lugubris*. According to Prof. W. E. Ritter, in the *American Naturalist* for 1903, workmen employed in clearing oaks in the grounds of the California University took numbers of both the salamanders and their egg-clusters from chinks and holes in the bark of these trees.

TWO other articles in the *American Naturalist* demand brief mention. In one Mr. H. W. Shimer continues the series devoted to the description of the adaptations of mammals to special modes of life, dealing in this instance with fossorial forms. In the other Prof. W. Patten returns to his favourite theory as to the arthropod affinities of the fish-like Pteraspis and Cephalaspis of the Old Red Sandstone. The subject is rediscussed in considerable detail, the author dismissing the theory that the resemblance between the two groups is due to mimicry or parallelism as unworthy of credence, and reiterating his arguments in favour of their genetic affinity. Much importance is attached to the "fringing lateral plates" of Cephalaspis as indicative of arthropod relationship.

THE habits and life-history of the holothurian *Stichopus japonicus* form the subject of an article by Dr. K. Mitsukuri in the first part of vol. v. of *Annotationes Zoologicae Japonenses*. As this creature forms a marketable commodity, the author discusses the possibility of increasing the supply by cultivation and protection; its roving habits are, however, a bar to dividing up the shore into lots for separate leasing, after the fashion followed in the case of oyster-beds.

A SECOND edition of the "Index Bryologicus," compiled by M. E. G. Paris, is being published by A. Hermann, of Paris; all mosses will be included which were recorded before the year 1901. The work will consist of twenty-four or twenty-five parts, which will be brought out monthly at 2½ francs the part. The editor requests the collaboration of bryologists to send him information with regard to corrections or omissions, which will be collected into an appendix.

THE pioneer work which has been carried out by the British Cotton-Growing Association in introducing cotton cultivation into our colonial possessions is already beginning to show results, and now that the Colonial Office has promised to render its valuable assistance, the success of the scheme seems to be practically ensured. It is significant to find that during the last few weeks samples of cotton grown at Ibadan from American seed have arrived from Lagos which compare favourably with the ordinary upland American cotton. In the West Indies the Sea Island variety has been sown, and it is expected that during this year 20,000 acres will be under cultivation. Samples received from this source have been valued at prices ranging from 1*s.* to 1*s.* 4*d.* per lb. It is intended to introduce cotton into British East Africa and Rhodesia, and samples have already been received from British Central Africa.

BY arrangement with Messrs. Smith, Elder and Co., Messrs. Watts and Co. have issued for the Rationalist Press Association, Ltd., at sixpence, "An Agnostic's Apology," by the late Sir Leslie Stephen, K.C.B.

WE have received the issue for the present year of the "Annuaire de l'Académie Royale des Sciences, des Lettres et des Beaux-Arts de Belgique." In addition to the usual lists of members and committees, the volume contains biographical notices of MM. C. de la Vallée-Poussin and P. Benoit, and a historical account of the Royal Academy by M. le Chev. Edm. Marchal.

THE twenty-fourth annual report of the Wellington College Natural Science Society affords interesting evidence of the good work which such associations can accomplish in connection with public schools. The sectional reports

include an exhaustive meteorological record for each day of 1903, and particulars of the field work in which the members of the society engaged during the session under review.

THE first two volumes of Mr. Herbert Paul's "History of Modern England"—which is to be completed in five volumes—have been published by Messrs. Macmillan and Co., Ltd., at 8*s.* 6*d.* net each. The first volume deals with the events of the years 1846–1855, and the second carries the history as far as 1865. We propose to review Mr. Paul's work when the third volume has been published, but we take this early opportunity of expressing our satisfaction that—following the example of John Richard Green—Mr. Paul records the work done in science in this country during the years with which he is concerned.

A SECOND edition of a "Manual and Dictionary of the Flowering Plants and Ferns," by Mr. J. C. Willis, has been published at the Cambridge University Press. In this edition the two parts of the original work are combined into one volume, while part i. is shortened by the omission of controversial matter, and by the use of smaller type for paragraphs of descriptive terms and other articles not intended for consecutive reading.

IN the Paris *Comptes rendus* for February 1 Messrs. Sabatier and Mailhe describe a method for the reduction of aromatic halogen derivatives by subjecting the vapours mixed with excess of hydrogen to the action of finely divided nickel at a temperature of about 270° C. In these circumstances considerable yields of benzene are obtainable from monochloro- and dichloro-benzene. Similarly toluene is easily obtained from the chlorinated toluenes, and trichlorophenol gives considerable quantities of carbolic acid. With bromine derivatives the reaction proceeds similarly, but not quite so readily as in the case of the chlorine substitution products.

IT is well known that the requirements of the fundamental law of mass action when applied to the electrolytic dissociation of salts, strong acids and bases are not satisfied, and in recent years many attempts have been made to account for this fact. In the Jubelband of the *Zeitschrift für physikalische Chemie*, Prof. Rothmund attributes this to the incorrectness of the values for the degree of dissociation obtained by the usual conductivity and cryoscopic methods. A new method of obtaining the extent of dissociation is developed, and the author shows that in the case of the fairly strong picric acid the values so obtained are in agreement with the mass action law.

THE additions to the Zoological Society's Gardens during the past week include two Two-spotted Paradoxures (*Nandinia binotata*) from West Africa, presented by Mr. A. W. V. Crawley; a Common Paradoxure (*Paradoxurus niger*) from India, presented by Captain Robin; two Asiatic Deer (*Cervus asiaticus*) from Central Asia, presented by H.G. the Duke of Bedford, K.G.; three Hedgehogs (*Erinaceus europoea*), British, presented by Mr. M. Yearsley; a Hairy-footed Jerboa (*Dipus hirtipes*) from North-east Africa, presented by Mr. G. C. Kennedy; a Greater Sulphur-crested Cockatoo (*Cacatua galerita*) from Australia, presented by Mrs. Payne; a Ring-necked Parrakeet (*Palaeornis torquatus*) from India, a Rose-crested Cockatoo (*Cacatua moluccensis*) from Moluccas, a Children's Snake (*Lialis childroni*) from Madagascar, deposited; a Kiang (*Equus hemionus*) from Tibet, purchased; a Sonnerat's Jungle Fowl (*Gallus sonnerati*) from Southern India; a Golden-bellied Grosbeak (*Pheucticus aurieventris*) from Argentina, received in exchange.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN MARCH:—

Mar. 7. 16h. Venus in conjunction with Saturn. Venus 0° 20′ N.
8. 12h. Ceres in conjunction with the moon. Ceres 0° 29′ S.
16. 17h. 45m. Annular eclipse of the sun invisible at Greenwich.
18. 8h. 56m. Minimum of Algol (β Persei).
20. 13h. Sun enters the sign Aries. Spring commences.
21. 5h. 45m. Minimum of Algol (β Persei).
22. 10h. 0m. to 10h. 41m. Moon occults θ′ Tauri (Mag. 3·9).
25 9h. 2m. to 10h. 11m. Moon occults λ Geminorum (Mag. 3·6).
26. 22h. Jupiter in conjunction with Sun.

VARIABILITY OF MINOR PLANETS.—In *Circular* No. 75 of the Harvard College Observatory Prof. Pickering publishes and discusses the results of Prof. Wendell's observations of the minor planet Iris (7). The planet's magnitude was compared with several B.D. stars, and a variation, having a period of about 6h. 13m. and a range of about two- or three-tenths of a magnitude, was established. This variation closely resembles that of Eros, and the conditions for that planet, as discussed in *Circular* No. 58, are also applicable in the present case.

Prof. Pickering suggests that both Eros, which is now approaching its second stationary point, and Iris should be carefully watched.

Circular No. 64 from the Kiel Centralstelle announces that on February 16 Prof. Paliser discovered a decided variation in the magnitude of the minor planet Hertha (135), having a range of 0·5 mag., from 10·0 to 10·5. The following ephemeris is abstracted from one calculated by Dr. Neugebauer for 12h. Berlin M.T.:—

1904	α	δ	log Δ
	h. m. s.	° ′ ″	
Feb. 29 ...	9 29 30 ...	+15 58·3 ...	0·2948
Mar. 2 ...	9 27 48 ...	+16 4·9	
,, 4 ...	9 26 9 ...	+16 11·2	
,, 6 ...	9 24 34 ...	+16 17·1	
,, 8 ...	9 23 4 ...	+16 22·5 ...	0·3047

R.A. ±1m. Dec. = ±5′·2.

OBSERVATIONS OF VENUS DURING 1903.—In *Bulletin* No. 6 of the Lowell Observatory, Mr. Percival Lowell describes and discusses the objective reality of the markings seen by him on the surface of Venus during 1903. In the first place he discusses the possibilities of illusion on the part of the observer in seeing such faint details, but he has arrived at the conclusion that there are two kinds of *real* markings on this planet's surface. The first class includes the nicks running in from the terminator, the collar round the South Pole, and the two spots, Astoreth and Ashera, upon it. Of these Mr. Lowell has no doubts as to their reality, and from his observations of them he is assured that the period of rotation of the planet is 225 days. The second class of markings includes the long shades, such as Anchises regio and Hero regio, which, commencing at the terminator, run towards the centre of the disc. It is more difficult to confirm the objective reality of these markings, although from the permanence of their observed positions Mr. Lowell concludes that they are real features of the planet's surface. Measurements of the position angle, from the cusp, of the tip of Paris regio on the limb, when the longitude of the centre of the disc was between 79° and 86°, gave as a mean of sixteen measures on eight nights 19° 6′. The position angle of the tip of a marking to the left of this was determined as 27° 1′.

Mr. Lowell strongly insists upon the fact that the appearance of these markings is in no sense "canaliform"; they are not regular, not of even width, not dark or sharply defined, are never doubled, and they do not form a system of interlacing lines as do the "canals" of Mars. Four drawings of the planet's disc at different times are reproduced in the *Bulletin*, and a comparison of two of these made on April 14, 1903, with an interval of nearly six hours between the two observations, shows no change in the positions of the markings, thus indicating that in that interval the effects of the planet's rotation were imperceptible.

CATALOGUE OF NEW DOUBLE STARS.—Prof. R. G. Aitken has just published, in No. 50 of the Lick Observatory *Bulletins*, a sixth list of new double stars discovered by him during the systematic search he has prosecuted since 1899. The present list contains 216 new pairs, none of which appear in Prof. Burnham's General Catalogue. These doubles were discovered with the 36-inch and 12-inch refractors, 61 of them—several of which are separated by less than 0″·25—being credited to the smaller instrument. About 30 per cent. of the included stars have distances under 0″·50, 50 per cent. under 1″·0, and in more than 72 per cent. the distance of separation is less than 2″·0. The numbers assigned to the stars in the present list are in continuation of those in the former lists, and the star places are given for the epoch of 1900·0.

NOTES ON THE HISTORY OF THE METRICAL MEASURES AND WEIGHTS.

A TRADITION exists in this country that towards the end of the eighteenth century the French Government invited the English Government to cooperate in forming a joint committee for the measurement of the seconds pendulum at the latitude of 45°, which was to be used as a standard of length, and from this length a universal system of measures and weights was to be derived; the English Government having declined to accede to the request, the French savants took the matter in hand and devised the metre and its derivatives. Although this tradition existed, it did not appear to be easy to obtain documentary evidence with regard to it, and it was quite natural that Mr. Alexander Siemens, who was interested in the subject, should apply to the Royal Society in the expectation that some record of the transaction would be found in the minutes of council; these were searched, but without result.

Hearing accidentally of the application, I thought that I could at once place my hand on a reference that would settle the question, but found myself mistaken, so I concluded that I must have heard the statement made by one of my former professors, Hofmann or Frankland.

Having succeeded ultimately in tracing the early history of the negotiations and allied matters, it is possible that the following notes may be not without interest.

Inquiries amongst several friends being without avail, it struck me that there might be some record at the Foreign Office that would throw light on the subject; I therefore wrote to Lord Cranborne, then Under Secretary for Foreign Affairs, asking if the index of their foreign correspondence mentioned the matter. He replied that the correspondence was not indexed, and that it was now at the Record Office; he was also good enough to obtain for me a permit to search the original documents. Before I had proceeded very far in the search, Dr. R. T. Glazebrook suggested a reference to the book by Méchain and Delambre, "Base du Système mètrique Décimal," Paris, 1806. In the introduction, or "Discours préliminaire," there occurs on p. 14 an extract from a decree of the National Assembly asking the King to write to His Britannic Majesty requesting him to submit the decree of the National Assembly to the English Parliament.

In vol. xxxiv. of the *Foreign Office French Correspondence*, January to June, 1790, at the Record Office, is a letter from the French Ambassador in England, the Marquis de la Luzerne, enclosing a copy of the decree of the National Assembly to the Duke of Leeds, the Secretary of State for Foreign Affairs.[1]

The Marquis de la Luzerne to the Duke of Leeds.

"Portman Square le 22 Mai, 1790.

"Le Mis de la Luzerne a l'honneur de faire bien des compliments à Monsieur le Duc de Leeds et se conforme aux ordres de sa Cour en lui envoyant ci-joint la copie d'un decret de l'Assemblée Nationale concernant les poids et mesures. Ces ordres lui prescrivent de faire au Ministère de sa Majesté Britannique les demandes qui y sont indiquées, et de l'assurer que le Roi son Maître verra avec satisfaction que Sa Majesté Britannique les juge de nature à être prises en considération.

"Décrét de l'Assemblée Nationale du 8 Mai, 1790.

"L'Assemblée Nationale desirant faire jouir à jamais la France entière de l'avantage qui doit résulter de l'uniformité des poids et mesures, et voulant que les rapports des anciennes mesures avec les nouvelles soient clairement determinés et facilement saisis, décrète que Sa Majesté sera suppliée de donner des ordres aux administrateurs des divers départemens du Royaume, à fin qu'elles se procurent et qu'elles se fassent remettre par chacune des Municipalités comprises dans chaque département, et qu'elles envoyent à Paris, pour être remis au secrétaire de l'Académie des Sciences, un modèle parfaitement exact des différens poids et des mesures élémentaires qui y sont en usage.

"Décreté ensuite que le Roi sera également supplié d'écrire à Sa Majesté Britannique, et de la prier d'engager le Parlement d'Angleterre à concourir avec l'Assemblée Nationale à la fixation de l'unité naturelle de mesures et de poids: Qu'en conséquence, sous les auspices des deux nations, des commissaires de l'Académie des Sciences de Paris pourront se réunir en nombre égal avec des Membres choisis de la Société Royale de Londres, dans le lieu qui sera jugé respectivement le plus convenable, pour déterminer à la latitude de quarante cinq degrés, ou toute autre latitude qui pourroit être préférée, la longueur du pendule, et en déduire un modèle invariable pour toutes les mesures et pour les poids; Qu'après cette opération faite avec toute la solemnité nécessaire, Sa Majesté sera suppliée de charger l'Académie des Sciences, de fixer avec précision pour chaque municipalité du Royaume, les rapports de leurs anciens poids et mesures avec le nouveau modèle, et de composer ensuite pour l'usage de ces municipalités des livres usuels et élémentaires où seront indiquées avec clarté toutes ces proportions.

"Décrète en outre que ces livres élémentaires seront addressés à la fois dans toutes les municipalités pour y être repandues et distribuées; Qu'en même tems il sera envoyé à chaque municipalité un certain nombre de nouveaux poids et mesures, les quels seront délivrés gratuitement par elles à ceux que ce changement constitueroit dans les dépenses trop fortes: Enfin que six Mois seulement après cet envoi, les anciennes mesures seront abolies et remplacées par les nouvelles.

"Collationnée à l'original par nous Président et Secrétaire de l'Assemblée Nationale à Paris le 9 Mai 1790. Signé Gouttes, curé d'Argilliers, Président, L'Abbé Collaud de la Salcette, de Champeaux Palame, Le Cte de Crillon, Chabrond, de la Revelliere, de l'épaux, et de fermon, Secrétaires."

It will be observed that this decree does not specifically state that a new standard is to be introduced, but that the existing standards are to be corrected by one that has been compared with the length of the seconds pendulum.

Delambre states (*loc. cit.*) that the above decree was sanctioned on August 22, and that the Academy of Sciences nominated a commission consisting of MM. Borda, Lagrange, Laplace, Monge and Condorcet. He does not say that any reply was received from the English Government, and there is not any mention in the papers at the Record Office before the end of August that any reply had been sent.

It was considered probable that the reply, if any, might have been forwarded through the French Ambassador without having been recorded at the Foreign Office, or that the draft of the letter might have been lost. Sir Eric Barrington, Private Secretary to the Marquess of Lansdowne, very obligingly obtained, through the British Embassy at Paris, a copy of a letter from the Duke of Leeds to the Marquis de la Luzerne, dated December 3, 1790. On further search the draft of this letter was found in vol. xxxv. of the *Foreign Office French Correspondence*, July to December, 1790, at the Record Office, together with the note from the Marquis de la Luzerne reminding the Duke of Leeds of his letter of May 22.

The Marquis de la Luzerne to the Duke of Leeds.

"M. De la Luzerne a l'honneur de faire bien des compliments à Monsieur le Duc de Leeds et de lui rapeller qu'il a eu cetui de lui addresser, Le 22 mai dernier, par ordre

[1] The orthography and the accentuation of the original documents are here followed.

de sa cour, un office dont l'objet était d'inviter le Gouvernement Britannique à vouloir bien concourir avec le Gouvernement de France, à prendre les mésures qui seraient jugées respectivement les plus convenables, pour fixer l'unité naturelle des mesures et des poids. Si Monsieur le Duc de Leeds avait la bonté de faire connaître à M. de la Luzerne, les intentions de Sa Majesté Britannique sur ce point et de la mettre en état de satisfaire aux nouveaux ordres qu'il reçoit de sa cour, M. de la Luzerne lui aura beaucoup d'obligations.

" Portman Square, Le 30 9^{bre} 1790."

The Duke of Leeds to the Marquis de la Luzerne.

" Le Duc de Leeds fait bien ses Complimens à Monsieur Le Marquis de la Luzerne, et a l'Honneur d'informer Son Excellence que les Mesures, dont Elle fait mention dans sa Note d'Hier, pour fixer l'Unité des Mesures et des Poids, doivent necessairement rester pour la Consideration du Parlement.

" A Whitehall, ce 1 Dec^{re}, 1790."

The same to the same.

" A Whitehall, ce 3 Décembre, 1790.

" Monsieur,

" Je n'ai pas manqué de rendre compte au roi de la note dont Votre Excellence m'a honoré du 22 mai, renfermant la copie d'un Décrêt de l'Assemblée Nationale, concernant l'Unité de Mesures et de Poids, qu'on souhaitoit de fixer, en concurrence avec le Parlement d'Angleterre; et j'ai l'honneur d'informer Votre Excellence qu'aiant, par ordre du Roi, fait faire des perquisitions à ce sujet, it paroit que l'affaire a été agitée dans la Chambre des Communes, vers la fin du dernier Parlement, mais qu'aucune proposition de la Chambre n'a été faite en conséquence.

" Il a souvent été question d'un tel arrangement parmi nos économistes publics, mais le projet a paru exposé à tant de difficultés que son accomplissement, tout désirable qu'il pourroit être, a été regardé comme presque impraticable.

" Il est superflu, Monsieur, d'assurer Votre Excellence de nouveau de la satisfaction avec laquelle le Roi sera disposé en tout tems de coopérer avec Sa Majesté très Chrètienne à tout ce qui pourroit être utile aux intérêts des deux royaumes.

" J'ai l'honneur d'être, avec la considération la plus distinguée,

" Monsieur,
" De Votre Excellence,
" le très humble et
" très obéissant serviteur
" [Signé] LEEDS."

A Son Ex^{ce} Mons. le Marquis De la Luzerne, &c. Consequence. On a écrit en marge—" Envoyé copie à M. Dupont, le 9 janvier, 1791.—" Envoyé copie au Comité des Poids et Mesures, le 25 prairial."

Archives des Affaires Etrangères. Correspondance d'Angleterre. Supplément, t. 18, pièce 66, fol. 353. Original.

The reference to the action taken in the previous Parliament is doubtless the motion made on February 5, 1790, by Sir John Riggs Miller,

" That the clerks of the market of the different cities and market towns throughout England and Wales, and the town of Berwick upon Tweed, and the clerks of the different counties of the same, do forthwith make out and transmit to the sheriffs of the respective counties in which the said towns are situated, returns of the different weights and measures now in use in their respective cities and market towns, as well as specifications and descriptions of any particular commodities that are bought and sold by any customary denominations or proportions of weight and measure, as far as such have come under their observation." " That the said order be sent to the sheriffs of the several counties in England and Wales, and be by them transmitted to the clerks of the markets in their respective counties; and that the said sheriffs do return to the Clerk of the House, to be by him laid before the House, the returns they shall receive from the clerks of the markets."

The speech by Sir John Riggs Miller is of much interest, and describes the confused condition in which the weights and measures in use in England were at that time. He said " He should not impose upon the House for the present an attention to a philosophical discussion, which would better suit a more advanced stage of the investigation, but content himself with merely acquainting them at that time, that the vibration of a pendulum would, he hoped, prove such a standard." The resolutions he proposed were unanimously agreed to. (*Parliamentary Register*, vol. xxvii. [marked 44 on the binding of the British Museum copy], 1790, pp. 41–48. *Parliamentary History*, vol. xxviii., 1816, cols. 315–323.)

On April 1, 1790, the House of Commons ordered that a committee be appointed to consider the several returns which shall have been or shall be made to the orders of the House of the 5th day of February last respecting the different weights and measures now in use in the several cities and markets throughout England and Wales and the town of Berwick upon Tweed, and to examine and report on the same, with their observations and opinions thereon, to the House.

Committee appointed accordingly.

The list of the members of the committee contains forty-three names, as well as all the members for Bristol, Liverpool, Hull, Glasgow, Lynn and Yarmouth, all the Knights for Shires, Gentlemen of the Long Robe, and Merchants in the House (*Commons Journal*, vol. xlv. p. 359).

On April 13, 1790, Sir John Riggs Miller made another speech to the House, in which he said that he had received a letter from the Bishop of Autun (M. Talleyrand de Périgord, afterwards Prince Talleyrand) encouraging him in his attempts to improve the weights and measures, and saying that " he took the hint of making his proposition to the National Assembly of France from what had been lately submitted to the British Parliament upon the same subject."

On this occasion Sir John Riggs Miller entered more fully into the question of standards, which he thought should be obtained from some natural length or some property of matter. He suggested that a certain number of drops of water or alcohol at a certain temperature might be used as a measure of weight, and that the length of the side of a cube which would contain the standard weight might be taken as a standard of length; as another standard, the distance through which a body would fall in one second; as another, the length of a degree of a great circle on the earth, but he thought that it would not be possible to measure this with sufficient accuracy; and lastly, what he calls the London pendulum of 39·126 inches.

Amongst general qualities that a standard should possess he stated, " It is desirable that its denomination should be in tens, to give it the advantage of whole numbers, or decimal fractions."

On the same day the reports of committees made in 1758 and 1759 on the original standards were ordered to be referred to the committee appointed on April 1. (*Parliamentary Register*, vol. xxvii. [marked 44 on the binding of the British Museum copy] pp. 395–403. *Parliamentary History*, vol. xxviii., 1816, cols. 639–649.)

This committee did not report; it is doubtful if it ever met, for a committee on standards of weights and measures which reported on July 1, 1814, states that the minutes of the proceedings of the committee of 1790 could not be found.

At the British Museum there is a volume of " Political Tracts," 1789–1790, which contains a pamphlet by Sir John Riggs Miller giving his speeches in the House of Commons, and several documents, amongst which are copies of letters from the Bishop of Autun (a copy of the same pamphlet is in the library of the Royal Institution). The letter to which he referred in his speech is as follows :—

The Bishop of Autun to Sir John Riggs Miller.

" Paris, 28 Mars, 1790.

" J'ai appris, Monsieur, que vous avies presenté au Parlement d'Angleterre un beau travail sur la Reduction des Mesures. J'ai cru devoir faire une Proposition sur le même sujet à notre Assemblée Nationale; je m'empresse di vous l'addresser, il me paroit digne de l'Epoque actuelle que les deux Nations se concertent pour la fixation d'une mesure

invariable, et quelles consultent ensemble la Nature pour arriver à ce résultat important.

" Si cette Idée vous paroit juste, Monsieur, si vous pensés qu'un grand bien doit en resulter, c'est à vous qu'il appartient d'en assurer le succès, et j'ose vous le recommendér : trop long temps les deux Nations se sont devisées pour de vaines pretentions ou de Coupables Interets, il est temps que deux Peuples libres assoçient leurs efforts et leurs Travaux pour une Recherche utile au Genre Humain.

" J'ai l'honneur d'être avec des
" Sentimens respectueux,
" Monsieur, votre très humble
" Et trés obeissant serviteur
" L'EVEC. D'AUTUN.

" To Sir John Riggs Miller, Bart.
" Member of the House of Commons, London."

(The English printer seems to have taken some liberties with the foreign language.)

Parliament was dissolved on June 11, 1790, so the committee ceased to exist, and it appears that Sir John Riggs Miller was not re-elected in the next Parliament.

I have been unable to ascertain the date when the Bishop of Autun made his proposition to the National Assembly, and if, in doing so, he referred to the action taken in the House of Commons. In the pamphlet of Sir John Riggs Miller is a reprint of a paper which the Bishop of Autun sent to all the members of the National Assembly, with a note attached saying that he considered that it would be preferable to print his proposition than to make a speech on the subject.

This paper contains the following paragraph, when referring to the measurement of the pendulum :—" Il m'est impossible de douter que l'Angleterre, qui dans ce moment paroît vouloir s'occuper de la reduction de ses mesures, avertie par votre détermination et invitée par vous, ne se réunire à la France pour l'exécution d'une entreprise que nos relations de commerce doivent rendre commune et dont le résultat doit appartenir un jour au Monde entier."

It will be a surprise to many to learn that there was any connection, even of the remotest kind, between the action of the British House of Commons and the proposition which ultimately led to the metrical measures and weights.

The committee that was appointed by the French Academy on August 22, 1790, reported on March 19, 1791 (" Histoire de l'Académie Royale des Sciences," Année MDCCLXXXVIII., published in 1791, pp. 7–16). The committee considered three proposed standards of length, the length of the seconds pendulum at the latitude of 45°, which was rejected in consequence of its involving the artificial element of time ; the measurement of an arc of the equator, which was also rejected, because of the difficulties that would attend such an operation in an uncivilised country ; and the measurement of an arc of the meridian, which was adopted, and the 10,000,000th part of the quadrant was selected as the standard of length.

The account given by Delambre of the measurement of the arc of the meridian from Dunkerque to Barcelona is most interesting ; he was commissioned to measure the northern section whilst Méchain undertook the southern portion. Delambre left Paris with orders from the King, and before long he found them of little use ; he had a difficulty in obtaining money for the expenses of the work, and at one time he was dismissed, as it was thought that his opinions were not in accord with those prevalent in Paris. Later he was permitted to continue the undertaking. He found that many of the church towers and spires which had been used in the survey of 1740, and which he intended employing again, had been destroyed ; he could not use signal fires, for they were thought to be signals to the enemies of the country, and when he covered some of his stations with white sheets, so that they might be more visible at a distance, they were supposed to be standards of the counter revolution, and it was necessary to place blue and red bands on them to calm the suspicions of the populace. When Méchain had completed his work in Spain he was not allowed to return to Paris, and although he finished his portion of the survey, he died before the determination of the standards had been brought to a conclusion. Notwithstanding all these adverse circumstances and disappointments, Delambre's account is remarkably free from bitterness.

It had been determined to submit the whole survey to a committee of foreign scientific men, so that it should have an international character, and the meeting was fixed for 15 vendémiaire an 7 (the 6th October, 1798) ; the survey, however, was not completed until about two months later. The account of the invitation to this final meeting is best given in Delambre's own words :—

" On a vu que le premier projet avoit été d'inviter la Société royale de Londres à concourir avec l'Académie des Sciences à la fixation de l'unité fondamentale ; mais l'unité projetée étoit alors la longueur du pendule. La mesure de la méridienne étoit une entreprise bien plus considérable, et d'une trop longue durée pour qu'on pût se flatter de la voir terminer par les commissaires réunis des deux nations, lorsque tant de causes probables et prochaines pouvoit troubler la bonne intelligence entre leurs gouvernemens. L'événement ne prouva que trop tôt combien cette crainte étoit fondée. Mais les mesures terminées, avant. d'en déduire les conséquences, il n'y avoit plus aucun inconvénient, on devoit au contraire trouver un avantage réel, à soumettre le travail à l'examen de tous les savans de l'Europe ; et toutes les puissances amies ou seulement neutres furent invitées à nommer des députés à ce congrès d'une espèce toute nouvelle." (Méchain and Delambre, " Base du Système mètrique Décimal," Paris, 1806. Tome i. " Discours préliminaire," pp. 85–86.)

" Les savans étrangers venus pour prendre part à ces travaux étoient MM. Æneae et van Swinden, députés bataves ; M. Balbo, député du roi de Sardaigne, remplacé depuis par M. Vassali Eandi, envoyé par le gouvernement provisoire du Piémont ; M. Bugge, député du roi de Danemarck ; MM. Ciscar et Pédrayés, députés du roi d'Espagne ; M. Fabbroni, député de Toscane ; M. Franchini, député de la République romaine ; M. Mascheroni, député de la République cisalpine ; M. Multedo, député de la République ligurienne, et M. Trallès, député de la République helvétique " (*loc. cit.* p. 92).

At that time England could not have been considered one of " les puissances amies," for war was declared by France against England in 1793, and continued for nearly nine years.

It has been the custom to discredit the Royal Society with having instigated the refusal of the French invitation, but there is no indication whatever that the matter was at any time referred to the society. The council minutes do not contain any mention of the invitation, and if the society had formally or informally suggested or approved of the refusal, it is inconceivable that the Duke of Leeds, who was at the time a member of the council, although a not very regular attendant at the meetings, would have omitted to mention such a support of his action. With regard to the absence of any English men of science on the last committee of revision, it seems certain, from Delambre's statement, that an invitation was not sent, and the minutes of the council of 1798 and 1799 are silent on the subject.

Without the kind assistance of others it would have been impossible for me to have obtained the information above given, and I take this opportunity of tendering my sincere thanks to the Marquess of Salisbury, Sir Eric Barrington, Sir Courtenay Ilbert, Dr. R. T. Glazebrook, the officials of the Royal Society and of the Public Record Office, for their help, and lastly to my former colleague, Prof. Alfred Lodge, who first put me on the right track by furnishing dates which much assisted the search.

HERBERT MCLEOD.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The Sedgwick prize in geology is awarded to H. H. Thomas, B.A., Sidney Sussex College.

Z. U. Ahmad, B.A., Trinity College, has been elected to the Isaac Newton studentship in physical astronomy.

The Medical College, Lahore, has been added to the list of recognised schools of medicine.

A syndicate is to be appointed to draw up a scheme of instruction and examination in mining engineering, with a view to the requirements of the Coal Mines Regulation Amendment Act, 1903.

THE Secretary of State for War has, on the nomination of the Senate of the University of London, appointed Sir Henry Roscoe, F.R.S., to be a member of the War Office Advisory Board for Military Education, as a representative of the university.

THE King has been graciously pleased to promise a donation of 100 guineas in response to the appeal of the Senate of the University of London for funds to build and endow an Institute of Medical Sciences under the control of the university. A large sum is needed to carry out the scheme. Donations, which may be extended over a period of three years, should be sent to the honorary treasurers, Dr. J. K. Fowler and Mr. H. T. Butlin, at 35 Clarges Street, W.

THE Senate of the University of London has adopted the following resolution:—"That the Board of Education be informed that the Senate, while in no way wishing to cause any postponement of the appointed day, think it desirable, in the interests of education in London, that the University should be closely associated with the Education Committee to be appointed by the London County Council, and that persons experienced in education should be members of that committee."

THE new Paddington Technical Institute of the London County Council was opened by Sir Arthur Rücker on February 27. The premises have been acquired for a sum of 15,000*l.*, and are now admirably equipped as a technical institute. Sir Arthur Rücker, in his address, said that the new institute represents what those in connection with the London University have long desired to see carried out—the union of the forces which have been engaged already in the work of teaching. What is being done at Paddington must be done on a larger scale elsewhere throughout the metropolis so as to bring the schools into closer contact with the university, for until the combination of forces was effected they could not realise the full advantages of the system they wanted to inaugurate. Cooperation will be the note of the education in the future. The chairman of the London Technical Education Board, in proposing a vote of thanks to Sir Arthur Rücker, mentioned that in the course of a short time it was intended to erect a power-house at the new institute and establish an engineering laboratory for the purpose of carrying on a motor-car school.

AT a meeting of the Senate of the University of Wales, held at Bangor, it was resolved to present an address of congratulation to Sir Henry Roscoe in connection with the forthcoming celebrations. It was also unanimously desired by the Senate that Principal Griffiths should represent the university in his official capacity of Vice-Chancellor at the opening of the new laboratories by the King at Cambridge. The memorial circulated by the Royal Society with reference to the teaching of science in schools was read by the Vice-Chancellor and discussed. A protracted discussion took place on a motion relating to the desirability of framing a scheme for the matriculation examination by which Latin would cease to be compulsory, and on a division taking place the motion was carried by a majority, a committee being appointed to bring the matter before the Senate in a more definite form later on. In connection with a recent petition presented to the University Court by the Mayor and an influential deputation from Swansea on behalf of the Swansea Technical College, a committee was appointed to draft a scheme, to be submitted to Parliament, for conferring on that college certain privileges of affiliation to the university.

LORD KELVIN distributed the prizes and certificates gained during the past session, to the students of the Northampton Institute, Clerkenwell, on February 26. During the course of his address, speaking of the work of the London Technical Education Board, Lord Kelvin said:—"Many must feel regret that that board will cease to exist in the course of a few days. The new board which is to take its place will have all kinds of education under its charge—primary, secondary, and technical. It will need more money, and I hope it will be courageous and not fear to make a call on the rates when it is convinced that the payment of them will be for the benefit of the ratepayers." Continuing Lord Kelvin remarked:—"When you think of the great discoveries of Faraday in England and of Henry in America, and the succession of workers from their time to the present day who have added so much to our knowledge, you cannot help being struck with the enormous progress which science has made within a comparatively short period; and perhaps that progress has been even more remarkable and striking at the beginning of the twentieth century than during the whole of the nineteenth century. Many of these discoveries were for the moment in the realm of pure science, presenting no prospect of practical application; but what is to be thought of a scientific investigator who only looks for an immediate practical application of the result of his labours? The electrical discoveries of Faraday and Henry would never have been made if those great men had contented themselves with asking *Cui bono?*—who will benefit by them? The every-day workman would be all the happier for knowing something of the laws of nature developed in the work he is called upon to perform. The habit of mind of thinking scientifically and bringing scientific knowledge to bear on the practical work of life not only contributes to the work being well done, but also to the richness and mental wealth of the work."

THE Prince and Princess of Wales paid a visit on February 24 to the Battersea Polytechnic, on the occasion of the tenth anniversary of the opening of that institution by the present King. The Prince of Wales distributed the prizes and certificates gained by the evening students during the past year, and Her Royal Highness opened a number of new rooms which form an extension of the domestic economy department. Addresses of welcome were read by the chairman of the governing body of the polytechnic and by the Mayors of Battersea and Wandsworth. The Prince of Wales, in replying, pointed out how much the success of the London polytechnics was indebted, first, to the far-seeing thought of the Charity Commissioners, who twenty-one years ago suggested that the funds of certain ancient City charters should be devoted to the establishment in different parts of London of polytechnic institutes, and also to the City parochial foundations and the Technical Education Board of the London County Council. In the course of his address to the prize-winners, His Royal Highness remarked:—"Probably at no time in the history of our country has there been a greater demand upon the intellectual powers than there is to-day. Keen competition and rivalry characterise the existing relations between communities and nations. Prof. Huxley some years ago pointed out with regard to our industries that we were in the presence of a new struggle for existence; and more recently Sir Norman Lockyer, in his address to the British Association last year, went further, and declared that the scientific spirit, the brain-power, must not be limited to the workshop when other nations utilise it in all branches of their administration, and he declared that universities and other teaching centres are as important as battleships and big battalions, and are, in fact, essential parts of a modern State's machinery." By thus directing attention to the principle that national development depends upon the provision made for the cultivation of brain-power, the Prince of Wales has advanced the plea put forward by Sir Norman Lockyer in his presidential address at Southport. The Prince evidently recognises that the progress of a nation is promoted by the forces of higher education and research; and his conviction should encourage far-seeing statesmen to face seriously the question of organising the forces which will make us equal to Germany or the United States in the struggle for commercial supremacy. It must be clearly understood that the scientific spirit—inquiring, critical, and progressive—is essential in the polity of a modern State; and for this reason it is to be hoped that the Prince of Wales's remarks will be well considered by our political leaders.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, January 28.—"The 'Islets of Langerhans' of the Pancreas." By H. H. **Dale**, M.A., B.C., George Henry Lewes Student. Communicated by Prof. Starling, F.R.S.

Since first described by Langerhans, in 1869, the "islets" have had various functions assigned to them, on the assumption that they are independent structures embedded in the pancreatic tissue, the prevalent view regarding them as ductless glands furnishing an internal secretion necessary for normal carbohydrate metabolism.

Lewaschew and others have stated that intermediate forms exist between the "islets" and the ordinary pancreatic alveoli, and that the abundance of islets and the prevalence of intermediate forms are increased by activity of the gland. Lagnesse described a conversion of secretory alveoli into islets and *vice versâ* during embryonic development.

These observations were made on the pancreas of the dog, cat, rabbit and toad, in conditions of rest, exhaustion, starvation, and after ligature of the duct. The tissue was hardened in a sublimate-formaldehyde mixture, cut in paraffin, and stained with toluidine blue and eosine.

In the resting pancreas of all the species examined, the intermediate forms described by Lewaschew were observed, and in the toad indications were found of a reconstruction of alveoli from islets.

In the condition of exhaustion, produced, in the mammalian pancreas, by intravenous injection of secretin during anæsthesia, in that of the toad by hypodermic injection of the same substance, a very extensive conversion of secretory alveoli into "islets" was observed, specimens being obtained from a dog with the greater part of a lobule, from a toad with the greater part of the whole pancreas so converted.

The effect of starvation, observed in a stray cat and in toads from the laboratory tank, was similar, but slighter in degree.

In the dog and rabbit, occlusion of the duct caused an interstitial fibrosis, the areas of tissue not destroyed assuming the "islet" condition. The preformed islets appeared to have no special immunity.

February 4.—"On the Origin of Parasitism in Fungi." By George **Massee** (Principal Assistant, Herbarium, Royal Gardens, Kew). Communicated by Sir William T. Thiselton-Dyer, K.C.M.G., C.I.E., F.R.S.

The hitherto unexplained problem as to why parasitic fungi are usually confined to one, or at most a few closely allied host-plants is shown to be due to chemotaxis. An extensive series of experiments was conducted with both parasitic and saprophytic fungi for the purpose of determining the positive or negative chemotactic nature of various substances occurring normally in plants. Among such may be enumerated saccharose, glucose, asparagin, malic and oxalic acid, and pectase. Practically the germ tubes of all fungi are positively chemotactic to saccharose, and the reason why all plants containing this substance are not attacked by every kind of fungus is because certain other substances present in the plant are negatively chemotactic or repellent to the germ-tubes.

Immune specimens of plants belonging to species attacked by an obligate parasite owe their immunity to the absence or small proportion of the substance chemotactic to the parasite. This discovery will assist in the production of immune strains of cultivated plants, all previous attempts in this direction having been conducted along lines of physical resistance.

Purely saprophytic fungi can be educated to become parasitic by sowing the spores on a living leaf that has had a substance positively chemotactic to the germ-tubes of the fungus experimented with injected into its tissues. By similar means a parasitic fungus can be led to attack a new host-plant.

These experiments prove what has hitherto only been assumed, namely, that parasitism on the part of fungi is an acquired habit.

Infection occurs more especially during the night or in dull damp weather, owing to the greater turgidity of the cells and to the presence in excess of the chemotactic substance in the cell-sap.

February 11.—"On Certain Properties of the Silver-Cadmium Series of Alloys." By T. Kirke **Rose**, D.Sc. Communicated by C. T. Heycock, F.R.S.

The attempts made at the Royal Mint to produce uniform standard trial plates of silver and copper have been unsuccessful owing to the segregation of the constituents. The cooling curve of the alloy shows that solidification begins at 900° and ends at 778° after passing through a pasty stage, during which rearrangement of the constituents can take place, with the result that the uniform distribution of the silver is disturbed. The cooling curve of the alloy containing 92·5 per cent. of silver and 7·5 per cent. of cadmium is found to resemble that of a pure metal, showing no appreciable pasty stage, and on testing plates made of these materials they were found to be uniform in composition. The alloy is exceedingly ductile, and no difficulty is encountered in making assays on it by any of the well-known methods. In preparing large ingots it is necessary to pour silver into a suitable amount of molten cadmium, this method minimising the loss of cadmium by volatilisation. The cooling curves and the microstructure of the whole series of alloys of silver and cadmium have also been studied, and evidence has been obtained of the existence of a number of compounds. The alloys containing from 100 to 80 per cent. of silver are homogeneous at all temperatures below the solidus curve, although they appear to contain two bodies between the solidus and liquidus curves.

"On the High Temperature Standards of the National Physical Laboratory: an Account of a Comparison of Platinum Thermometers and Thermo-junctions with the Gas Thermometer." By J. A. **Harker**, D.Sc. Communicated by R. T. Glazebrook, F.R.S.

This paper contains an account of a continuation of the work of Dr. P. Chappuis and the author (*Phil. Trans.*, A., 1900) on a comparison of the scale of the gas thermometer with that of certain platinum thermometers, from below zero to 600° C.

The results of this work confirmed the experiments of Callendar and Griffiths, and showed that the indications of the platinum thermometer may be reduced to the normal scale by the aid of Callendar's difference formula

$$d = T - pt = \delta[(T/100)^2 - T/100],$$

where pt is the platinum temperature, T the temperature on the normal scale, and δ a constant which, for pure platinum, is about 1·5.

The temperatures chosen for the determination of δ are 0° C., 100° C., and the boiling point of sulphur.

In the present paper the work is extended to a temperature of 1000° C., a number of standard thermo-junctions of platinum—platinum-rhodium being also included in the comparisons.

The gas thermometer employed for this work was presented to the laboratory by Sir Andrew Noble. The bulbs used were of porcelain, glazed inside and out, and the gas used was pure dry nitrogen. The thermo-junctions were carefully compared at a number of fixed points up to 960° C., before use, with concordant results. A special potentiometer designed and made in the laboratory enabled the thermo-junction readings to be taken with great accuracy.

The platinum thermometers employed were one of the three used by Harker and Chappuis in their earlier work, and a new one belonging to the British Association. The different instruments, after determination of their constants, were tested together in specially constructed electric resistance furnaces, heated from a special battery in which temperatures from 400°–1100° C. could be very steadily maintained for considerable periods. Special winding enabled a compensation to be made for the greater cooling effect at the ends of the furnaces, so that over a considerable length the temperature was exceedingly uniform.

The investigation shows that:—

(1) The readings of the platinum thermometers BA_2 and K_2, which may be taken as representative instruments, when reduced to the air scale by the use of Callendar's

difference formula, are, up to a temperature of 1000° C., in close agreement with the results obtained from the constant volume nitrogen thermometer, employing chemical nitrogen, and using the received value for the dilatation of the Berlin porcelain, of which the bulb is made.

(2) The platinum thermometers agree very closely with a set of thermo-junctions representing the temperature scale of the Reichsanstalt, based on measurements with a gas thermometer having a bulb of platinum-iridium.

As the results of these experiments seem to justify very completely the use of Callendar's parabolic formula over a wide range, a table has been calculated by which the value of T may be obtained directly from the value of *pt* for a range of temperature extending from −200°–1100° C., and for the value 1·5 of the constant δ.

"A New Method of Detecting Electrical Oscillations." By J. A. **Ewing**, LL.D., F.R.S., and L. H. **Walter**.

The paper describes a detector of electrical oscillations suitable for wireless telegraphy. It is based on Ewing's hysteresis tester, and employs the change which electrical oscillations produce in the hysteresis of a magnetic metal exposed to reversals of magnetism by means of a revolving field. The hysteresis causes the magnetic metal to be dragged after the field, and this drag is opposed by a spring, a definite deflection of the metal being thereby produced. When the oscillations act this deflection undergoes a sudden change which constitutes the indication.

Under the conditions first experimented on, the authors found, as they expected, a reduction of the hysteresis deflection when the oscillations acted. But in later experiments, when the magnetic metal was arranged in the form of a fine insulated steel wire through which the electrical oscillations were caused to pass, it was found that they produced a large increase in the deflection.

In the instrument exhibited the revolving field is supplied by an electromagnet with long wedge-shaped pole pieces between which a long bobbin of the steel wire is pivoted, so that the magnetic drag tends to make it turn on its axis. It is controlled by a spring and furnished with a mirror or other indicator of deflection. The bobbin is wound with about 500 turns of No. 46 gauge hard-drawn steel wire, insulated with silk, the winding being non-inductive. It is immersed in oil, which serves to steady the deflection as well as to reinforce the insulation.

The detector gives quantitative readings, and, in some cases, the deflection may be too large to be easily read by the scale. For this purpose a variable shunt is provided, by which the deflection can be regulated.

For the purpose of wireless telegraphy, the instrument has the advantage of giving metrical effects. The benefit of this in facilitating tuning, and in other respects, need not be insisted upon.

From the physical point of view, the augmentation of hysteresis is interesting and unlooked for. It is probably to be ascribed to this, that the oscillatory circular magnetisation facilitates the longitudinal magnetising process, enabling the steel to take up a much larger magnetisation at each reversal than it would otherwise take, and thus indirectly augmenting the hysteresis to such an extent that the direct influence of the oscillations in reducing it is overpowered. The net result appears to be dependent on two antagonistic influences, and, in fine steel wire, under the conditions of the experiments, the influence making for increased hysteresis, as a result of the increased range of magnetic induction, is much the more powerful.

Linnean Society, February 4.—Prof. S. H. Vines, F.R.S., president, in the chair.—Mr. C. E. **Salmon** exhibited two specimens of *Epilobium collinum*, C. C. Gmel., from Scotland, with a series of *E. montanum* and *E. lanceolatum* for comparison.—The **President** gave an account of researches into the physiology of the yeast-plant (*Saccharomyces Cerevisiae*). He directed attention to the fact that though this plant consists of but a single minute cell it produces a variety of enzymes or ferments: *diastase, invertase, glucase, zymase,* as well as an undefined enzyme, *protease*, which digests proteid matter. The proteolytic activity of yeast has engaged the attention of many observers, of whom Hahn and Geret express the opinion that the plant contains a protease which resembles, in some respects, the pepsin of the animal body, in other respects the trypsin. In November, 1902, the discovery of a protease resembling the recently discovered *erepsin* of the animal body was announced by the president. Since then he has endeavoured to determine whether or not the proteolytic phenomena of yeast may not be due in part to the presence of an enzyme of this character, with results which indicate that this is the case. A filtered watery extract of yeast readily decomposes the simpler proteids, such as albumoses and peptones, into non-proteid bodies, such as leucin, tyrosin, &c., as indicated by the tryptophane-reaction. Such an extract was, however, in no case observed to exert any digestive action upon a higher proteid, such as fibrin. The conclusion to be drawn is that the protease extractable from yeast by water is an erepsin. Yeast contains a protease that digests fibrin. If yeast be extracted with a 2 per cent. solution of common salt, a liquid is obtained which digests fibrin with certainty. What, now, is the nature of this protease that digests fibrin? Though the point can only be finally settled by separating and isolating the two proteases, the probability is that this peptonising enzyme is a vegetable trypsin. The conclusion suggested by the observed facts is that yeast contains at any rate two proteases, the one an erepsin, the other probably a trypsin.—Mr. E. S. **Salmon** gave an account of his further researches on the specialisation of parasitism in the Erysiphaceæ. The comparative inoculation experiments of 1650 leaves of various species of Bromus, carried out by the author, have shown that a very high degree of specialisation has been reached in the adaptive parasitism of *Erysiphe Graminis*, DC., to the different species of the genus Bromus. This specialisation has involved the evolution of a considerable number of "biologic forms" of the fungus. The facts obtained show not only the high degree of specialisation which the fungus has undergone, but also that each species of Bromus possesses distinctive physiological characters existing concomitantly with the specific morphological characters.

Physical Society, Feb. 12.—Annual general meeting.—Dr. R. T. Glazebrook, F.R.S., president, in the chair. The president delivered an address in which he dealt with one or two matters connected with the theory of the microscope.

EDINBURGH.

Royal Society, January 4.—Prof. Duns in the chair.—In a paper on the bilateral origin of the epiphysis in the chick, Dr. John **Cameron** showed that the epiphysis in the chick arises in the form of two bilateral outgrowths, of which the left is by far the better marked of the two. These results correspond in their main features with those already obtained by the author in the case of the Amphibia. The evidence is gaining ground that the epiphysis is bilateral and not mesial in origin.—Prof. A. C. **Mitchell** gave an account of a multi-metre resistance bridge, which he had constructed for investigations in which very strong currents were to be used. There were some special features for securing steady pressure contact. The many standard coils which could be arranged in a great variety of ways were loosely wound in long coils, and the temperature was determined by the change of resistance of a platinum coil wound similarly in the heart of the collection of resistance coils. The coils were made of Beacon wire, and had all been carefully standardised by the Board of Trade.—Two mathematical papers by the Rev. F. H. **Jackson** dealt with certain fundamental power series and their differential equations, and an additional note on generalised functions of Bessel and Legendre.

January 18.—Dr. Robert Munro in the chair.—Prof. Graham **Kerr** read a paper on the early development of motor nerves and myotomes in *Lepidosiren paradoxa*, Fitz. Photographs taken from untouched negatives were shown illustrating the following points:—(1) the fact that the motor nerve trunks existed as metamerically repeated bridges of granular protoplasm at a period when myotome and spinal cord were still in contact; (2) that the nerve trunk was at first naked; (3) that later on it received a covering of yolk-laden mesenchymatous protoplasm which spread itself out and formed a continuous protoplasmic sheath; and (4) that at certain stages complete continuity

could be observed between motor nerve trunk and the protoplasmic body of the myoepithelial cell, of which, indeed, the former was merely a tail-like prolongation. In regard to the myotomes, it was pointed out that the greater part of the fully-formed muscle segment was derived from the *outer* wall of the myotome.—Dr. T. H. **Bryce** read a paper on the histology of the blood in the embryo of *Lepidosiren paradoxa*, part i., structure of the resting and dividing corpuscles. The material loaned by Prof. Graham Kerr is exceptionally advantageous for the study of cell structures. The large red corpuscles, 50μ in diameter, have a definite fibrillar structure, with a broad fibrillar equatorial band round the equator in the resting disc-shaped corpuscle. The nucleus has a very coarse chromatin network which stains differently from that of all the other nuclei, taking in acid and basic mixtures only the acid dye. The chromosomes in mitosis react similarly. No centrosome is present in the disc-shaped corpuscle, but it appears as a double body with exceptional distinctness in oval and round corpuscles. As all stages between the flat disc and the round corpuscles are found, it is probable that the disc rounds up before division, and as the centrosome disappears when division is even, that it is formed afresh at each division. The leucocytes are found in several varieties—a small mononuclear hyaline corpuscle, a large mononuclear form with distinct protoplasmic meshworks basophil in reaction, and polymorphonuclear granular corpuscles. The granules are eosinophil, vary much in size, and accumulate in the cytoplasm until it is entirely filled with them. These corpuscles are actively amœboid, and each possesses a large permanent centrosome and attraction sphere, evidently related to the amœboid movements.—A paper by Mr. E. J. **Bles**, on the development of Xenopus, was also read, and was fully illustrated by a fine series of lantern slides.

PARIS

Academy of Sciences, February 22.—M. Mascart in the chair.—On some points in the theory of algebraic functions of two variables and their integrals: Émile **Picard.**—Refractometric studies relating to the constitution of methinic cyano-acids: A. **Haller** and P. Th. **Muller.** The introduction of negative radicles into neutral molecules such as camphor, acetoacetic and malonic esters gives rise to substances of clearly acid function to which the name of methinic acids is applied. Ten of these compounds, in which the negative radicle is cyanogen, have been prepared and their refraction and dispersion measured, with a view to throwing light on the question as to whether they possess a ketonic or enolic constitution. It is shown that the experimental numbers approach more nearly those calculated on the assumption of the enolic formula than those required for the ketonic formula. It is possible, however, that some of the divergences noted may be due to the association of three negative groups with the same carbon atom.—On the genus Ortmannia, and the mutations of certain Atyides: E. L. **Bouvier.** The author regards *Ortmannia Henshawi* as being a mutation of *Atya bisulcata*, which presents the peculiarity of recalling the immediate ancestral form of the Atya.—The action of human serum on some pathogenic trypanosomes; the action of arsenious acid upon *Tr. gambiense*: A. **Laveran.** It has been shown by Dutton and Todd that the trypanosome obtained from horses in Gambia and *Tr. gambiense* are probably not identical, and the author has found that these two pathogenic trypanosomes are clearly differentiated by their reaction towards human serum. The former is clearly though slightly affected by human serum, whilst *Tr. gambiense* is completely refractory. An experimental study of the various remedies that have been suggested for the amelioration of trypanosomiasis shows that arsenious acid is the only one possessing marked effect, and this is required in large doses. It is possible that treatment with this in the early stages of sleeping sickness, before nervous lesions have commenced, may lead to a cure.—The photographic registration of the action produced by the *n*-rays on a small electric spark: R. **Blondlot.** Reproductions are given of negatives showing the increase in the actinic action of the electric spark by the action of the *n*-rays, and also showing that the rays emitted by a Crookes's tube are polarised. Details of the precautions necessary to obtain successful results are also given.—The direct addition of hydrogen to aniline: the synthesis of cyclohexylamine and of two other new amines: Paul **Sabatier** and J. B. **Senderens.** The vapour of aniline, treated with an excess of hydrogen in presence of reduced nickel at 190° C., gives ammonia, cyclohexylamine, $C_6H_{11}NH_2$, dicyclohexylamine, $(C_6H_{11})_2NH$, and cyclohexylaniline, $C_6H_5.NH.C_6H_{11}$, the two latter being new. A description is given of the physical properties of these amines, together with the preparation of the carbonates and hydrochlorides.—On the soils of fossil vegetation of Sigillaria and Lepidodendron: M. **Grand'Eury.**—On a group of problems in geometry: C. **Guichard.**—On suites of analytical functions: P. **Montel.**—On the representation of functions by rational fractions: R. de Montessus **de Ballore.**—On the fragility of metals: A. **Perot** and Henri Michel **Levy.** In a former paper the authors have given a new method for measuring the effects produced by shock in notched test-pieces. In the present paper the results of the application of this method to two metals are given, and it is shown that differences in properties can be thus brought out which are not detected by the ordinary methods of testing.—The part played by the corpuscles in the formation of the anodic column in tubes of rarefied gases: H. **Pellat.** From the author's experiments the conclusion is drawn that the luminescence of a gas to which the name of anodic column is given follows exactly the trajectory which would be expected for the negative corpuscles, and has no relation with that of the positive ions. A reproduction of two photographs showing the appearances observed with hydrogen and oxygen tubes accompanies the paper.—The laws of the anomalous propagation of light in optical instruments: G. **Sagnac.**—The relation between diffusion and viscosity: J. **Thovert.** The diffusion constant, D, and the viscosity, *t*, were measured for a 1 per cent. solution of phenol in various solvents, and it was found that the product D*t* was a constant.—Contribution to the study of audition: M. **Marage.** The study of the ear in a pathological state has led the author to propose some modification in Helmholtz's theory of hearing.—On the spectrum of the arc: C. **de Watteville.** The method of Fleming and Petavel, devised to study the luminous intensity of the electric arc produced by an alternating current, is applied to a study of the spectrum under similar conditions. The modifications produced are such that the arc spectrum approaches in character that of the flame spectrum.—On disruptive discharge at very high pressure: J. **de Kowalski.**—A new receiver for wireless telegraphy: N. Vasilesco **Karpen.**—On the *n*-rays emitted by an electric current passing through a wire: P. **Jégou.** The rays were put in evidence both by the effect on the lustre of phosphorescent calcium phosphide and by the action on a blue gas flame.—The study of the law of photographic development as a function of the time: Adrien **Guébhard.**—A new improved type of chronograph: Robert Ludwig **Mond** and Meyer **Wildermann.** In this chronograph the cylinder is fixed, and the style, with the electromagnet which actuates it, rotates round the cylinder. With a cylinder 60 cm. long, a record lasting fifty minutes, and with an accuracy of 1/50th of a second, can be obtained.—On the specific potentialisation and the concentration of energy: Ernest **Solvay.**—Experimental researches on distillation: Eug. **Charabot** and J. **Rocherolles.** A study of the theory of steam distillation.—On the manganimanganates of the alkaline earths: V. **Auger** and M. **Billy.**—The action of carbonic acid on solutions of sodium nitrite: Louis **Meunier.** The author controverts the conclusions of MM. C. Marie and R. Marquis, and shows that the liberation of nitrous acid in their experiments was due to the presence of potassium iodide in their solutions.—On mannamine, a new base derived from mannose: E. **Roux.** Mannose is converted into its oxime by means of hydroxylamine; this is reduced, and the amine separated in the form of the oxalate. Several salts and derivatives of the new base are described.—Researches on ricinine: L. **Maquenne** and L. **Philippe.** The formula $C_8H_8N_2O_2$ is ascribed to this compound, which is the methyl ester of ricininic acid. The latter acid appears to be the carboxyl derivative of an iminomethylpyridine.—On the inversion of sugar: L. **Lindet.**—On the simultaneous existence in living cells of diastases which possess both oxidising and reducing properties, and on the oxidising power of re-

ductases: Emm. **Pozzi-Escot.** A claim for priority as against MM. Abelous and Aloy.—On the development of the vascular cryptogams: G. **Chauveaud.** The stem of the fern is constituted by the fusion of different parts, varying in number according to the level considered.—On the systematic position of the endophytes of orchids: I. **Gallaud.** Several authors have obtained from the roots of orchids fungi allied to Fusarium, but these would appear to have been external; the endophytic forms obtained from the cells of the orchid are distinct from Fusarium.—The mycelium and conidian form of the Morel: Marin **Molliard.**—On the age of the human skeletons from the caves of Mentone: Marcellin **Boule.** The skeletons would appear to be of the same age as the deposits in which they were found, corresponding to the warm and most ancient period of the Quaternary. Other skeletons found in higher layers correspond to later periods of the same formation.—On a tunnel at Oupliz-Tsike, Transcaucasia: E. A. **Martel.**—Researches on the emission of the *n*-rays in certain phenomena of inhibition: Aug. **Charpentier** and Ed. **Meyer.**—The action of the radium radiations on colloids, hæmoglobin, ferments, and the red corpuscles: Victor **Henri** and André **Mayer.** The β-rays, charged negatively, can precipitate positive colloids, and are without action on negative colloids. Oxyhæmoglobin from the dog and the frog is transformed into methæmoglobin and slowly precipitated; carbonoxyhæmoglobin remains unaltered. Ferments under the action of the rays slowly lose their activity, and after several days become completely inactive.—The emission of the *n*-rays in certain pathological cases: Gilbert **Ballet.**—The influence of the radium radiations on the toxicity of snake poison: C. **Phisalix.** The rays emitted by radium exercise an attenuating influence on snake poison, the intensity of which is a function of the time.—A physical and chemical method of recognising and measuring deep submarine currents: M. **Thoulet.**—Some new observations on phthiriosis in the vine: L. **Mangin** and P. **Viala.**—On the effects of grafting on the vine: Lucien **Daniel** and Ch. **Laurent.**

DIARY OF SOCIETIES.

THURSDAY, MARCH 3.

ROYAL SOCIETY, at 4.30.—An Inquiry into the Nature of the Relationship between Sunspot Frequency and Terrestrial Magnetism: Dr. C. Chree, F.R.S.—The Optical Properties of Vitreous Silica: J. W. Gifford and W. A. Shenstone, F.R.S.—A Radial Area-Scale: R. W. K. Edwards.—The Origin of the Flutings in the Spectra of Antarian Stars: A. Fowler.

ROYAL INSTITUTION, at 5.—Electrical Methods of Measuring Temperature: Prof. H. L. Callendar, F.R.S.

RÖNTGEN SOCIETY, at 8.30.—Presidential Address: Some Laboratory Notes of the last Six Months.

LINNEAN SOCIETY, at 8.—List of the Species of Carex known to occur in Malaya: C. B. Clarke, F.R.S.—On some Species of the Genus Palæmon, Fabr., from Tahiti, Shanghai, New Guinea, and West Africa: Dr. J. G. de Man.

CHEMICAL SOCIETY, at 8.—Chemical Dynamics of the Alkyl Iodides: Miss K. A. Burke and F. G. Donnan: The Constitution of Phenolphthalein: A. G. Green and A. G. Perkin.—8-Ketohexahydrobenzoic Acid: W. H. Perkin, junr.—Photochemically active Chlorine: C. H. Burgess and D. L. Chapman.

FRIDAY, MARCH 4.

ROYAL INSTITUTION, at 9.—Breathing in Living Things: Prof. W. Stirling.

GEOLOGISTS' ASSOCIATION, at 8.—Remarks on the British Association Geological Photographs: Dr. C. Gilbert Cullis.

SATURDAY, MARCH 5.

ROYAL INSTITUTION, at 3.—The Life and Work of Stokes: Lord Rayleigh.

MONDAY, MARCH 7.

ROYAL INSTITUTION, at 5.—General Monthly Meeting.

ARISTOTELIAN SOCIETY, at 8.—Faith and the Will to Believe: L. T. Hobhouse.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—Observations on Cotton and Nitrated Cotton: H. de Mosenthal.—The Products, and Relative Temperature of Combustion of some Smokeless Powders: W. Macnab and A. E. Leighton.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Journeys on the River Yalu and in Southern Manchuria: R. T. Turley.—About Korea: Rev. C. T. Collyer.

SOCIETY OF ARTS, at 8.—Recent Advances in Electro-Chemistry: Bertram Blount. (Cantor Lecture, I).

VICTORIA INSTITUTE, at 4.30.—Date of the Last Rise of the Land in the British Isles: Prof. E. Hull, F.R.S.

TUESDAY, MARCH 8.

ROYAL INSTITUTION, at 5.—Japanese Life and Character: E. Foxwell.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Erection of Iron Bridges: R. S. Scholefield.

ANTHROPOLOGICAL INSTITUTE, at 8.15.—The Gilyaks and other Tribes of Sakhalin: C. H. Hawes.

WEDNESDAY, MARCH 9.

SOCIETY OF ARTS, at 8.—Mechanical Piano Players: J. W. Coward.

GEOLOGICAL SOCIETY, at 8.—On the Probable Occurrence of an Eocene Outlier off the Cornish Coast: Clement Reid, F.R.S.—The Valley of the Teign: A. J. Jukes-Browne.

THURSDAY, MARCH 10.

ROYAL INSTITUTION, at 5.—Electrical Methods of Measuring Temperature: Prof. H. L. Callendar, F.R.S.

MATHEMATICAL SOCIETY, at 5.30.—On Inner Limiting Sets of Points: Dr. E. W. Hobson.—On the Unique Expression of a Quantic of any Order in any Number of Variables with an Application to Binary Perpetuants: Mr. P. W. Wood.—The Derivation of Generalised Bessel Coefficients from a Function Analogous to the Exponential: Rev. F. H. Jackson.—Illustrative Examples of Modes of Decay of Vibratory Motions: Prof. A. E. H. Love.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The Railway Electrification Problem and its Probable Cost for England and Wales: F. F. Bennett.—The Rated Speed of Electric Motors as affecting the Type to be Employed: H. M. Hobart.

SOCIETY OF ARTS, at 4.30.—China Grass; its Past, Present, and Future: Frank Birdwood.

FRIDAY, MARCH 11.

ROYAL INSTITUTION, at 9.—The Motion of Viscous Substances: Prof. F. T. Trouton, F.R.S.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Premium System of Payment for Labour: W. G. Banister.

PHYSICAL SOCIETY, at 8.

MALACOLOGICAL SOCIETY, at 5.—A *Résumé* of Recent Researches on the Structure of Pelecypod Gills: Dr. W. G. Ridewood.—Descriptions of two new Species of Opisthostoma from Borneo: E. A. Smith.—On some Non-Marine Hawaiian Mollusca: C. F. Ancey.—New Species of Mollusca from New Zealand: Rev. W. H. Webster.

SATURDAY, MARCH 12.

ROYAL INSTITUTION, at 3.—The Life and Work of Stokes: Lord Rayleigh.

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