THURSDAY, DECEMBER 5, 1912.

## THE METABOLISM OF LEPIDOPTEROUS PUPÆ.

*Die Assimilationstätigkeit bei Schmetterlings-Puppen.* By Prof. Gräfin von Linden. Pp. 164+iii Taf. (Leipzig: Veit and Co., 1912.) Price 4.50 marks.

THE phenomena of insect metamorphosis have been widely studied in this country from the point of view of morphology; the physiological aspects of the process have in comparison met with little attention. Several foreign observers have devoted themselves to the investigation of various questions relating to the exchange of material during growth and development in insects, the species usually selected being the common silkworm-moth of commerce. Results of considerable interest have followed from these researches; and, as the author of the treatise before us remarks, a wide field is thereby opened for further physiological investigation.

The Gräfin von Linden has put together in connected form the outcome of her own experiments, conducted from 1906 to 1911, on gas-exchange in lepidopterous pupae. To these records she has added an account of the investigations of other workers, summarising the whole in a concluding chapter, and giving her own interpretation of the facts and figures derived from these various sources.

The species experimented on by the author were the "scarce swallow-tail" (*Papilio podalirius*), the spurge hawk-moth (*Sphinx euphorbiae*), the pine eggar (*Lasiocampa pini*), the small tortoiseshell (*Vanessa urticae*), and the "small magpie" (*Botys urticata*). In all these it was found that in an atmosphere charged with $CO_2$, $CO_2$ was absorbed and $O_2$ might be given off. The insect, like the plant, uses light-energy to bring about the decomposition of $CO_2$ and the consequent liberation of oxygen. It was also found that under similar conditions the pupæ could take up nitrogen from the air, and thus increase their nitrogenous constituents. The insects experimented upon took up from the atmosphere, according to the author, carbon, nitrogen, hydrogen and oxygen, and, even when no other source of nutriment was open to them, they were thus able, not only to repair loss caused by respiration, but also to build up new organic substances. This, she remarks, recalls the assimilatory process in plants. The resulting materials were protein, fat, and carbohydrates.

Of external influences favouring the absorption of $CO_2$, light, especially the rays of low refrangibility, is the principal in insects as in plants. Temperature has also a strong influence. High temperatures stimulate the respiratory process, so much so that even under otherwise favourable conditions of light the assimilatory process is masked. Another important factor is the degree of $CO_2$ concentration in the atmosphere, a high amount of $CO_2$ in the air hindering, especially in active larvæ, the respiratory process, and correspondingly favouring assimilation. Lastly, the humidity of the atmosphere has a strong effect in promoting $CO_2$ absorption.

The Gräfin's results on the assimilation of atmospheric nitrogen are of special interest to physiologists. In almost all her experiments with pupæ a taking up of nitrogen was observed; in larvæ, an alternate taking up and giving out. Where there was a regular assimilation of nitrogen it was dependent on light; the same occurred in plants. This, she says, seems striking, in view of the fact that most plant-physiologists deny assimilation of atmospheric nitrogen except by the help of bacteria. But it is less remarkable in the case of pupæ, because the absorption of nitrogen is already known to take place under starvation in very diverse animals (Regnault and Reiset).

The author believes that not only in an artificially $CO_2$-laden atmosphere, but also under normal conditions, the assimilation of $CO_2$ by pupæ may take place; supporting this view by citation of the results obtained by Kellner, Urech, Dubois, Couvreur, and others. Space will not permit of a full statement of her conclusions, which are certainly unexpected, and in some particulars revolutionary. Certain obvious criticisms must also be forgone. But her treatise is an arresting one, and the subject undoubtedly calls for fresh investigation. F. A. D.

## SYLVESTER'S MATHEMATICAL PAPERS.

*The Collected Mathematical Papers of James Joseph Sylvester, F.R.S.* Vol. iv. (1882-97). Pp. xxxviii+756. (Cambridge University Press, 1912.) 18*s.* net.

THE longest items in this final volume are the "constructive theory of partitions," published in *The American Journal*, and the lectures on reciprocants. The first of these is more consecutive than the notes on Sylvester's King's College course printed in a previous volume; perhaps, for this very reason, it is not quite so interesting. But his use of graphs is most ingenious, and the occurrence of Farey series in this connection may be specially noted. It is a rather curious fact that at the end of Art. 17 (pp. 15–16), Sylvester says that he has not proved a

theorem there stated about resolving N into sets of sequences. The theorem actually follows from the most elementary considerations; the only reason that can be suggested for Sylvester missing the proof is that he failed to note a one-one correspondence between two arithmetical expressions for sets of numbers.

The lectures on reciprocants aroused great interest at the time of their delivery, and the subject was taken up by English mathematicians with considerable vigour. Here, as in other cases, Sylvester had to suffer for his neglect of current mathematical literature. It was pointed out with truth, but unnecessary acrimony, that the whole theory of reciprocants was a mere particular case of Lie's transformation-theory; with this, and even with Halphen's papers on differential invariants, Sylvester seems to have been practically unacquainted until his attention was directed to them. Still more remarkable is the fact that he makes no allusion to Cockle's papers on criticoids. However, his work on reciprocants is permanently valuable, as giving a calculus of differential invariants analogous to that employed in the case of algebraic forms. Dr. Baker points out (p. xxxiii) that Sylvester was familiar with the idea of infinitesimal transformations; this, of course, is quite true, but he does not explicitly construct a theory of *groups* of such transformations, although his results constantly depend on the existence of such groups.

There are many brief notes of a stimulating character, such as those on matrices, on the distribution of primes, and on Goldbach's theorem. The theorem of Goldbach (or Euler) is to the effect that every even number, $2n$, can be expressed in at least one way as the sum of two odd primes. Sylvester adds, on the strength of experiment, that in at least one such representation, supposing $n$ is composite, each of the primes will lie between $n/2$ and $3n/2$. On this assumption he makes a remarkable first step towards the proof of the theorem; for if $p$, $q$, $r$, &c., are the odd primes between $n/2$ and $3n/2$, it easily follows that the power-series equivalent to

$$\left(\frac{1}{1-x^p}+\frac{1}{1-x^q}+\frac{1}{1-x^r}+\ldots\right)^2$$

must give, as the coefficient of $x^{2n}$, the number of compositions $2n=p+q$, if we reckon $(p+q)$, $(q+p)$ as different compositions when $p$, $q$ are unequal. All that has to be done now is to show that the coefficient of $x^{2n}$ does not vanish.

This volume, like its predecessors, illustrates Sylvester's power of attracting willing and devoted disciples. Thus Franklin, and more particularly Hammond, toiled ungrudgingly in the service of the master; and their services deserve cordial recognition and gratitude.

A single remark will show how much we are indebted to the editor, Dr. Baker, for his care in revision. Mr. Morgan Jenkins supplied no fewer than twenty-seven corrections of errors and misprints in the "construction theory of partitions"—that is, about one for every three pages. Probably Dr. Baker found others, and it is not at all likely that this memoir was exceptionally inaccurate. So the corrections involved in the four volumes run into many hundreds. We have only noticed one place where a note seems required and has not been added. On p. 358 it is said that "the extent is not altered by the operation of V"; this is only true if the operand contains the highest letter to the second or higher degree. Oddly enough, Sylvester immediately takes an example where V diminishes the extent!

The biographical notice gives an interesting account of Sylvester's life and character, and a judicious estimate of his mathematical work. In particular, it is pointed out how strictly he confined himself to what may be called combinatorial analysis; writing nothing on groups, for example, and never dealing with function-theory properly so called. In addition to the notice, we have a photogravure reproduction of the portrait which hangs in the hall of St. John's College, Cambridge, and an engraving of the obverse of the Royal Society Sylvester medal, which represents his face in profile. G. B. M.

## PHILOSOPHY OF NATURE.

(1) *Tierpsychologisches Praktikum in Dialogform.* By Prof. Karl C. Schneider. Pp. iii+719. (Leipzig: Veit and Co., 1912.) Price 16 marks.

(2) *Richtlinien des Entwicklungs- und Vererbungsproblems.* Beiträge zur allgemeinen Physiologie der Entwicklung. By Prof. A. Greil. Erster Teil: Principien der Ontogenese und des biogenetischen Grundgesetzes. Pp. iii+352. (Jena: Gustav Fischer, 1912.) Price 10 marks.

(3) *Alle Fonti della Vita.* Prolegomeni di Scienza e d'Arte per una Filosofia della Natura. By Dr. William Mackenzie. Pp. 387. (Genova: A. F. Formiggini, 1912.) Price 10 lire.

MODERN science supplies an abundance of material, such as the philosophers of the past could not have dreamed of, for the psychologist and the metaphysician to explore when the man of science has worked through it. This material is also remarkably prolific in suggesting new lines of philosophic thought, as the work of William James and Henri Bergson, for instance, has shown. It is significant, however, that the

psychologist, in his search for the links that bind subject to object, and mind to nerve, and the metaphysician, in his attempts to solve the problems of reality, must still be either Platonist or Aristotelian—a necessary consequence this of the orthogenesis, so to say, of the human mind.

(1) It was a happy thought of Prof. K. C. Schneider to set in dialogue form the various lines of inquiry and points of view available for the fascinating subject of animal psychology. The nature of man's mind and the foundations on which it is built up are engrossing questions which can best be approached by experimental study of the lower forms of mentality. And the distinctive character of this dialogue is that each point discussed starts from an experiment. The conclusions to be drawn from such experiments must vary with the personal equation. For instance, in the case of the method of trial and error, one is apt to forget that it is, after all, the principal method of human reasoning even in its highest developments. The philosopher himself, if called upon to solve the problem which he sets before a cat or a dog in the shape of one of those labyrinthine boxes, well-named "Vexierkasten," such as Hobhouse, Thorndike, and Lloyd Morgan have traditionalised—a good specimen is reproduced on page 578 of the author's book—would proceed at once, or certainly *sub finem*, by the method of trial and error. That is the universal method of organic intelligence, which behaves throughout as if enclosed in a Hampton Court Maze of matter.

The Psychologist, the Monist, the Vitalist, the Physiologist, the Lamarckian, and the Darwinian, the persons of the dialogue, discuss all possible phenomena of perception, action and experience, from the amœba to the ape. Orientation and various tropisms lead up to the "mono-, bi-, and tri-polar hypotheses." The dreams and games of animals are well treated; the "speech of animals" is a suggestive chapter. The illustrations are apt; many are original. The book should be translated into English.

(2) Psychological problems are midway between biological and metaphysical. Prof. Greil in his first volume argues very thoroughly but with a great deal of repetition and rhetoric, with a wealth of abstract terms and with a poverty of experimental illustrations, in favour of Haeckel's principle of *epigenesis*. There are few more interesting lines of thought than those presented by ontogeny and phylogeny—for, whether it be that the organism is continually coming into new circles of environment throughout its existence, or that its changes are preordained by determinants, either or any hypothesis is at once in the metaphysical and the mechanical sphere. How to engineer even embryological developments, and how to rationalise the process and the result so as to satisfy the "logical principle," are as much mysteries as any the Schoolmen meditated. The author, professor of anatomy at Innsbruck, traces very lucidly the development of theory, from the old systematism, which started from anatomy, to the new *Entwicklungsmechanik*, which ends in enzymes and commences with chemical combinations and mechanical forces. He well criticises the "mosaic theory," but one wishes he could give us, so to say, the perspective of an orthogenic principle that would convince the mind. The volume has the defect of being entirely without headings to chapter or page—the author's name and the title of the book surmount each column of type, while the reader experiences difficuity in knowing where he is.

(3) Dr. W. Mackenzie writes in Italian a disquisition such as is increasingly abundant to-day on the principles, logical and metaphysical (in the older application of the terms), which may underlie the processes of organic life. This style of "philosophy of nature" is practically a modern form of neo-Platonism. The "idea" is pursued, with the help of analogies, chiefly suggested by morphology, from the "individualised" cell to the ethical and æsthetic Absolute inherent in the universe. "World harmony," the "omnipresence of the moral principle," the "artistic principle," and, behind them, the "logical principle," are merely impressions from the die in which our thought is formed. Such metaphysics, no doubt, will always be written and always illustrated by beautiful diagrams and coloured pictures. But this author cannot tell us what the "psychical and teleological energy" is; he expounds "biological unity," but gets no nearer to an explanation of the dynamical capacity of living matter. "Beauty arises from death," like similar pronouncements, is merely superficial. It is kinematography, not science, nor even metaphysics.

A. E. CRAWLEY.

## OUR BOOKSHELF.

*Zur Phylogenie der Primulaceenblüte.* Studien über den Gefässbündelverlauf in Blütenachse und Perianth. By Dr. Salvator Thenen. Pp. iv+131. (Jena: Gustav Fischer, 1911.) Price 8 marks.

THE course of the vascular bundles in the perianth and floral axis has been studied by the author in a large number of species of the Primulaceæ. His results are described in this work, and are

discussed in relation to some phylogenetic problems of the floral structure.

One of the chief objects of this research was to see how far the data obtainable would agree with Van Tieghem's view that five of the vascular bundles of the corolla represent the supply of a suppressed second whorl of stamens. The bundles in question traverse the tube of the corolla in an antisepalous position, and usually each of them forks into two just below the limb, the two branches then passing out into the adjacent lobes of the corolla so as to form lateral bundles in them. Van Tieghem regards the suppression of the stamen as having led to its vascular supply being utilised by the neighbouring lobes of the corolla.

The author has carefully traced the vascular bundles from the floral axis upwards into the two perianth-whorls. This has revealed the fact that, in those species which possess lateral bundles in the calyx-lobes, the origin of these bundles is precisely comparable to that of the lateral bundles of the corolla-lobes. In each perianth-whorl the lateral bundles are derived (and in a similar way) from the strands which become the median bundles of the lobes of the other perianth-whorl. Thus any theory applied to the origin of the lateral bundles of the corolla and inapplicable to the calyx gains no support from the course of the vascular strands.

A comparison of the different forms, including those with "staminodes," yields further data, which also appear to militate against Van Tieghem's theory, and to supply some interesting material relating to floral phylogeny.

(1) *New South Wales. Historical, Physiographical and Economic.* By A. W. Jose, T. Griffith Taylor, Dr. W. G. Woolnough. Edited by Prof. T. W. Edgeworth David, F.R.S. Pp. xii+372. (Melbourne: Whitcombe and Tombs, Ltd., n.d.) Price 4*s.* 6*d.*

(2) *Cambridge County Geographies: Radnorshire.* By Lewis Davies. Pp. xi+156. *Renfrewshire.* by Frederick Mort. Pp. ix+177. *Perthshire.* By Peter Macnair. Pp. xii+180. *Dumfriesshire.* By Dr. James King Hewison. Pp. ix+170. *North Lancashire.* By Dr. J. E. Marr, F.R.S. Pp. xii+180. (Cambridge University Press, 1912.) Price 1*s.* 6*d.* each.

(1) THE interaction between the relief of the land and its climate, between the passive, or physiographic, factors and the active, or human, factors in the development of the life of a country is strikingly illustrated by this book on New South Wales, which summarises the latest information regarding that region. The student, who has hitherto had to search through the volumes of various scientific societies for his facts, will be grateful to the authors, not only for this concise summary, but also for the coherence with which the facts have been collated. The treatment of climate and that of the development of the physical features of the country seem the most valuable parts of a thoroughly sound exposition.

(2) The well-known features of the Cambridge County Geographies are preserved in the new volumes. It remains but to mention points of special interest. Radnorshire is strong regarding the agriculture and the military history of the county; Renfrewshire on the relationship between the county and the estuary of the Clyde; Perthshire includes a panorama of the mountains and a population map showing the influence of the valleys on the distribution of the people; Dumfriesshire has an interesting map connected with the place names of the locality; and North Lancashire emphasises the relation between the geology and the scenery of the county. Perthshire contains a map of the rainfall of Scotland by Dr. Mill, which differs, especially in the case of the Southern Uplands, from the more detailed map by Mr. Andrew Watt which is printed in the other volumes. B. C. W.

## LETTERS TO THE EDITOR.

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### The Moon and Poisonous Fish.

MR. E. G BRYANT, in NATURE of November 14, asks a question regarding the effect of moonlight in "turning" fish. I have lived many years in South Africa, and have encountered the same belief, that moonlight will hasten the turning bad of fish; and at one time, when living at Muizenberg, I obtained some experimental proof of the moon's action on fish. It seems curious, at first sight, that moonlight, which has so little effect on meteorological instruments, should have this effect on fish. I have thought it probably due to insects or some low form of life which would be abroad, or be stimulated to action, on moonlight nights and not on dark nights.

The action of moonlight in stimulating the rise of sap in trees is widely believed in by practical wood cutters in almost every quarter of the world.

D. E. HUTCHINS.

Ridley, Kent, November 23.

### What the British Caves might tell us.

WILL you kindly allow me, as one who has made considerable additions to our Pleistocene fauna, vertebrate and invertebrate, to support Mr. Hunt's appeal for the resurrection of that vast amount of material now stored away that was obtained in Kent's Cavern? Those of us who have paid attention to the subject are aware that the recorded lists give us but a poor idea of what the caves could tell us, and that from the waste dumps have been obtained a large number of new species, and even from the lowest layers these bones include those of man himself. In these circumstances we feel the time has come, not only for this material to be put into competent hands, but for the caves to be reworked on modern lines and in the light of recent research.

W. J. LEWIS ABBOTT.

## THE APPLICATION OF OPTICAL METHODS TO TECHNICAL PROBLEMS OF STRESS DISTRIBUTION.

IT is interesting, in the study of experimental work on the properties of engineering materials, to trace the general trend of the design of apparatus for research, as the need of more accurate knowledge has arisen. Much of our fundamental knowledge of materials has been gained from the study of strains in wires, bars and beams, under uniform conditions of loading; and the experimental apparatus employed has generally made these conditions necessary. The bulk of the technical problems which still require solution are, however, those in which the internal stress varies enormously from point to point; and hence the strain-measuring apparatus now employed in researches has been so increased in delicacy that it is possible to obtain average measurements over very small distances which approximate, if they cannot reach, to the measurement of the strain at a point.

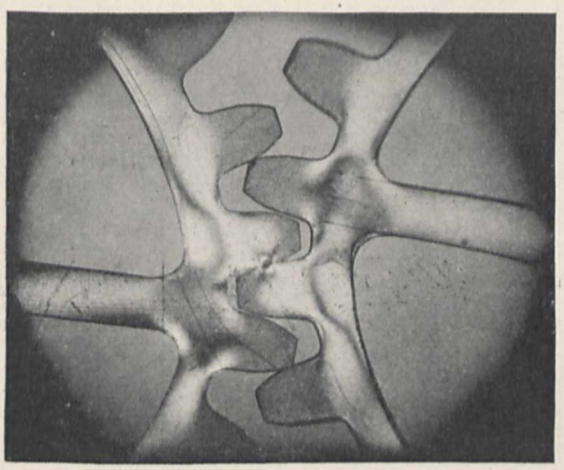

FIG. 1.—Transparent spur wheels in circularly polarised light.

Optical science has, however, provided a very perfect method for investigating the stress at a point, and the mathematical and physical investigations of physicists, among them Neumann, Clerk Maxwell, Mesnager and Filon, on the temporary double refracting properties of stressed glass have made it possible to enlist the aid of a valuable experimental means of studying internal stresses produced in models of structures and machines.

It is not necessary here to show that the stresses in glass of good optical quality agree very closely with the calculated values of the theory of elasticity. It is worth while, however, to point out that the apparent neglect of a valuable means of technical research has been due to almost unavoidable causes, the chief of which have been the great cost and fragility of glass specimens when shaped to forms adapted for investigations, and the necessity of employing very small models to suit the dimensions of the optical appliances available.

Some of these difficulties have been removed by the substitution for glass of one of the nitro-cellulose compounds now available. These compounds approach glass in the perfection of their optical properties, and are considerably superior in ductility, and in the ease with which the material can be fashioned into complicated shapes at a fraction of the cost of glass specimens. An example of this is afforded by the accompanying photograph, Fig. 1, of a pair of toothed wheels of transparent material shaped in a gear-cutting machine in exactly the same way, and as accurately as their metal counterparts. They are shown here under somewhat heavy loads; and the condition of internal stress is marked by colour fringes, which appear as black bands in the photograph.

An important feature of this kind of material is its ability to sustain stresses of as much as several thousands of pounds per square inch without injury, so that the double refraction produced by the loading can be made much more intense than in glass, which usually fractures at very small loads.

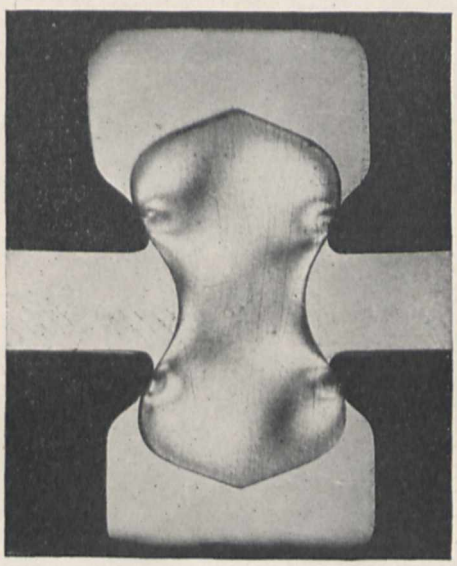

FIG. 2.—Model of cement briquette in plane polarised light.

The comparative rarity and great cost of large Nicol prisms have also restricted optical investigations to very small objects, but, as will be shown, this difficulty has been surmounted, and the size of the specimen illuminated by plane or circularly polarised light may be chosen at pleasure. Although not an essential feature, it may be mentioned that the brilliant colour effects of double refraction may be permanently recorded in a very convenient manner by any of the modern photographic plates now available.

In describing in general outline a method of obtaining the stress distribution in a loaded body, it may be useful to recall that a glass or celluloid body under stress causes an incident beam of plane polarised light to divide into two rays, which have different phases at exit, and also have their planes of vibration in the directions of the principal axes of stress in the body. A stressed object between crossed Nicols, therefore, shows dark bands or brushes, and these mark the positions

of points in the body corresponding to definite inclinations of the principal axes of stress. If, for example, we take a transparent model of some stressed object, such as a cement briquette, Fig. 2, of the form used by engineers for testing the tensile strength of cements, we can observe the movements of the bands shown on this model as the Nicols are rotated, and can mark the positions of the axes of principal stress at every point in the specimen.

A series of positions of the central lines of these isoclinic bands is shown in Fig. 3*a* for this case, and from these curves we can readily obtain, by graphical or other processes, a map of the lines of principal stress (Fig. 3*b*) throughout the body. The isoclinic lines are especially valuable for verifying the results of mathematical calculations,[1] as only small loads need to be employed, thereby avoiding the fracture of costly glass specimens and the possible variation of the physical properties of the material at high stresses. In technical problems, however, and in cases where a mathematical solution is not available, it is generally advisable, and it may be necessary, to measure the intensity of the double refraction produced by load.

The colour fringes indicating the stress are observed more accurately with circularly polarised light as the isoclinic bands are then absent, and the difference of the principal stresses at a point can be obtained from a colour or a wave-length scale. A direct measure can also be obtained by stressing a simple tension member, set along one direction of principal stress, until the field is reduced to blackness at the point desired. This has the advantage of being a zero method, and is simple to carry out with ordinary mechanical appliances.

The problem of determining accurately the principal stresses separately is, in general, one of some difficulty, and a combined method depending on optical and thermo-elastic properties has been suggested,[2] but in many cases this may be accomplished fairly accurately by approximate methods, especially where one principal stress is very great compared with the other. In the present instance, the chief interest lies in the distribution of stress at the minimum section, where fracture is intended to take place. The minor principal stress at this section is small everywhere, and vanishes at the ends. Hence, the experimental curve of values of the difference of principal stresses at the section, Fig. 3*c*, also shows the tensions at the ends accurately, and very nearly so at other points.

If this stress curve is integrated and compared with the stress applied, a mean value of the minor principal stress may be determined, and an approximation to the minor principal stress distribution obtained. Even without this we can see that the stress across the section of a cement briquette probably varies very greatly, and that the universal method of reckoning the stress intensity, by dividing the total applied load by the cross sectional area, is inaccurate and misleading. Experiment shows also that models of the standard briquettes of Continental Europe, America and England differ appreciably in their stress distribution curves, and have, in fact, no common basis for the comparison of results.[3]

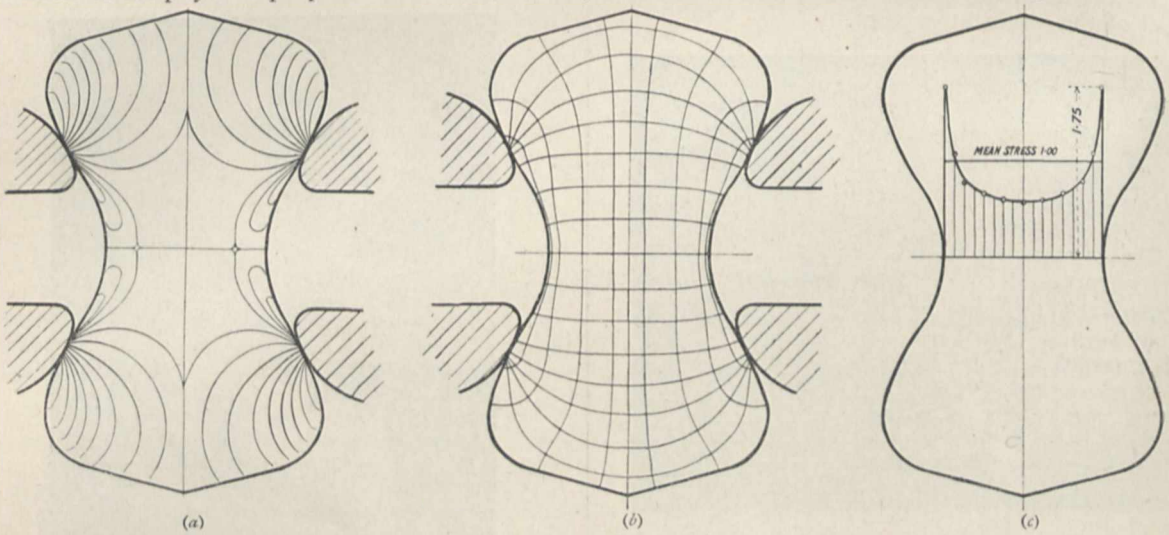


FIG. 3.—Model of a cement briquette: (*a*) Centre lines of isoclinic bands. (*b*) Lines of principal stress. (*c*) Approximate stress distribution at the section of fracture.

For examining models of structures and parts of machines it is usually essential to obtain a field of view in circularly polarised light far beyond the scope of the largest Nicol prisms and quarter wave plates hitherto constructed. In collaboration with Prof. Silvanus P. Thompson these difficulties have been overcome by the construction of polariscopes and quarter-wave plates of a size beyond any immediate requirements.[4]

One of these instruments is shown in cross-

1 "The Investigation of Stresses in a Rectangular Bar by means of Polarised Light." By L. N. G. Filon, *Phil. Mag.*, January, 1912.

2 "The Determination of the Stresses in Springs and other Bodies by Optical and Electrical Methods." By E. G. Coker, Brit. Assoc., 1912, and *Engineering*, September 20, 1912.

3 "The Distribution of Stress at the Minimum Section of a Cement Briquette." By E. G. Coker, the International Congress for Testing Materials, New York, 1912.

4 "The Design and Construction of Large Polariscopes." By Profs. E. G. Coker and S. P. Thompson, Optical Convention, London, 1912.

section by Fig. 4. Light from a bank of lamps, *A*, is diffused by tissue-paper screens, *B*, and afterwards reflected from a black glass plate, *C*, set

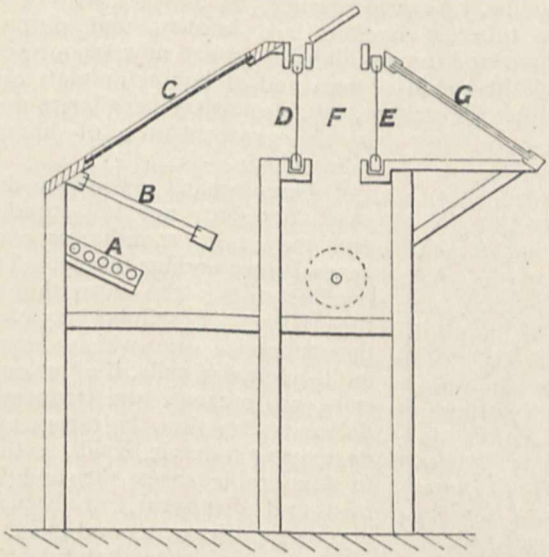


FIG. 4.—Cross-section of a polariscope for examining models of girders and ships.

at the polarising angle. Quarter-wave plates *D* and *E* are arranged to produce a circularly polarised field in the object space, *F*, and for demonstration purposes the analyser is constructed of thin glass plates, *G*, while a small Nicol prism is used for quantitative work. This apparatus, intended for models of bridge structures and ships, is capable of affording a clear field of view through quarter-wave plates of nearly a yard in length and a foot in depth, but so far no models of this size have been found necessary.

Polariscopes of a size adapted to show the whole of a model at one time appear to be essential for successful work in many instances. An example of their use is afforded by a determination of the distribution of stress in a long thin plate, *A*, Fig. 5, subjected to pure shear.[5] A plate of celluloid, 3/16 in. thick and 10 in. long, was rigidly clamped at the sides, *B*, and a maximum pull of about three tons was exerted by a centrally disposed weight, *W*, thereby affording a nearly pure shear over the free portions of the plate. The whole of the sheared area was visible in the field of view of the polariscope, and with the aid of a calibrating tension member the distribution of shear stress was plotted for different lengths of plate. The mean shear applied was 800 lb. per square inch in all cases, and the results show some interesting peculiarities. In a long thin plate the shear stress rises slightly in value from the centre to near the ends, and then rapidly falls to a zero value at the extreme edges of the plate. The maxima become more pronounced as the plate is shortened, until a critical length is reached, where the distribution changes to one with a central maximum and ultimately becomes parabolic in character with a large increase of intensity, as the final curve shows.

Another field of usefulness which suggests itself is the application of optical science to the design of structural members. If, for example, we take a model eye-bar of a type often used in suspension bridges and the lower chords of pin-connected trusses, we can readily obtain (Fig. 6*a*) a map of the lines of principal stress for this form, and their general resemblance to those obtained in a hook[6] at once suggests that across the principal section the stress is very badly distributed. It is apparently very intense at the eye and rapidly decreases until it ultimately changes to compression stress at the outer end of the section. Experiments now partly completed confirm this view, and they also show that another form (Fig. 6*b*) gives a much better stress distribution wholly tensional across the principal section, as the curves of principal stress indicate.

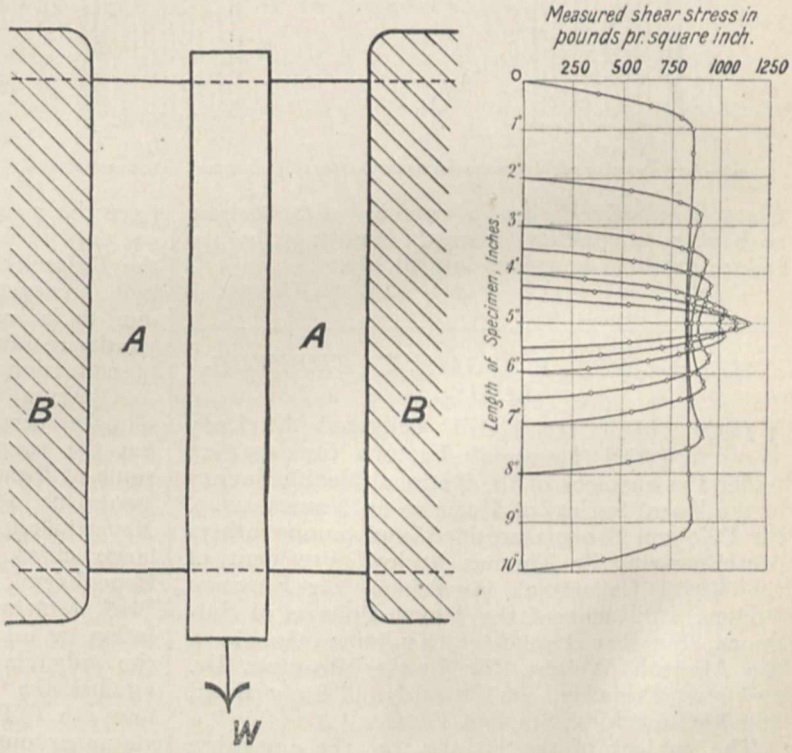


FIG. 5.—Distribution of stress in a long thin plate subjected to shear.

Both forms appear to restrict unduly the lines of stress where the head joins the main member,

[5] "An Optical Determination of the Variation of Stress in a Thin Rectangular Plate subjected to Shear." By E. G. Coker, Proc. R.S., vol. lxxxvi, 1912.

[6] "The Optical Determination of Stress." By E. G. Coker, *Phil. Mag.*, 1910.

and it is inferred that the head ought to merge more gradually into the main body of the member than is at present the common practice. The applications of optical science may possibly be of use, therefore, in the design of structures and machines, as these examples indicate, especially where new problems arise, such as in the design and construction of aeroplane stays and struts, where a poorly designed member adds weight without coresponding strength, and may by its failure result in a serious loss of life.

E. G. COKER.

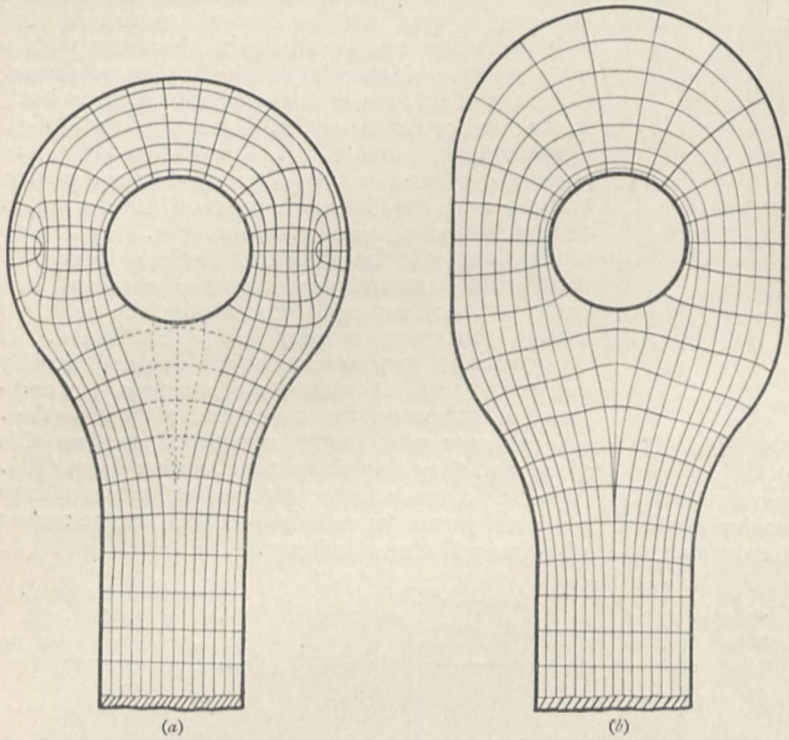


FIG. 6.—Lines of principal stress in two standard types of eye-bars used in bridge structures.

## *THE WARFARE AGAINST TUBERCULOSIS.*

PROF. METCHNIKOFF delivered the Lady Priestley Memorial Lecture for 1912–13 under the auspices of the National Health Society at the Royal Society of Medicine on November 29. Sir Crichton Browne presided, and among others present were Sir Thomas Barlow, President of the Royal College of Physicians, Sir Rickman Godlee, President of the Royal College of Surgeons, Sir Ray Lankester, Sir James Goodhart, Sir Almroth Wright, Sir Lauder Brunton, Dr. and Mrs. Priestley, Sir Edward and Lady Busk, and Mr. and Mrs. Stephen Paget.

The subject of the lecture was the campaign against tuberculosis, and subjoined is a summary of Prof. Metchnikoff's remarks.

Although tuberculosis had been regarded by some as contagious, particularly in southern countries, it was a French observer, Villemin, who fifty years ago showed that the disease can be transmitted by inoculation. Then in 1881 Robert Koch discovered the causative germ, the tubercle bacillus. Several species, or at least strains, of the tubercle bacillus are known, and piscian, avian, and mammalian forms are now recognised, and the bacilli of man and of bovine animals also exhibit differences, but the variety peculiar to man is the great source of human tuberculosis.

Tuberculosis is a common disease, but does not kill rapidly, and may take months or even years before ending fatally. The bacillus causes the formation in the tissues of cellular nodules, the tubercles, in which large multi-nucleated cells, the "giant" cells, are present, and perform a defensive function, ingesting and destroying tubercle bacilli, so that in favourable cases the nodules heal and disappear, or become fibrous or calcareous and inert.

There is evidence that tuberculous infection is exceedingly frequent, for the healed or calcareous tubercles are very common at the apex of the lung of those dying from any cause, and can also be demonstrated by applying the Pirquet test. This consists in applying tuberculin to a scarified patch on the skin, which gives rise in tuberculous persons to an inflamed red spot, and 90 per cent. of the adult European population is shown in this way to have been infected with the tubercle bacillus, yet only 15 per cent. die of tuberculosis. Among the Kalmuk Tartars, studied by Prof. Metchnikoff, however, tuberculosis is rare, but this is not due to a natural insusceptibility, for Kalmuk youths residing in towns in Russia for purposes of education contract tuberculosis freely.

Attempts to cure tuberculosis by drugs, diet, climate, serum, and tuberculin were discussed, but the conclusion was expressed that, though some of these are helpful, no real remedy or sure treatment for tuberculosis has been found. Nevertheless, the death-rate from tuberculosis in large cities, such as London, Hamburg, and Copenhagen, is steadily declining, and this result Prof. Metchnikoff ascribes to unconscious inoculation by infection with mild or benign strains of the tubercle bacillus, which serves to protect against the virulent organism. It is on these lines that Prof. Metchnikoff believes that the stamping out of tuberculosis is to be attempted, viz., the discovery or artificial production of strains of the tubercle bacillus having but slight virulence, which, on inoculation in suitable doses, will serve to protect the inoculated against the virulent organism.

R. T. H.

## REPORT OF THE GOVERNMENT CHEMIST.

IN his report [1] upon the work of the Government Laboratory for the year 1911–12, the Government Chemist gives a short historical introduction, showing the principal steps in the progress of the department.

The origin of the laboratory dates back to 1843. Its duties at first were mainly concerned with checking the adulteration of tobacco; but subsequently its scope was extended, and other branches of the executive besides the fiscal departments obtained permission of the Treasury to avail themselves of its services. Recently, in order to promote the centralisation of Government chemical work, and to place all the departments using the laboratory on the same footing, it was constituted a separate establishment, with the official title of "The Department of the Government Chemist." There are two branches of the laboratory, namely, the main building, at Clement's Inn Passage, and a smaller establishment at the Custom House.

In the present report the matter has been classified more conveniently than formerly, and in respect of the chief substances examined explanatory notes are given, showing for what purposes the analyses are undertaken. These modifications make the report so much the more easily understood by the non-technical reader.

Evidence of the necessity for the kind of analytical control which the laboratory exercises is to be found in plenty in the pages of the report. For example, in the matter of safeguarding the revenue it was found that the "declarations" of brewers, on which the assessment of beer-duty is based, were erroneous in 20 per cent. of the cases examined during the year. Also, out of 2608 samples of certain exported spirituous articles on which rebate was claimed, the proportion of alcohol was found to have been wrongly stated by the exporters in 315 instances, and the amount of sugar in 185.

In connection with the supervision of foodstuffs, more than a quarter of a million pounds' weight of tea was condemned as containing sand or being otherwise unfit for consumption. This quantity of tea, it is noted, though apparently large, is small compared with the total amount of tea imported, namely 347 millions of pounds. The rejected tea was allowed to be used free of duty as a source of the alkaloid caffeine. Of the samples of imported butter examined, 30 per cent. were found to contain boron preservative, and 13·7 per cent. to have been coloured artificially. Oysters suspected to have caused copper poisoning were proved, on analysis, to contain not only copper, but zinc. A few samples of malt and beer were found to contain an excessive quantity of arsenic, which was generally traced to the fuel used in drying the malt.

For many years past analytical work has been done in connection with supervision of dangerous trades by the Home Office. Numerous samples of air from collieries were examined last year for the purposes of the Mines Regulation Bill; and from pottery works where cases of lead poisoning had occurred fifty-six specimens of the glazes in use were taken; these proved to contain lead ranging in amount from 9 to 51 per cent. With few exceptions the whole of the lead present was "soluble" lead—accentuating once more the danger which attends the use of this form of lead in pottery glaze.

The total number of analyses and examinations made during the year was 195,170, as compared with 186,044 for the preceding year.

[1] Report of the Government Chemist upon the Work of the Government Laboratory.—Cd. 6363.

## ANNIVERSARY MEETING OF THE ROYAL SOCIETY.

THE anniversary meeting of the Royal Society was held, as usual, on St. Andrew's Day, November 30, when the report of the council was presented, the president's address was read, and the new council, the names of the members of which were given in NATURE of November 14 (p. 312) was elected.

From the report of the council, we learn that the Government of India has agreed to appoint an additional European assistant in the Indian Meteorological Department, and to maintain the scheme of observations of the upper air for a further period of ten years, unless in the meantime they prove void of result.

The council of the Royal Cornwall Polytechnic Society has informed the Gassiot Committee that it will be necessary, owing to insufficiency of funds, to discontinue Falmouth Observatory at the end of the year. Individual members of the committee have been giving their support to efforts that are being made to secure the necessary financial assistance for that observatory from Government.

The attention of the council has been directed to the urgent desirability of installing self-recording magnetic instruments at suitable stations in South Africa, as few standard records of terrestrial magnetism are available for the southern hemisphere; and also to the great need of providing stations to take part in the observations of tidal disturbance of the solid earth, which are now being inaugurated in Europe and America under the general direction of Dr. Hecker, of Strasburg. The council has transmitted to the Royal Society of South Africa, for its information and for transmission to the South African Government, the opinion of the Royal Society that provision for installing and attending to permanent magnetographs, giving continuous magnetic records at suitable observatories at different places in South Africa, and also arrangements for observations on tidal deformation of the solid earth, are urgently needed in the international interests of the sciences of terrestrial magnetism and geodesy.

Reference was made by the council last year to the provision of new buildings for the National Physical Laboratory. The estimated cost of these buildings, together with the Wernher Metallurgy

building recently erected, was 30,000*l.*, or 35,000*l.* including equipment. Towards this total the sum of 10,000*l.* was given by Sir Julius Wernher, and 15,000*l.* will be provided by the Treasury. Some additional amounts have also been received. For the further sums necessary the laboratory will be dependent on the assistance of other donors. A committee, with Sir William White as chairman, consisting of representatives of the various societies and institutions connected with the laboratory, has been appointed to raise the necessary funds, some 9000*l.* in all, and help has already been received from some of the City companies and others.

In his address, the president, Sir Archibald Geikie, K.C.B., referred first to the losses the society had sustained by death since the previous anniversary meeting. Four foreign members have passed away, and ten Fellows, among whom were two former presidents of the society and Copley medallists. We print from the address the descriptions of the prominent points of the work of the medallists of this year.

### The Copley Medal.

The Copley medal is this year assigned to Prof. Felix Klein, of Göttingen, for his researches in mathematics. Prof. Klein is, perhaps, most widely known in this country for his investigations in geometry, which attached themselves closely to the work of Cayley and other British mathematicians. This work has expanded and systematised our conceptions of non-Euclidean geometry, and indeed the philosophy of geometry in general. Of at least equal importance have been his researches in theory of functions. In his earlier papers he dealt mainly with the transformation of elliptic functions and the related theory of modular functions. The key to the most of what followed lies in the memoir, "Neue Beiträge zur Riemannischen Functionentheorie," published in 1882. In this memoir, quite independently of Poincaré, and from an entirely different point of view, Klein lays the foundations of the theory of automorphic functions.

### The Rumford Medal.

This year the Rumford medal has been awarded to Dr. Heike Kamerlingh Onnes, of Leyden, in recognition of the great value of his contributions to low-temperature research, among which his liquefaction of helium is the most noted. He has founded at Leyden the most thoroughly equipped laboratory in the world for investigations in low temperatures. In that institution a series of researches has been carried out regarding the effects of such great cold as can be obtained by the use of liquid hydrogen and even helium on the properties of substances, such as their magnetic relations and the electrical resistance of pure metals and alloys, the results of which are most striking and important for future progress.

### The Royal Medals.

The awards of the two Royal medals annually given by our patron the King have received his Majesty's approval. One of these medals has been assigned to our colleague, Prof. William Mitchinson Hicks, as a mark of the society's appreciation of the value of his contributions to physical science. Among his researches may be specially mentioned those on hydrodynamics, and particularly on vortex motion, published in the Philosophical Transactions. Of late years he has devoted much attention to the numerical relations which exist between the frequencies of lines belonging to the same spectral series.

The other Royal medal has been adjudged to Prof. Grafton Elliot Smith, in recognition of the value of his biological investigations, more especially in regard to the morphology of the brain as developed in amphibians, reptiles, birds, monotremata, marsupials, and nearly every group of placental mammals. Prof. Elliot Smith's work among the ancient cemeteries of Nubia may also be mentioned. Already it has brought to light many interesting anatomical features in the buried remains of the former population of the Nile Valley.

### The Davy Medal.

The Davy medal has been assigned to Prof. Otto Wallach for his researches in organic chemistry, particularly in regard to the essential oils. Our present knowledge of these complex vegetable products is largely the result of the numerous analytical investigations which he has carried out in the laboratories of Göttingen. He has made many important discoveries, more especially in connection with the cyclo-olefines and their derivatives, and his researches on these compounds have played a notable part in the general development of organic chemistry.

### The Darwin Medal.

The Darwin medal is this year awarded to one of the sons of the illustrious man in whose honour this medal was founded twenty-two years ago. Mr. Francis Darwin by his researches has done much to emphasise the importance of plant movements in relation to environment, and has shown how strong is the evidence for the view that these various movements are the expression of the plant's own individuality in response to external stimuli, and that they have been developed or acquired by the plant as an adaptation to environment in the struggle for life. It is pleasant to remember that these interesting researches have been a continuation of the work which he carried on, conjointly with his father, in the long series of observations and experiments which are recorded in that important treatise, "The Power of Movement in Plants."

### The Buchanan Medal.

This medal is awarded every five years in recognition of distinguished services to hygienic science or practice in the direction either of original research or of professional, administrative, or constructive work, without limit of nationality or sex. It has this year been adjudged to Colonel William Crawford Gorgas, for his remarkable services under the American Government, in combating the terrible scourge of yellow fever. As chief sanitary officer at Havana, Cuba, he there for the first time applied those sanitary methods by which the yellow fever was almost entirely eradicated from the place. This marked success led to his being entrusted in 1904 with a similar but greater task in the Panama Canal zone, where the same disease was rampant, and where he is still engaged. His success in that region has been not less conspicuous.

### The Hughes Medal.

This medal has been adjudged to William Duddell, F.R.S., in recognition of the value of his researches in technical electricity, and, in particular, his investigations with the oscillograph on telephonic sounds, his work on radiotelegraphy with the thermo-galvanometer, his development of the vibration galvanometer, and his investigations on the production of currents of very high frequency by the electric arc and by mechanical means.

At the anniversary dinner, held on Saturday evening, the new German Ambassador (Prince Lichnowsky) and Prof. Metchnikoff were among the guests. In proposing the toast of "The Royal Society," Sir Rickman Godlee, president of the Royal College of Surgeons, dwelt upon the relations of the society to medicine. After responding to the toast, Sir Archibald Geikie proposed the health of the German Ambassador, and pointed out that this was the first public dinner that their guest had attended since he arrived a few weeks ago.

In the course of his reply, Prince Lichnowsky remarked:—

"Of all bonds that unite nations none are stronger than intellectual sympathy, and nothing is more apt to promote a real and lasting understanding between nations than the common struggle against darkness, ignorance, and misery. From time immemorial a close connection has existed between the intellectual leaders of our two great countries. Newton laid the basis of the modern development of physical science in Germany. Carlyle's work on Frederick the Great is a standard work, unrivalled, and of the works of all foreign historians the most popular in Germany. Hume was the predecessor of Kant and Schopenhauer, and I do not believe that in any country in the world are Shakespeare and Byron more fully appreciated or deeply understood than in Germany. I am confident that this close intellectual connection will in the future as in the past be a powerful help to the efforts of all those who work for the establishment of good understanding and harmony between our two kindred peoples."

Prof. Metchnikoff replied to the toast of "The Guests," in a speech in which he referred, in appreciative terms, to the influence the society exerted upon scientific progress, and the recognition it gave to the merits of men of science in many parts of the world. He cited particularly the case of Mendeléeff, who, though refused admission to the St. Petersburg Academy of Science, was elected a foreign member of the Royal Society.

## NOTES.

IN reply to a question asked in the House of Commons on Monday, the Prime Minister stated that he feared the Government will not be able to find time to pass the Mental Deficiency Bill this session, but that the Home Secretary hopes to reintroduce the Bill early next session embodying the amendments made by the Standing Committee. The pledge that the Bill would be passed this session is thus held to be of no account. That Parliamentary exigencies should cause the jettisoning of the Bill is greatly to be deplored. Men of science know with a certainty that arises out of their qualifications that the problem of the feeble-minded and mentally deficient does not stand still. Its urgency caused the appointment of the Royal Commission in 1904; the report emphasised the necessity for immediate action in 1908; yet December of 1912 finds the subject shelved and put on one side. *The Times* has opened its columns to various expressions of feeling on this occasion, but many people who do not see its files will share in Sir Edward Fry's "distress and dismay" at a postponement which is "little short of a national calamity," and agree with the long list of distinguished signatories in the issue of November 28, that "this neglect is causing untold suffering to thousands of feeble-minded individuals who, because it is impossible under the existing law to train them and care for them, become inebriates, prostitutes, criminals, and paupers." Nor is it only these persons themselves with whom we need concern ourselves. They leave behind them a new generation of mentally and physically degenerate children, increasing daily in number, to be a shame to our national life, and a menace to our racial superiority.

THE High Commissioner for the Commonwealth of Australia has received official information of the arrangements that are being made for the visit of the British Association to Australia in 1914. A Federal Council has been formed, under the patronage of the Governor-General, with the Prime Minister as chairman. The members of the association will arrive at Fremantle on August 4, Adelaide August 8, Melbourne August 13, Sydney August 20, and Brisbane August 27, and those returning home by the shortest route will reach London on October 11. The Commonwealth has granted 15,000*l.* to be handed to the British Association by the High Commissioner to cover the passages of not fewer than 150 official representatives, including selected Dominion and foreign men of science. A special invitation has been issued to Sir Charles Lucas, formerly head of the Dominions Department of the Colonial Office. Dr. Rivett has been appointed organising secretary, and will visit London next year. The Governments of the several States offer special facilities for prolonged visits of men of science interested in special problems in Australia.

A VERY interesting tract of wild country has just been vested as a nature reservation in the National Trust for Places of Historic Interest or Natural Beauty. This is Blakeney Point, in Norfolk, a tract of about 1000 acres, consisting of three and a half miles of the shingle spit, with the sand-dunes and salt-marshes protected by it; the frontage on the North Sea is three and a half miles, viz. the end of the spit. A remarkable feature of the tract is the series of terrains instituted by the silting process, and the resulting formation of series of vegetations. Norfolk generally is one of our richest counties in rare flora and fauna. Blakeney Point is a typical area of the county in this regard. It possesses the four chief species of Statice (sea lavender), the very rare *Mertensia maritima* (oyster plant), and the fine shrub, sea-blite, *Suaeda fruticosa*, which grows in great profusion. It is famous for its birds, protected for some years now by the Wild Birds' Protection Society. The oyster-catcher, ringed plover, common and lesser tern breed freely; the latter and various gulls are extraordinarily abundant. Being a sort of "hook" in the North Sea, the point receives interesting stragglers, seals, sharks, and last year a whale. Salt-marshes such as these are rich in insect fauna. The gift is due

to the generosity of the Fishmongers' Company, and some private individuals. *The Times*, from whose report we quote, well says "it is hoped that with Blakeney Point a satisfactory beginning of the establishment of 'national reserves' may be made in England."

THE death is announced, in his seventy-ninth year, of Sir Charles Whitehead, an authority in agricultural matters. He was an active member of the council of the Royal Agricultural Society from 1870 to 1898, was chairman of the botanical and zoological committee of the society, and wrote much in its Journal. He was a vice-president of the society from 1885–1907. From 1893 to 1897 Sir Charles Whitehead served on the Royal Commission on Agriculture, and from 1884 to 1887 he advised the Agricultural Department of the Privy Council Office, when he was appointed agricultural adviser—the first in this country. He was afterwards transferred to the Board of Agriculture as technical adviser. Among his numerous contributions to the literature of agricultural science may be mentioned "The Agriculture of Kent," his leaflets on insects and fungi, and his reports on the Hessian fly, the means of checking potato disease, and on the attack of the diamond black moth. He was a fellow of the Linnean, Royal Geographical, and Geological Societies.

THE death is announced, at the age of ninety years, of Dr. Robert Fletcher, the medical bibliographer. Dr. Fletcher was born at Bristol, and qualified as a member of the Royal College of Surgeons in 1844. Later he took the degree of M.D. at Columbia University. He inaugurated the Army Medical Library at Washington, U.S.A., and, in association with Dr. J. S. Billings, the present head of the New York Public Library, he compiled and edited the index catalogue of the library of the Surgeon-General's Office, Washington, and was entirely responsible for some of the volumes. With Dr. Billings, too, he compiled the "Index Medicus," which was later revived and taken over by the Carnegie Institution, when it was edited by Dr. Fletcher. Since 1880, thirty-two folio volumes of the index have been issued. Dr. Fletcher wrote also papers on anthropology and folklore. He formerly lectured on medical jurisprudence at one of the Washington schools, and afterwards gave an annual course of lectures on the subject at the Johns Hopkins Hospital School at Baltimore. The council of the Royal College of Surgeons of England in 1910 conferred upon Dr. Fletcher the honorary medal of the college for "distinguished labours eminently conducive to the improvement of natural knowledge and the healing art."

MR. T. FRANCIS CONNOLLY, of the Solar Physics Observatory, South Kensington, has been appointed an assistant-inspector of scientific supplies at the India Stores Department, Lambeth.

THE Physical Society's eighth annual exhibition, to be held on Tuesday, December 17, at the Imperial College of Science, South Kensington, will be open in both the afternoon (from 3 to 6 p.m.) and in the evening (from 7 to 10 p.m.). Mr. S. G. Brown will give a discourse at 4.30 and again at 8 p.m., on some methods of magnifying feeble signalling currents. About thirty firms will exhibit instruments and other apparatus.

REMAINS of a human skull and mandible, considered to belong to the early Pleistocene period, have been discovered by Mr. Charles Dawson in a gravel-deposit in the basin of the river Ouse, north of Lewes, Sussex. Much interest has been aroused in the specimen owing to the exactitude with which its geological age is said to have been fixed, and it will form the subject of a paper by Mr. Dawson and Dr. Smith Woodward to be read before the Geological Society on December 18.

A COURSE of twelve Swiney lectures on geology in connection with the British Museum (Natural History) will be delivered by Dr. T. J. Jehu, in the Lecture Theatre of the Victoria and Albert Museum, South Kensington, on Mondays, Thursdays, and Saturdays, at 3 p.m., from Saturday, December 7, to Saturday, December 21 (inclusive), and from Saturday, January 4, to Monday, January 13 (inclusive). The subject of the course is "The Record of Life as revealed in the Rocks." Admission to the lectures is free.

ON Friday last, November 29, Mr. Edgar A. Smith, assistant-keeper in the zoological department of the Natural History Museum, was, in view of his approaching retirement, presented by the director, Dr. L. Fletcher, F.R.S., on behalf of the subscribers, including many of his colleagues and other friends, with a tea and coffee service, a drawing-room clock, and a pair of field-glasses. Mr. Smith joined the staff of the museum in 1867, and has served the trustees for the exceptional length of time of forty-five years; at their special request he has consented to continue his duties up to the end of March next.

WE are informed that the "Cecil" medal and prize of the Dorset Field Club for 1912–13 will be awarded for the best paper on the known sources of supply of petroleum oil and its various products; its advantages or disadvantages compared with the future price, illuminating power, heat and energy of coal by land, sea, and air. The competition is open to any person who was between the ages of eighteen and thirty-five on May 9, 1912, and either was born in Dorset or had on May 9, 1912, resided in the county for the previous twelve months. Further particulars may be obtained from Mr. H. Pouncy, *Dorset County Chronicle* Office, Dorchester.

As a result of a suggestion contained in a paper on the nomenclature of alloys, read by Dr. W. Rosenhain before the Institute of Metals in January last, a committee consisting of representatives of the Institute of Metals and Allied Societies has been appointed under the name of the Nomenclature Committee, and will shortly hold its first meeting. Another new committee has been appointed by the council for the purpose of assisting the Dominions Royal Commission in the inquiry into the question of the supply of non-ferrous metals and ores in this country. A report dealing with this subject is being prepared by the committee, of which Prof. T. Turner is the honorary secretary.

THE following are among the lecture arrangements at the Royal Institution, before Easter:—Sir James Dewar, a course of six experimentally illustrated lectures, adapted to a juvenile auditory, on Christmas lecture epilogues: December 28, alchemy; December 31, atoms; January 2, light; January 4, clouds; January 7, meteorites; January 9, frozen worlds; Prof. W. Bateson, six lectures on the heredity of sex and some cognate problems. Prof. H. H. Turner, three lectures on the movements of the stars: the nebular hypothesis; the stars and their movements; our greater system. Mr. Seton Gordon, two lectures on birds of the hill country. Prof. B. Hopkinson, two lectures on recent research on the gas engine. Mr. W. B. Hardy, two lectures on surface energy. Sir J. J. Thomson, six lectures on the properties and constitution of the atom. The Friday evening meetings will commence on January 17, when Sir J. J. Thomson will deliver a discourse on further applications of the method of positive rays. Succeeding discourses will probably be given by Prof. J. O. Arnold, Mr. G. M. Trevelyan, Sir John Murray, Prof. A. Gray, Mr. S. U. Pickering, Mr. C. T. R. Wilson, the Hon. R. J. Strutt, Dr. A. E. H. Tutton, and other gentlemen.

THE influence of Libyan migrations on the people of the Nilotic delta and the southern shores of the Ægean is now generally admitted. A useful collection of facts illustrating the historical aspects of the question from Egyptian and other sources is made in an article by Mr. Oric Bates under the title of "History of the Eastern Libyans," contributed to *The Cairo Scientific Journal* for August last. He emphasises the constant protest by these people against foreign dominion, and their failure to amalgamate with their European invaders. With the Carthaginians they certainly mixed to some extent; but there was no conspicuous intermixture until Arab times, when there arose the great Berber-Arab dynasties of the Atlas, and eventually the Negro-Berber-Arab Songhay empire in the south-west. Fierce, predatory, and impatient of foreign dominion, yet incapable of ruling themselves, they were a race without a mission until they became sufficiently united with the Arabs under Islam to give strength and weight to the Mohammadan dynasties of Africa and Spain.

THE archæological department of the Geological Survey of Canada has begun a systematic study of the archæology of the whole of the Dominion. Messrs. Harlan I. Smith and W. J. Wintemberg conducted reconnaissances in the Ottawa Valley, Nation Valley, and neighbouring regions. Cave dwellings were found in the Laurentian Mountains near the north side of the Ottawa River containing pottery of an Iroquoian type, and also village sites probably of Algonkin origin; they are all small, and are generally near the streams on camping-places suitable for canoe-parties. They also explored some large Iroquoian village sites near the headwaters of the Nation, which are usually on the top of low hills near a spring or small stream, and thus differ from those previously mentioned. Charred corn (maize) and beans are found; thus the people were agricultural. Stone arrow-points are exceedingly rare, and those made of antler are uncommon. The grooved axe has not been found; even celts are rare, but fragments of pottery and bone awls are common. A number of burials, usually unaccompanied by artifacts, have been found; the skeletons show that the people suffered from bone diseases, and that there was a considerable infant mortality. They were apparently all of one physical type. Messrs. G. E. Laidlaw and W. B. Hicker have also done useful archæological work, as have two volunteers, Dr. T. W. Beeman and Mr. C. C. Inderwick. On a previous occasion we directed attention to the advantage that would be gained by Canadian archæology by the appointment of Mr. Smith as government archæologist, and now we congratulate him on having secured so many zealous co-workers.

AMONG many articles of special interest in the Christmas issue of *Chambers's Journal* is one by Mr. Waldemar Kaempffert on "Eugenics and What it Means." Some striking instances are given of the way in which the mental and physical characters of a human being are reproduced again and again in his descendants. Particulars of 1200 descendants of Max Jukes, a criminal fisherman born in 1720, are compared with statistics of the 1394 descendants of Jonathan Edwards, the distinguished American. The facts obtained by Prof. Karl Pearson and other workers show the vital importance of dealing promptly with the question of the mentally defective. It is urged that the manner in which family traits, good and bad, are inherited should be studied, and that "we must prevent the perpetuation and increase of a stock which we know is a menace to the nation."

LEMURS and their relatives form the subject of a popular article by Miss S. S. Müller in *The Museum News* of Brooklyn. The author appears to be unaware that pottos (Perodicticus) occur in Uganda, as well as in West Africa.

IN the November number of *The Annals and Magazine of Natural History* Dr. Ridewood states that certain specimens in the Natural History Museum collected in the Antarctic during the voyage of the *Erebus* and *Terror* in 1841 or 1842 are apparently referable to the genus Cephalodiscus (an organism on the border line between vertebrates and invertebrates), which was named in 1876 on the evidence of examples brought home by the *Challenger*. They seem referable to *C. nigrescens*, described by Sir Ray Lankester in 1905.

NO fewer than five different authors, Messrs. Griffini, Heller, Hilzheimer, Lotichius, and Schwarz have recently published independent communications on the members of the quagga and zebra group, and it is not a little remarkable how their conclusions differ. Mr. Schwarz (*Arch. Naturges.*, vol. lxxviii., Heft 7, p. 34) considers that *Equus quagga* should include the *burchelli* group, and also that certain races of the former, such as *E. greyi*, which have been described from the Cape, are invalid, while it is also considered that *E. grevyi* is not generically separable from the other. The latter is, however, referred to a new

genus by Dr. Hilzheimer (*Abh. Senckenberg Ges.*, vol. xxxi., p. 85, under the preoccupied name Megacephalon, while the *E. burchelli* group is kept distinct from *E. quagga*. Mr. Heller (Smithson. Misc. Collect., vol lx., No. 8, p. 1) also generically separates Grévy's zebra, as Dolichohippus. Mr. Griffini's work was reviewed in NATURE of November 28 (p. 358); the remaining publication does not demand further notice.

AN interesting research on the sensory perceptions of the fowl tick (*Argas persicus*) has been carried on in the Quick Laboratory, Cambridge, by Dr. E. Hindle and Mr. G. Merriman, who publish their results in *Parasitology*, vol. v., No. 3, 1912. The reaction of the ticks, in all stages, to light is negative; they are also sensitive to pronounced differences in the intensity of illumination, selecting the darker places to rest in. Occasionally this "negative phototropism" is masked, because the ticks are decidedly attracted to a source of heat. They bring as much as possible of the surface of their bodies into contact with surrounding objects. Experiments with vapours showed that the sense of smell is very well developed, and observations on ticks that had suffered amputation of the terminal segments of their front legs proved that the chitinous sac, there situated, and known as "Haller's organ," is olfactory in function. The impressions received through this organ, together with the positive reactions to heat and contact, are believed to be of service to the ticks in enabling them to find appropriate hosts.

WE have received a report of the Amphipoda of the Scottish Antarctic expedition (Trans. Roy. Soc. Edinburgh, xlviii. (1912), pp. 455–520, two plates), by Prof. Charles Chilton, of Canterbury College, New Zealand. The collection contained fifty-six species from Antarctic or sub-Antarctic seas. The great majority of these were already known, but nine new forms are established. It appears that many species range around the globe in sub-Antarctic seas, and the author also directs attention to the similarity or identity of some Arctic and Antarctic species. What interpretation is to be put on this "bipolarity"? Prof. Chilton points out that a species which occurs both in the Arctic and the Antarctic is not always entirely absent from the tropics, but exists there in deeper waters. Moreover, the tropical or temperate form is sometimes so much smaller than the polar one that it has been reckoned as a separate species. For it must be noted that, for some reasons not altogether understood, many Amphipods find their optimum environment near the Arctic and Antarctic regions, not only occurring there in greatest abundance, but attaining a size far larger than that usual for similar or identical species in warmer seas.

A USEFUL list of British lichens, published by Messrs. Dulau, at 1*s.* net (post free 1*s.* 1*d.*), has been compiled by the secretary of the Lichen Exchange Club, and contains the names of more than 1200 species, belonging to 142 genera. This list will be of service to collectors, but the club intends shortly to publish a census catalogue and also "An Easy Account of British Lichens," of which the latter will doubtless be of greater utility to general students. The enterprise of the Lichen Exchange Club is greatly to be commended, as it is likely to lend an impetus to the study of this difficult group of plants among field botanists, and the issue of these handy and inexpensive compilations is well-timed, following as they do the recently completed monograph of the lichens in the British Museum herbarium.

THE synoptic weather maps of the North Atlantic and adjacent continents during the interval of November 4–14, shown on the first issue of the meteorological chart for December by the Meteorological Office, are of more than usual interest. During the first few days atmospheric disturbances occupied the region from Greenland to the Azores and Canary Islands, but subsequently the maps show that a remarkable development of high pressure took place, and "a vast anticyclone ruled from the United States across the Atlantic and Europe to the greater part of Siberia," and much fine weather was experienced. The barometric pressure over central Siberia exceeded 31¼ in. on two days, and was down to 28¾ in. near Iceland. In the week commencing with November 10 a more wintry type of weather set in, with a large anticyclone central about 52° N., 22° W., and depressions on the Newfoundland side.

A USEFUL paper, entitled "Data of Heavy Rainfall over Short Periods in India," has recently appeared in the Memoirs of the Indian Meteorological Department (vol. xxi., part iii.). The information is arranged in chronological order showing (1) daily falls exceeding 10 in. in each of the fourteen chief political divisions for the period 1891–1911, and also the amounts recorded on the preceding and following days, with a supplementary table giving from fragmentary sources records of heavy rainfall prior to 1891; (2) bursts of heavy rain lasting a few hours. No general summary is given of the maximum daily falls, but the figures are astounding; records of 20 in. and upwards are not uncommon, with considerable falls on the previous and following days. At Cherrapunji (Assam) 40·8 in., in the United Provinces 35 in., and in the Punjab 32·4 in. are quoted within twenty-four hours. This valuable information has been published to meet demands for trustworthy data for use in irrigational and commercial undertakings.

THE American journal *Good Lighting* publishes in its October number a well-illustrated article, by Messrs. C. L. Law and A. L. Powell, on small store lighting in that country, a subject on which the authors read a paper at the Niagara Falls meeting of the Illuminating Engineering Society in September. More than 800 small stores in the less prominent streets of New York and neighbouring cities were investigated, and the authors embody their results in a table showing the maximum, minimum, and average watts per square foot of floor area, based on the use of tungsten filament lamps with glass reflectors. They conclude by recommending a definite number of watts per square foot for each type of store. Although the internal arrangements of an American store differ considerably from those of an English shop, the recommendations are of importance to English illuminating engineers, and we reproduce them:—Art

store, 1·3; bakery, 0·8; barber, 1·2; cigar, 1·4; clothing 1·5; confectionery, 1·0; delicatessen, 1·1; drug, 1·2; dry goods, 1·0; florist 1·1; grocery, 1·0; haberdashery, 1·7; jewellery, 1·6; meat, 0·9; millinery, 1·3; music, 1·1; restaurant, 1·1; shoe, 1·0; stationery, 1·0; wine 1·0 watt per square foot of floor.

THE October issue of *Science Progress* contains a full account, by Mr. W. A. Davis, of the experiments on the chemical effects of light, to which so much attention has been directed in recent years. The changes produced may be of some half-dozen types. The most important of these is probably a reciprocal oxidation and reduction, but isomeric and polymeric change, synthesis and hydrolysis are also effected in many cases. These changes are somewhat irregular in their occurrence; thus the nitrobenzaldoximes undergo isomeric change on exposure to light, whilst the parent substance remains stable; again, maleic acid is converted into fumaric acid by light in presence of bromine, but the other halogens do not produce this effect. One of the most striking changes is that of *allo*-cinnamylidene acetic acid,

$$C_6H_5.CH : CH.CH : CH.CO_2H,$$

which, when dissolved in benzene with 3 per cent. of its weight of iodine, actually sets within three minutes on exposure to light, owing to the conversion of 80 per cent. of the acid into a less soluble isomeride; in the dark no change occurs in six days.

WE have received from the Carnegie Institution of Washington a monograph on the conductivity, &c., of aqueous solutions of salts and organic acids, by Prof. H. C. Jones. As this summarises the data that have been pulished in a series of American papers, it will be of considerable value to those who have to refer to the figures now collected. In the original papers the data for the range 0° to 35° C. were all issued separately from those from 35° to 65° C.; in such cases the advantages of publishing in bulk rather than in successive portions cannot be emphasised too strongly. The present publication is therefore doubly welcome.

MESSRS. T. C. AND E. C. JACK have added another dozen volumes to their "People's Books," which are published in cloth binding at 6*d*. net. The additions include a volume by Dr. T. G. Bonney, F.R.S., entitled "The Structure of the Earth," in which he gives a very brief statement of the problems and methods of geology, and a popular account of the disintegrating forces at work modifying the earth's crust, of volcanoes, land movements, and the life-history of the earth. In "Hypnotism and Self-Education," Dr. A. M. Hutchison writes on the present-day position of medicine as regards diseases which demand healing other than that which can be given by drugs. A volume by Mr. William Hall, R.N., on "Navigation," is intended to initiate the reader "as a sort of honorary member in the great company of seafarers," and expounds simply such subjects as dead reckoning and astronomical navigation. Mr. R. G. K. Lempfert, superintendent of the Forecast Division of the Meteorological Office, describes in his volume "Weather Science" how meteorological observations are made and their relation to the changes going on in the atmosphere, and explains what can be learnt by combining the results of observations taken at a number of stations. Two other of the books—"Marriage and Motherhood," by Mr. H. S. Davidson, and "The Baby: A Mother's Book," by a Mother, provide in simple words the information with which every wife and mother should be familiar.

IN view of the increasing importance of the study of public hygiene, the syndics of the Cambridge University Press have decided to publish a series of volumes dealing with the various subjects connected with public health. The provisional lists of subjects, all of which will be treated by experts, include:—The causation of tuberculosis, house-flies and disease, bacteriology of foods, tropical hygiene, sewage disposal, water purification, school hygiene, sound and unsound foods, domestic sanitation, chemical analyses of foods, &c. It is intended that the whole series shall appeal not only to medical men but also to those engaged in the study or administration of public health at home or abroad. The series will be under the general editorship of Dr. G. S. Graham-Smith and Mr. J. E. Purvis.

MESSRS. KEGAN PAUL, TRENCH, TRÜBNER AND CO., LTD., are about to publish a work on the "Theory of Evolution," by the Rev. K. Frank, S.J., with a chapter on ant guests and termite guests, from the pen of Father E. Wasmann, S.J. The work has been translated from the German by Mr. C. T. Druery, and will be illustrated.

## *OUR ASTRONOMICAL COLUMN.*

RADIUM IN THE CHROMOSPHERE.—In No. 454 of *The Observatory*, Dr. Dyson replies to the views expressed by Mr. Evershed and Mr. Mitchell concerning his suggestion that there is some evidence for the existence of radium among the elements spectroscopically disclosed in the solar chromosphere.

His contention is that the chromospheric spectrum is an enhanced-line spectrum, and that before accepting any coincidence of Fraunhoferic and chromospheric lines as evidence of identity of source, the behaviour of any line in question in the spark should be taken into account. On these grounds he questions Mr. Mitchell's identifications of the lines λ4699·52 and λ4533·34 with lines given by Rowland. Other cases are against the radium identifications, however, and Dr. Dyson expresses the hope that the question will receive attention at future eclipses, and that the radium line at λ5813·9, referred to by Mr. Evershed, will be looked for.

OBSERVATIONS OF JUPITER.—Despite the unfavourable conditions of altitude and weather some interesting observations of Jupiter were made during May-July at the observatory of the French Astronomical Society, and the results, with drawings, are now published in the November number of *L'Astronomie*.

The north polar region was much darker than the neighbouring region during May, but later it cleared until its hue was similar to the north temperate zone. Great changes of form and relative movement were observed in the great southern perturbation, and about the middle of July the displacement was at the rate of about 1000 kms. per day; these changes are illustrated by curves and drawings. Later observa-

tions, September 13 and October 9–10, showed that the north equatorial band, so inconspicuous for the past four years, had suddenly become one of the darkest and most conspicuous details on the planet, and it suggested that, at the next opposition, the aspect of Jupiter may be found to be considerably transformed.

THE DISCOVERY OF GALE'S COMET, 1912*a*.—In No. 1, vol. xxiii., of the Journal of the British Astronomical Association Mr. Gale, of Waratah (N.S.W.), tells the story of the discovery of his second comet, 1912*a*. Having to travel considerably, he finds but little time for telescopic work, but carries with him a field-glass of 2-in. aperture and a ×3 magnification. Examining the northern part of Centaurus on September 8, he saw a strange object of obviously cometary character, and on the next evening, having arrived at Mr. Beattie's observatory at Sydney, he was able to confirm the discovery and get a position. At the time of discovery the comet's magnitude was about 6, and the discovery emphasises the fact that a keen observer under a clear sky may do important work without possessing any considerable instrumental equipment.

A STAR CALENDAR.—We have received a copy of the "Star Calendar," by Mrs. H. Periam Hawkins, for 1913, and can strongly recommend it to all amateur astronomers. With its revolving disc it enables one to find the position in the sky of any constellation, or the time of rising and setting in these latitudes, for any hour in the year; the price is 1*s*. net. Mrs. Hawkins has also prepared, as in previous years, a "Star Almanac," which contains a great deal of useful information frequently needed. In addition to star charts for the four seasons, various useful tables and notes, the almanac contains a reproduction of Dr. Wolf's photograph of the "Butterfly" nebula of the Pleiades, and quotes Sir Norman Lockyer on the employment of the stars as guides to travellers; the price is 6*d*. net, and both calendar and almanac are published by Messrs. Simpkin, Marshall, Hamilton, Kent and Co.

THE SPECTROSCOPIC BINARY β SCORPIONIS.—In 1908 Dr. Slipher found that the calcium lines in the spectrum of β Scorpionis did not appear to partake of the oscillations of velocity shown by the other lines, and, also, that they were sharply defined instead of being broad and diffuse, as are the other lines.

The inquiry as to this peculiar behaviour has been taken a step further by Mr. J. C. Duncan, who, in No. 54 of the Lowell Observatory Bulletins, discusses a large number of new measures of the spectrum carried out by him. The elements which best represent the orbit give a period of 6·8284 days, an eccentricity of 0·27, and a projected semi-major axis of 10,990,000 km. for the brighter, and 14,450,000 for the fainter, component; the semi-amplitude of the velocity curve for the brighter star of the system is 126 km. per sec., and for the fainter star 166 km. per sec.

While the velocity of the centre of mass of the system is −8·0 km. per sec., that given by the calcium radiation, K, is −16·6 km. per sec., thus showing a difference of more than 8 km. per sec., which seems too great to be attributed to errors of measurement. This seems to support Hartmann's suggested explanation for a similar phenomenon in the case of δ Orionis, viz. that the calcium absorption is produced by a mass of calcium vapour, independent of the star, moving with a constant velocity between the earth and the star. Observations of other stars in the Scorpio, Orion, and Perseus regions, made by Dr. Slipher, suggest the presence of such calcium clouds in all those regions. On the other hand, a suspected shortening of the period of β Scorpionis would suggest that the calcium cloud envelops the binary system, and produces the effect of a resisting medium on the revolution of the components, but the suspicion needs much more confirmation than is at present forthcoming.

## *MEDICAL RESEARCH AND PUBLIC HEALTH.*

ON November 28, at a meeting of the General Medical Council, Sir Clifford Allbutt raised the question, how the grant for research provided by the National Insurance Act could be used to the best advantage. He looked forward, not to a crusade against tuberculosis alone, but to a crusade against many other endemic diseases, a "general movement all along the line against all these plagues." He pointed out, very truly, that research, diagnosis, and treatment go hand in hand; that the business of pathological and clinical laboratories, in great cities, is to be in touch with men in practice, and to educate them in the methods of science, and in the results of science. He was opposed to the founding of one large institute in London: he was afraid that it would "harden into a bureau"; he desired to see more use made of the many institutions already founded in diverse parts of the country, in our great cities, and in our university cities. Medical research and medical education are inseparable; the doctor must not regard bacteriological institutes as places where he can put a specimen in the slot and get a diagnosis; he must take an intelligent part in the work of the institute. This view was approved by the General Medical Council.

On November 30, at a meeting of the Metropolitan Asylums Board, a recommendation was made by the Hospitals Committee, "that in view of the continued incidence and fatality of zymotic disease, approval be given to the appointment, at a salary of 500*l*. per annum, of a research bacteriologist." Since 1870, the board's hospitals have received more than 500,000 cases of infectious disease, with nearly 40,000 deaths. For one example of the national loss from these diseases, we have the fact that measles alone, in five years, in London, accounts for 10,199 deaths. We want to know more about measles. Probably it would pay the country to appoint more than one bacteriologist, at more than 500*l*. per annum, to study measles alone. We have looked at measles for ages, but have not found the cause of it. The discovery of the cause of diphtheria led to the discovery of diphtheria antitoxin. It is not improbable that some equally valuable discovery is waiting to be made in measles. Dr. Bousfield, at this meeting of the Metropolitan Asylums Board, put the matter in very plain words:—

"We have simply been warehousing infectious disease for years. We have been treating the symptoms and knew nothing about the disease itself. We have spent in forty years 15,000,000*l*., and we now ask that machinery may be set up by which the lives of patients will be saved and the period of their stay in hospital considerably shortened, with a consequent saving of expense to the ratepayers."

This recommendation, of course, was agreed to; and, so far, so good. For in all London there is no authority wiser or more beneficent than the Metropolitan Asylums Board. But what is the good of one bacteriologist? We hope that he will be only the thin end of a wedge of bacteriologists. We are tired of babies dying of measles, tired of our ignorance of the cause of measles. It may be nature's way of killing off the undesirables, but she kills off likewise many desirables, and we want the bacteriologists to take nature in hand.

## GEOGRAPHY AT THE BRITISH ASSOCIATION.

WHEN the British Association last met at Dundee in 1867 the president of Section E, Sir Samuel Baker, had but lately returned from his discovery of the Albert Nyanza. In his presidential address for 1912 Colonel Sir Charles Watson returned to the subject of the Sudan, pointing out how much and yet how little has been learnt since the time of Sir Samuel Baker. In 1869 Sir Samuel Baker was appointed by the Khedive Ismail governor of the country south of Gondokoro, with instructions to extend the Khedive's authority as far south as possible. Owing to the increase of the Sudd and the inadequacy of his forces, little was accomplished at his return in 1873. The same post was held from 1874 to 1876 by Colonel Gordon, who for three years from 1877 was governor-general of the whole Sudan. Pressure of administrative work lessened the opportunities of geographical discovery, and after 1881 the Sudan was closed to Europeans until 1898. Few know how limited is our knowledge of the Sudan even to-day. Small scale maps convey the impression that more is known than is really known, and whatever appears on a carefully engraved map comes to be accepted as true for all time. The course of the Blue Nile itself from Lake Tsana to Famaka, the upper waters of the Atbara, Rahad Dinder and Sobat, and the mountains from which they flow, still await exploration, while great areas of the level plains remain not only unsurveyed, but unvisited. A complete trigonometrical survey is out of the question for many years to come, and though there has been a wonderful increase in our knowledge, though the blank spaces will be gradually filled, the task of geographers in the Sudan is not even half-completed.

In the absence of the Director-General of the Ordnance Survey, Captain E. O. Henrici, R.E., read his paper on the international map, and exhibited the five sheets hitherto published. The discussion on this paper strongly supported the president's criticisms of the colour scheme, and a general feeling was manifested in favour of a black and white edition of the map.

A valuable paper by Mr. E. A. Reeves dealt with recent improvements in surveying instruments, including those which deal with astronomical observation, triangulation and levelling, such as lamps for theodolites, invar tape and reflecting levels, and also the latest instruments for plotting the facts observed, such as the stereo plotter, Orel's stereo-autograph, telescopic alidades, and the latest advances in photographic surveying. Great interest was shown in an exhibition of road-books and atlases which illustrated Sir H. G. Fordham's bibliography of British and Irish road-books and itineraries from Leland to Ogilby, from Ogilby to Cary, and in the last period from 1798 to about 1850, when railways made itineraries except Bradshaw unnecessary. This paper included some references to the road-books of France.

African geography was pursued further by Dr. Felix Oswald, who gave some of the results of his journeys between the Victoria Nyanza and the Kisii Highlands, and Mr. G. W. Grabham, who dealt with the country northward from Lake Albert. Mr. W. J. Harding King, in his paper on the Libyan Desert, pointed out that the sand dunes do not extend so far as was formerly supposed, since a large plateau, starting about 20 miles south-west from Dakkleh oasis and running west, banks up practically the whole of the dunes. Southward of this plateau is a sandy plain rising toward the south; the top of a hill in this plain was found to be 2150 feet above the sea. There are numerous fertile spots south of lat. 20° N. Ennedi is said to be full of Roman remains. Another desert paper was given by Mr. I. N. Dracopoli, who, in speaking of the Sonora Desert of Mexico, dealt with the physical features of the region and the characteristics of the Papago and Seri Indians.

Mr. P. Amaury Talbot gave his experiences of Southern Nigeria, especially in the forest belt lying between the coastal swamps and the grasslands of the interior. As the Yoruba and Ibo territory is better known, he paid most attention to the Cross River district and its ethnography—the Ododop or Korawp forest negroes, the Ojo and Uyanga and the Ekoi, a semi-Bantu people of a high type.

The Antarctic discussion, which occupied the Monday morning, was specially appropriate to Dundee; no fewer than four Antarctic vessels were actually lying in the harbour during the meeting. Sir Clements Markham, to whom with Sir John Murray the revived interest in the Antarctic is mainly due, confined his attention to the expeditions of Captain Scott, Mr. Mawson, and Captain Filchner. Dr. W. S. Bruce gave a full review of the configuration of the continent, both the coast and the interior, as at present known, and then discussed former connections with the southern continents, as suggested by the discoveries of the *Scotia*. Dr. R. N. Rudmose Brown, who opened the discussion, agreed in the main with Dr. Bruce's views of the continental structure. Dr. E. Marshall spoke of the work done by Sir Ernest Shackleton, and Dr. Hodgson of his experiences in the *Discovery*. Prof. Charles Chilton, of New Zealand, discussed the biological evidence for the former land connection with his country.

Two committees were appointed to report to the section at the 1913 meeting, one on the present state of geographical teaching in Scotland, and the other on the choice and style of atlas, textual, and wall-maps.

## PHYSIOLOGY AT THE BRITISH ASSOCIATION.

THE proceedings of the Section of Physiology were characterised by two features: the first was that a large number of foreigners attended the meetings of the section, and the second was that a whole day was devoted to subjects bearing on psychology.

Three subjects formed the bases of discussions. One joint discussion on animal nutrition with the Section of Agriculture is described in the report, which appears elsewhere in this issue, of the proceedings of that section.

The second joint discussion on the physiology of aquatic organisms was held with the Section of Zoology. This discussion was opened by Prof. A. Pütter, who gave the arguments in favour of his hypothesis that aquatic animals frequently obtain their food material in dissolved form. By measuring the respiratory exchange it is possible to calculate the amount of organic matter oxidised, and the quantity of organic matter in the form of plankton can be determined. If the plankton is uniformly distributed there is not sufficient particulate material to account for the organic matter oxidised unless the animals deal with disproportionately large amounts of water. He has kept animals for long periods without solid food, and found that they gained in weight. In addition, he determined the amount of dissolved organic matter in sea-water, and found that it was sufficient to account for the respiratory exchange of the animals.

Prof. Benjamin Moore, F.R.S., on the other hand, stated that there was not sufficient dissolved organic matter to account for the respiratory exchange. He considered that the plankton is not evenly distributed,

and that the animals, aided by their sense organs, forage for food. In order to show the great activity of the phyto-plankton in forming organic matter, Prof. Moore mentioned that he had found the sea-water to be more alkaline in August than in April. He attributed this change to the removal of carbon dioxide from the water. When one considers the great bulk of water concerned, the change in reaction must mean an enormous synthesis of organic compounds.

Prof. Fil. Botazzi added that the dissolved organic nitrogen in sea-water is not sufficient to nourish the animals, and that sea-water is almost neutral in reaction.

Dr. W. J. Dakin pointed out that plankton collections did not necessarily contain all the particulate food matter contained in the sea. Prof. Pütter had said that food was often absent from the alimentary canal, but this might be due to the rejection of food after the animal was caught. Dr. Dakin had frequently found food in the alimentary canal. He believed that although some animals may live on dissolved organic matter, others certainly ingested particulate matter.

Prof. Leonard Hill, F.R.S., spoke about the effect of high pressures of water on living tissues. Frogs can survive exposure to pressures of 300 atmospheres, but at 400 atmospheres their muscles become opaque and disorganised. Bacteria are killed when the pressure reaches 3000 atmospheres. Prof. Doflein pointed out that protozoa can live on dissolved organic matter, and that digestion causes the solution of all foods before they are absorbed. Dr. F. A. Dixey, F.R.S., stated that insects can construct organic substances from air, and hence sea animals may possibly form organic material from simple dissolved constituents. Dr. N. Annandale described the effect of food in altering the colour of a form of hydra from Bombay. When placed in an aquarium it takes food, and the colour changes. Prof. A. Dendy, F.R.S., considered that all work done on sponges can be discounted because they are usually mixed colonies of plants and animals. Therefore some of the experiments described by Prof. Pütter ought to be repeated with other animals.

The third discussion, on the relation of mind to body, was preceded by a paper by Prof. Max Verworn on the physiological basis of memory and abstraction. In this paper he stated that nerve cells increase in size by use, and that the strength of the nerve impulse depends on the size of the cell body. Thus a series of nerve cells which had not been used should act as a block by causing a gradual decrease in the strength of the nerve impulse until the impulse becomes too weak to pass from one cell to another; whilst a series of well-exercised cells should increase the strength of the impulse. Nerve impulses should therefore tend to be propagated along more frequented paths.

Prof. R. Latta opened the discussion by contrasting the Parallelist and Animist points of view. The former, recognising two independent systems which correspond point for point, involves an extension of the mechanical hypothesis to mind, in utter disregard of the fact that the mechanical hypothesis is founded on the necessity of excluding everything mental from the physical system. The latter insists on the recognition of a teleological factor in organism and mind, placed entirely outside the mechanical system, and requiring an endless series of miracles. His conclusion was that mind cannot be entirely separated from matter, and that the distinction between the physical and the psychical, the mechanical and the teleological, is a distinction within one and the same system.

Sir T. S. Clouston dealt with the effect of diseased conditions, thus emphasising the intimate connection of the structure and chemistry of the brain with the mental processes.

Dr. J. S. Haldane, F.R.S., emphasised that it is impossible to separate mind from the bodily structures, nor can physiological processes be separated from physical and chemical laws. His belief is that the body properly understood is the mind, and that the physical sciences treat of a one-sided aspect of reality. The line of development is that in which the organic extends so as to include the inorganic.

Dr. H. J. Watt maintained that before the problem of the mind-body relation can be raised, it is necessary to form a properly classified catalogue of psychological states, and to determine whether some satisfactory correlation cannot be found among known or possible physiological processes. He urged that the facts adduced by McDougall in favour of interaction are really compatible with the broader views of parallelism.

Dr. C. S. Myers held the most tenable hypothesis to be that of parallelism between neural and mental processes and products, coupled with the realisation that the same difficulties which beset the explanation of the course and nature of mental processes occur on the neural (physiological) side.

Prof. Geddes demonstrated by a diagram that the opposing views are really two aspects of the same thing, depending on whether the attention is fixed on the influence of the organism on the environment, or that of the environment on the organism. Prof. F. Geddes, F.R.S., and Prof. E. H. Starling, F.R.S., each considered that the discussion was premature, and they agreed with Dr. Watt that psychology must advance further before the subject can be profitably discussed. Prof. Leonard Hill, F.R.S., said that, in spite of our inability to reach a conclusion, the human mind seems prone to consider its relation to its environment, and that the present discussion was in deference to this propensity.

Two interesting demonstrations were given. Prof. Heger showed some kinematograph films illustrating the beating of the tortoise heart with the effect of poisons upon it, and the movements of the circulation in crustacea and the frog.

Prof. Leduc illustrated the effect of diffusion by placing drops of a watery suspension of Indian ink on a salt solution. He believes that cells represent dynamic centres which, by centrifugal and centripetal forces, produce the various appearances which we ascribe to cell structure.

Prof. F. Gotch, F.R.S.: In the dark adapted eye the peripheral portion of the retina is more sensitive than the fovea; red vision extends some distance beyond the fovea, but green is confined to it. A green light falling outside the fovea is recognised as a white glare. Owing to the peripheral portion being more sensitive, a feeble light disappears when it is fixed. Hence, after a light has been discovered at night, to distinguish white from green, night-glasses must be used in order to raise the luminosity above the threshold for the fovea.

Dr. Edridge Green criticised for three reasons the report of the Departmental Committee on Sight Tests. The retention of the wool test, the form of lantern, and method of flicker photometry recommended were condemned. In the subsequent discussion all who spoke condemned the wool test, but the form of lantern and flicker photometry were efficiently defended.

At one time an interesting discussion seemed imminent. After a paper by Prof. Hamburger on phagocytosis, Prof. Asher read a paper on cell permeability. The former demonstrated the ingestion of carbon by leucocytes, and described the effect of certain substances on the rate of phagocytosis. Some of these substances, he said, acted because of their

action on the lipoid layer of the corpuscles. The latter described the changes in staining capacity brought about by activity in the glands of the nictitating membrane of the frog. These changes, he said, must be independent of any lipoid material surrounding the cells.

Prof. Fil. Bottazzi reported the result of a series of determinations of the physical chemistry of muscle plasma. Dr. Campbell and Prof. A. B. Macallum, F.R.S., found that certain cells of the kidney tubule stain blue after the injection of a mixture of iron and ammonium citrate and potassium ferrocyanide. These authors state that this change will take place only in the presence of acid, and that therefore the cells are excreting acid.

Dr. Cramer reported the results of some metabolism studies on tumour growth. For the same increase in weight transplanted tumours require less protein than does normal growth. Glycogen is used during the period of growth. If the glycogen metabolism is interfered with by thyroid feeding, the transplanted tumours do not develop. Drs. Cramer and Pringle: Thrombokinase from platelets will pass through a Berkefeld filter, but the thrombokinase from tissues will not pass through. Mr. S. Dawson found that brightness discrimination is more accurate with two eyes than with one. There is, however, no summation, as the apparent brightness is the same whether the object is viewed with two eyes or with one.

Prof. Max von Frey described the effect of two adjacent pressure stimuli on each other. A stimulus accompanying another apparently increases the intensity of the one stimulus. The location of two neighbouring stimuli is between the two and nearer to the stronger stimulus.

Prof. Ida Hyde in a series of papers gave the following results. Tripolar electrodes are more efficient and less injurious in blocking nerve impulses than other methods. Afferent impulses more easily blocked than efferent. Afferent fibres were found in the phrenic nerve. The action of alcohol on the cutaneous reflexes of the frog is depressent.

Prof. A. Kossel dealt with the problem whether the guanidine group was or was not free in lysin. He concluded that it was not free.

Prof. H. Kronecker dealt with the distribution of taste sensations. He concluded that compensation occurs in the central organ. Prof. O. Loewi found that strophanthine acts like calcium in antagonising the effect of potassium. Prof. A. B. Macallum, F.R.S., showed slides representing the distribution of potassium in cells. He believes that the distribution is the result of potassium causing a decrease of surface tension at the interface.

Prof. J. J. R. Macleod: Stimulation of splanchnic nerve or hepatic plexus causes hyperglycæmia. A second factor is necessary, namely, the presence of adrenaline. Dr. J. L. McIntyre stated that animals form mental images by which they remember places. Rev. James Marchant read a paper arguing that, instead of devoting our energies to the prevention of race degeneration, we ought to attempt race regeneration.

Prof. C. R. Marshall presented a series of pharmacological papers showing that:—(1) Quarternary ammonium bases act on myo-neural junction; methyl compounds are more active than ethyl compounds. (2) Nitric esters cause vasodilatation by acting on myo-neural junction; relative activity corresponds with solubility except in the case of acid compounds, when the carboxyl group appears to exercise an inhibiting action; activity depends on ease of reduction to nitrites in alkaline solution. (3) Coriamyrtin and Tutin were contrasted.

Prof. T. H. Milroy concluded from his experiments that the gaseous exchange during apnœa is due to physical causes. Prof. F. H. Pike described the condition of the spinal vasomotor nerves in shock. Mr. H. Reinheimer stated that factors can be given to biological processes so that the value of an organism to the community can be computed in a similar way that factors in political economy enable general values to be calculated. Mr. W. Sack found that injection of extract of corpus luteum caused a retention of nitrogen in female rats, but not in males. This points to the action being upon the female generative organs.

Prof. W. H. Thompson investigated the output of nitrogen after administering arginine. The nitrogen was mainly excreted as urea and ammonia, but a certain amount was unaccounted for. The effect of simultaneous administration of methyl citrate on the excretion of creatin and creatinin was investigated.

Dr. C. W. Valentine concluded that the horizontal-vertical illusion is due to a retinal quality whereby equal lengths in the vertical direction are referred to greater distances than in the horizontal direction.

Prof. A. D. Waller, F.R.S., read an account of the nerves found in the trunk of an elephant which died near Dundee two hundred years ago. Patrick Blair secured the carcass and dissected until the remains became unfit for further work. He removed the trunk and made a dissection, as the result of which he described different nerves for movement, touch, and smell. The bones of this elephant were ultimately used as a fertiliser by a neighbouring farmer.

Prof. A. D. Waller, F.R.S., by means of the oscillograph, compared the electro-cardiogram with the pulse. He found that a deep inspiration may affect the pulse in two ways (*a*) by actually stopping the heart, and (*b*) by compression of the subclavian artery. Descent of the diaphragm diminishes the potential difference between the two hands, but increases that between the left hand and left foot.

All the reports and abstracts of papers received in sufficient time before the meeting were bound, and copies can be obtained at the British Association offices.

H. E. ROAF.

## *AGRICULTURE AT THE BRITISH ASSOCIATION.*

IN drawing up their programme for the Dundee meeting, the organising committee of the section decided to concentrate attention on three or four subjects, of which one or two should be of distinct local importance. The method worked so well that it is likely to be adopted in future years. The subjects selected were milk problems, animal nutrition, the application of meteorological information to agricultural practice, and the sources of the nation's food supply.

In his presidential address, Mr. T. H. Middleton described the changes that have taken place in the development of agriculture during the past two hundred years, and the address, the main parts of which are printed in NATURE of October 24, p. 235, formed a fitting historical introduction to the work of the section. This was followed by a series of papers on milk. Mr. W. Gavin dealt in a very able paper with the interpretation of milk records. He pointed out that in any statistical study of the inheritance of milk yield, or indeed in any systemised breeding experiment where more than a few cows are dealt with, it becomes necessary to define a cow's milking capability by a single and unqualified figure. Breeders generally depend on such figures as total yield per calf, total yield per calendar year, average per week, &c., but the enormous fluctuations found in the same animal show

that all these are subject to a variety of outside influences. Better results are obtained by a consideration of the maximum yield per day, the average yield per day during the fifth to twelfth week after calving, and the maximum yield per day maintained or exceeded for not less than three weeks.

Dr. Lauder and Mr. Fagan dealt with the effect of heavy root feeding on the yield and composition of milk; three experiments were made, each with eighteen to twenty-two cows, and the following conclusions were drawn :—(1) The feeding of a ration containing a large quantity of water does not increase the percentage of water in the milk or reduce the percentag of fat; (2) the larger yield of milk is obtained from the cows on the concentrated ration; (3) on the other hand, however, the milk from the cows on the turnip ration contained a higher percentage of fat and a greater total weight of fat. It was also noticed that much more fat was obtained in the milk than was given in the ration; thus the turnip ration contained 171 lb. digestible fat, while the milk contained 529 lb.

Messrs. Cooper, Nuttall, and Freak discussed the relationship between certain properties of the fat globules of milk and its churnability. A method was devised for determining the size of the globules, and a number of measurements have already been taken, but there seems to be very considerable variation in different milks of the same breed of cows. The question of a membrane surrounding the fat globule was studied, and an attempt was made to repeat Storch's work; no evidence could be obtained, however, in its favour, and the conclusion was drawn that the membrane does not exist.

The discussion on the nation's food supply was opened by Mr. R. H. Rew, C.B., who presented some interesting tables of statistics, and expounded them in his usual lucid manner. Perhaps the most striking conclusion is that the United Kingdom produces rather more than one-half of its total food requirements exclusive of sugar and beverages, such as tea and coffee, that cannot be grown in these islands. The home production is valued at about 180,000,000*l.* per annum, and the imports at 206,000,000*l.*, of which 39,000,000*l.* goes in sugar, tea, coffee, and cocoa. These figures came as a great surprise to the meeting, and it is certainly satisfactory to know that British agriculture has so well maintained its position in competition with other countries. In one commodity only is there any great falling off; we produce only one-fifth of the total wheat consumed. Under present systems of husbandry, wheat seems to be a pioneer crop produced in the new countries of the world.

Major Craigie followed with an interesting account of the development of Scottish agriculture during the past fifty years. Many thousand acres of grain, turnips, and potatoes have gone, but the area under rotation grasses has increased, while that under permanent grass has gone up very considerably; the yields also are all higher, especially of wheat and potatoes, the former having gone up from 28 to 41 bushels per acre, and the latter from 4 to 7 tons.

The joint meeting of the meteorological department of Section A, which was one of the prominent features of the programme, was described in NATURE of November 28, p. 369.

The second joint meeting was with Section I on animal nutrition. For the past ten years an important series of sheep and cattle feeding experiments has been carried out by Mr. Bruce, and the results were very ably summarised by Mr. Watson. A remarkable feature was the pre-eminent position of linseed cake as a food, animals fed on this always making greater progress than those on other substances. Better results were also obtained with Bombay cotton cake than with Egyptian cotton cake, in spite of their apparent identity on chemical analysis. A mixture of wheat, cottonseed and cotton cake made up to give the same analysis as linseed cake proved economically a failure. The conclusion is drawn that our present methods of valuing feeding stuffs do not afford particularly useful information. Prof. F. G. Hopkins dealt with the discrepancy. Until recently physiologists had been content to express diet in terms of energy and protein minimum, neglecting other factors. It is now known that these other factors do matter, and that one cannot group together all the constituents either in terms of a starch equivalent or of any other unit. There are other constituents just as important as carbohydrate, protein, or fat, and if these are removed the diet may lose much of its value or even predispose to disease. Dr. Funk gave an actual illustration in the work that he has been doing at the Lister Institute on the isolation of the so-called vitamine from rice polishings.

Prof. Leonard Hill described his experiments on the relative nutritive values of white and of standard bread as further illustrating the value of the subtle principles in the husk or coat of the grain. Standard bread proved the better food for rats and mice; indeed, white bread failed to maintain life. For the ordinary man, however, it is not necessary that bread should be a complete food owing to the variety of his diet, but for the poor it is undesirable that the valuable principles of the coats should be lost. This was followed by a practical paper by Mr. Ross, who emphasised the importance of individual attention to the animals. He described his own practice, which is admittedly very successful, and was recognised by the physiologists as very similar to sanatorium practice. In particular no check in growth is permitted; the animal is kept developing uniformly from his birth upwards.

Prof. Hendrick gave an account of his experiments showing that cottonseed oil and linseed oil may be substituted for butter fat in the rearing of calves. Up to the time of weaning, the whole milk proved the better diet, but later on the differences fell off, and at the time of slaughter there was no significant difference between the variously fed animals. Prof. Berry gave an exhaustive report on the feeding of dairy cows in the west of Scotland, and also in a second paper investigated the probable error of pig feeding experiments, which was found to come out at 13·8 per cent., a value identical with the 14 per cent. obtained by Prof. T. B. Wood. Dr. Crowther gave a very spirited defence of the starch equivalent; this is admittedly imperfect, but at any rate it represents the best criterion at present available for the chemist. The discussion was continued by Drs. Cathcart, Douglas, Wilson, and others.

Of the general papers, two by Dr. Hutchinson attracted considerable interest. Lime is found to act as an antiseptic in the soil and to exert the same partial sterilisation effects as are produced by volatile antiseptics or by heat. Thus it initially kills many of the bacteria and of the protozoa; later on there follows a very marked development of bacteria and consequent production of plant food. In the second paper experiments on nitrogen assimilation were described. It was shown that practically any plant residues added to the soil caused bacterial assimilation of nitrogen to set up, whilst sugar caused marked assimilation, particularly if the temperature was sufficiently high.

Prof. Berry gave an account of his analyses of the oat kernel, which have been carried out for several years past. So many have accumulated that it is now possible to distinguish several more or less well-defined groups in which the size of the grain and the thick-

ness of the husk are related to the percentage of oil. Two interesting papers were contributed by Prof. Hendrick, one showing the composition of water draining from soils practically free from carbonate of lime, and the other emphasising the value as manure of waste carbonate of lime.

A new line of agricultural study was opened up by Dr. W. G. Smith and Mr. Crampton, in a paper on the influence of origin and topography on grass lands. This is one of the earliest applications of the new ecological knowledge to agriculture.

Mr. Collins contributed a paper on the evolution of hydrocyanic acid from linseed, and several papers of economic interest were read by other members.

## *THE PALETTE OF THE ILLUMINATOR FROM THE SEVENTH TO THE END OF THE FIFTEENTH CENTURY.*[1]

IN the opening lecture given at the Royal Academy of Arts last year, Dr. Laurie dealt with the question of the history of the pigments used at various times by painters, bringing together such information as could be obtained by a literary inquiry. Since then he has made an examination with the microscope of a large number of illuminated manuscripts at the British Museum, the Advocates' Library, Edinburgh, and the Edinburgh University Library, from the seventh to the end of the fifteenth century. The result of this examination has made it possible to identify the larger number of pigments used, and classify them according to the centuries and according to different countries, Byzantine, Irish, French, English, Italian, and German manuscripts having been examined.

The general results are to show that during these centuries the palette was practically confined to vermilion, whether natural or artificial, red lead, orpiment, ultramarine and ultramarine ash, azurite, malachite, natural and artificial, verdigris, lakes, and preparations of the nature of Tyrian purple, with the addition of a remarkable transparent green used from the eighth to the fourteenth century, which owes its pigmentary value to copper, although it has not been possible to determine exactly the nature of the compound. A green closely resembling it in appearance and properties can, however, be prepared by dissolving verdigris in Canada balsam or other semi-liquid pine resins. In no case were any specimens of the Egyptian blue which was used so largely in classical times found on the manuscripts. It therefore seems probable that the method of manufacture of this copper silicate was lost before the seventh century.

In addition to these pigments, earth colours were occasionally used, and there are rarely present some pigments which it is difficult to classify. The lake used after the thirteenth century is closely matched by lac lake, which was introduced for dyeing purposes about that time, and on the manuscripts of the late fifteenth century a fine lake appears, which in one case has been identified with every probability as madder lake. The tests, however, cannot be regarded as absolutely conclusive.

No fresh light beyond that contained in the known records can be thrown on the mediums used, with the exception that on one later fifteenth-century manuscript the medium has been proved to be beeswax.

All the pigments mentioned on the above list were not used in the same countries at the same time. It is possible to show a gradual improvement, for instance, in the preparation of ultramarine from lapis lazuli. The use of a fine verdigris is not found until the beginning of the fifteenth century, and azurites of different quality appear and disappear at definite dates, while a marked distinction can be drawn between the palette used in Byzantium and Ireland, and that used in the rest of Europe from the tenth century. There are also remarkable examples of the use of gold dust, while the laying of golf leaf on raised gesso does not appear earlier than the eleventh century, and only becomes common in the twelfth century.

The whole result of the investigation is to settle with considerable exactness the actual pigments in use, and it is probable that the results will be of value in assisting in fixing the dates of doubtful manuscripts.

It will be noted that the pigments are almost entirely mineral in character. They are in all cases coarsely ground, and the decorative effect is largely due to the coarse crystalline particles resulting in a broken surface.

The detailed results of the investigation were laid before the Society of Antiquaries on November 28, and are being published by that society.

[1] Abstract of the opening lecture delivered at the Royal Academy of Arts on December 2 by Dr. A. P. Laurie.

## *UNIVERSITY AND EDUCATIONAL INTELLIGENCE.*

OXFORD.—On November 28 the preamble of a statute supplementing the ordinary form of procedure in Convocation by providing in certain circumstances for a special poll was moved by Prof. Geldart, supported by the Master of Balliol, and opposed on various grounds by Prof. Oman, Prof. Myres, and the president of Corpus. A division in a thin house showed twenty-five in favour of the preamble and twenty-four against it.

Sir William Mitchell Ramsay has been appointed Romanes lecturer for 1913. His subject has not yet been announced.

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THE prizes and certificates gained by students of the Sir John Cass Technical Institute during the past session will be distributed by Prof. Selwyn Image, Slade professor of fine art, Oxford University, on Tuesday, December 10, at 8 p.m.

IN reply to a question asked in the House of Commons on Monday, Mr. Wedgwood Benn said:—"The Government is under no promise to find a new site for the London University, and it is not intended to use part of the Botanic Gardens for this purpose."

IN the House of Commons on Tuesday, the Prime Minister was asked whether he was aware that in 1909 the Chancellor of Oxford University issued a memorandum urging the reform of Convocation and greater facilities for students of limited means, and that neither of these reforms had been attempted; and whether the Government was now prepared to advise that a Royal Commission be appointed to carry through those reforms. In reply, Mr. Asquith said:—"I am well aware of the importance of these matters and have given them much attention. I hope shortly to be able to make a definite statement on the subject."

THE Marquess of Northampton, K.G., will distribute the prizes and certificates at the Northampton Polytechnic Institute, Clerkenwell, to-morrow, December 6. The laboratories, workshops, &c., with various exhibits in them, will be open for inspection on that occasion, and also on Saturday evening. There will be kinematograph illustrations of twisting and breaking, by Mr. C. E. Larard; demonstrations with liquid air, by Mr. W. M. Wilcox; and an illustrated lecturette on notable bookbindings, by Mr. T. E. Harrison.

IT is announced in *Science* that Mr. George F. Baker, president of the First National Bank of New York City, has given a large sum, reported to be 400,000*l*., to bring about an alliance between the New York Hospital and the Cornell Medical College. From the same source we learn that Dr. Arthur T. Cabot, a fellow of Harvard University, has bequeathed 20,000*l*. to the Harvard Medical School and the larger part of his estate, estimated at 100,000*l*., to Harvard University, after the death of Mrs. Cabot. It is reported also that from the estate of George Crocker, Columbia University receives 315,00*l*. for the Crocker Cancer Research Fund, and that at the University of Rochester 52,500*l*. has been contributed to the endowment fund by old students living elsewhere.

FOR some years past Prof. M. J. M. Hill, F.R.S., has been endeavouring to bring into general use a modification of Euclid's method of treating the theory of proportion, in which one of the two distinct methods which Euclid employs to prove his propositions is shown to be sufficient to prove them all. The indirectness and consequent difficulty of Euclid's proofs then disappear. He has set forth his ideas in some detail in the July and October numbers of *The Mathematical Gazette* of this year, and he has arranged to give ten lectures, specially devised to meet the needs of teachers, on the subject, at University College, Gower Street, after Christmas. The lectures will be delivered on Tuesdays at 6 p.m., commencing on January 14, 1913. They are in connection with the London County Council, and are open on payment of a registration fee of 1*s*. to all teachers in schools and other educational institutions in the administrative county of London. Application for admission to the lectures should be made by January 1.

THE current session at University College, Nottingham, is the thirty-second since the foundation of the institution in 1881. The calendar for 1912–13, which has reached us, gives detailed information of courses of instruction for students desirous of graduating in one of the faculties of the University of London, and of classes arranged for technical instruction allied to the industries of the neighbourhood. The college confers the title of associate of University College, Nottingham, on students who have attended satisfactorily for three years any systematic degree or diploma course, and have passed the appropriate examinations, and on students who have passed the examinations of the three-years' course required by the Oxford and Cambridge Affiliation Scheme. College diplomas are awarded to those students who have followed the prescribed courses in engineering or mining, and passed the final examinations. Oxford and Cambridge affiliation certificates are awarded to students who, for three sessions, have received at least four hours' tuition weekly at the college, and have passed satisfactorily examinations approved by the University. The Universities of Cambridge and Oxford both grant certain privileges to students holding these certificates, who may subsequently enter either University. The diploma in mining has been approved by the Home Secretary for students qualifying for the Colliery Managers' Certificate.

A LETTER has been sent on behalf of the General Council of Edinburgh University to all the Scottish members of Parliament protesting against the action of the Treasury in respect of fees at the four Scottish universities. The Treasury has attached to the increased grants to the universities the condition that so far as class fees are concerned, an inclusive fee be substituted for the individual fees hitherto charged. In the statement addressed to the Scottish members of Parliament, we learn from *The Times*, the following paragraph occurs:—"In claiming that our ancient universities should be free we have no intention whatever of suggesting that they should not be required to give an account of how they spend public money. But the obligation to render such an account is a very different thing from the submission of the universities to the edicts of a State Department to which Parliament has assigned no right of interference with their internal affairs. The General Council protests against this extension of bureaucratic government to the Scottish universities. It is the first step towards a system which would in time destroy the true spirit of university education in Scotland." After reviewing French experience of State supervision of universities and contrasting it with the principle of academic freedom in German universities, the memorandum concludes:—"The plain teaching of history is not to be ignored. The universities of Scotland must remain free in respect both of their teaching and of their internal administration. The members of the General Council accordingly look with confidence to the Scottish members of Parliament to maintain this freedom, and to use their influence towards securing that the Treasury shall pay the grant to the universities, without deduction, and without conditions other than those laid down by Lord Elgin's Committee."

## SOCIETIES AND ACADEMIES.

### LONDON.

**Royal Society**, November 21.—Sir Archibald Geikie, K.C.B., president, in the chair.—A. S. **Russell** and R. **Rossi**: An investigation of the spectrum of ionium. The arc spectrum of an active preparation of ionium oxide mixed with thorium, separated by Prof. B. B. Boltwood from the pitchblende residues loaned to Prof. Rutherford by the Royal Society, has been investigated with a large Rowland grating. The complete spectrum of thorium was obtained, but no new lines were observed that could be attributed to ionium. It was deduced that if ionium were half transformed in 100,000 years, the preparation should contain about 16 per cent. of ionium oxide. By adding cerium and uranium to the preparation, it was found that 1 per cent. of the former and 2 per cent. of the latter could be easily detected spectroscopically. It was consequently concluded that the period of ionium cannot exceed 12,000 years. This result, taken in conjunction with Soddy's results on the period of ionium, points to the existence of at least one new, comparatively long-lived body between uranium and ionium in the disintegration series.—J. A. **Gray**: A note on the absorption of $\beta$ rays.—J. A. **Gray**: The similarity in nature of X and primary $\gamma$ rays. (1) Absorption experiments show that there is no fundamental difference in the absorption of X and $\gamma$ rays. (2) The primary $\gamma$ rays of radium E excite the characteristic radiations (series K) of silver, tin, barium, cerium, praseodymium and neodymium. (3) The scattering of the primary $\gamma$ rays of radium E is probably similar in character and magnitude to that of ordinary X-rays.—J. Crosby **Chapman**: The spectra of fluorescent Röntgen radiations. Radiations belonging to groups K L have been investigated as regards their X-ray properties. The absorption of the various radiations of both groups in copper, silver, and platinum has been found. In all cases it is shown that, if radiations from different groups suffer the same absorption in aluminium, then they are equally absorbed in any other element.—Dr. Walter **Wahl**: Optical investigation of solidified gases. II., the crystallographic properties of hydrogen and oxygen.—R. E. **Slade**: An electric furnace for experiments *in vacuo* at tem-

peratures up to 1500° C. This furnace was designed with a view to investigate, at temperatures up to 1500° C., certain cases of heterogeneous equilibrium in which the equilibrium is defined by the pressure of the system. Instances are the dissociation of oxides, nitrides, and carbonates and the reduction of oxides by carbon.—R. E. **Slade** and F. D. **Farrow**: An investigation of the dissociation pressures and melting points of the system copper—cuprous oxide. The melting point (temperature, composition) diagram of the system copper—cuprous oxide has been constructed. The following are the principal points:—Melting point of copper 1083°. Eutectic $Cu_2O$ 3·5 per cent., Cu 96·5 per cent., 1065° (determined by Heyn). Two liquid phases appear at 1195°, the denser one having the composition $Cu_2O$ 20 per cent., Cu 80 per cent., and the lighter one $Cu_2O$ 95 per cent., Cu 5 per cent. Melting point of cuprous oxide 1210°. The critical temperature at which the two liquid systems become identical is too high to be determined.—Dr. A. **Russell**: Note on the electric capacity coefficients of spheres. In connection with Mr. Jeffery's paper published in vol. lxxxvii. of the Proceedings, p. 109, the author gives and refers to formulæ by means of which the values of the capacity coefficients of equal spheres can be easily found. He uses these formulæ to check the tables given in Mr. Jeffery's paper.—W. J. **Harrison**: The motion of viscous liquid due to uniform and periodic motion maintained over a segment of an infinite plane boundary.—Prof. B. **Hopkinson** and G. **Trevor-Williams**: The elastic hysteresis of steel. A bar of steel, the reduced portion of which is 4 in. long by ¼ in. diameter, is subjected to alternating stress in the high-speed fatigue-testing machine described in a previous communication. This machine gives direct axial stress up to range of 30 tons per square inch or more, between equal limits of tension and compression, at a rate of about 120 cycles per second. The elastic hysteresis is measured by determining, with the aid of thermo-couples, the fall of temperature between the centre of the piece and each end when it is undergoing alternating stress within the elastic range. The dissipation of energy corresponding to a given fall of temperature is determined by heating the specimen with an electric current and measuring the watts dissipated by resistance. In the mild steel used in the experiments the energy dissipated per cycle when the limits of stress are $\pm 12\frac{1}{2}$ tons per square inch (giving a range of 25 tons, which is within the limiting elastic range as determined by ordinary fatigue experiments) is about 25,000 ergs per c.c., and gives a fall of temperature of about 5°. This is of the same order of magnitude as that due to the magnetic hysteresis in similar material under strong magnetic forces. The elastic hysteresis varies approximately as the fourth power of the stress range.—W. R. **Bousfield**: Ionic size in relation to molecular physics, together with a new law relating to the heats of formation of solid, liquid, and ionic molecules. In a former paper it was shown that ionic volumes (derived from mobilities) and solution volumes were connected by an empirical linear relation.

$$EV_s = a - bI_v.$$

In the present paper a new empirical relation is established of the form

$$D^{-1} = p - qN(I_v - K),$$

where D is the effective molecular freezing point depression, i.e. $\Delta/N(1+a)$. In the former paper the experimental data were given for KCl and NaCl, and in the present paper for LiCl, which data determine the constants $a$, $b$, $p$, $q$, for each salt. It is now shown that we can express in terms of these constants—(1) The factor required to reduce arbitrary ionic volume units to absolute units; (2) the volume of the ionic nuclei; (3) the volume and mean density of the "watery atmospheres" associated with the ions. It is shown for a group of fourteen solid and liquid salts and acids that their heats of formation are given by the expression $7/8\delta V + H_1 + H_2$, where $\delta V$ is the reduction of volume (or contraction) which takes place on combination, and $H_1$ and $H_2$ are constants for the elements of which they are composed. It is found that the heats of ionisation of the three salts may also be expressed under the same law as

$$\Sigma 7/8\delta V + H_1 + H_2 + 1{\cdot}3n - 29$$

where $\delta V$ includes volume change of combined water as well as of ionic nuclei, $n$ is number of molecules of combined water and $-29$ is a constant which represents endothermic changes involved in ionisation.—Dr. J. Emerson **Reynolds**: The synthesis of a silicalcyanide and of a felspar. During recent years the writer has obtained many compounds of silicon in which that element is directly united with the nitrogen of various organic groups, and amongst these silicocyanogen, SiN, in combination. The proof so obtained that silicon has a strong attraction for trivalent nitrogen in organic substances suggested that a similar capacity is operative in the mineral kingdom, but in respect of trivalent aluminium acting in the nitrogen rôle towards silicon. It seemed probable that some at least of the more important rock-forming minerals may be regarded as fully oxidised products of alumino-*silicides* somewhat analogous to SiN. The experimental work recorded in the paper supports this view, and has resulted in the formation of a remarkably stable substance termed *Calcium Silicalcyanide*, $Ca(SiAl)_2$, analogous to ordinary calcium cyanide, $Ca(CN)_2$. From this silicalcyanide a further synthesis of the felspar *Anorthite*, $CaSi_2Al_2O_8$, has been effected.—Prof. C. **Niven** and A. E. M. **Geddes**: A method of finding the conductivity for heat.

**Royal Microscopical Society**, November 20.—Mr. H. G. Plimmer, F.R.S., president, in the chair.—E. **Heron-Allen** and A. **Earland**: The distribution of *Saccammina sphaerica* (M. Sars) and *Psammosphoera fusca* (Schulze) in the North Sea, with particular reference to the suggested identity of the two species. These Foraminifera, belonging to the family Astrorhizidæ, and originally described as from the North Sea, but occurring also in all the great oceans, have been the subject of considerable controversy. Dr. Ludwig Rhümbler asserts that Psammosphœra is only an immature stage of Saccammina. As a result of the examination of about 150 dredgings made in the North Sea, the authors have no hesitation in affirming that the life-history of Saccammina, as recorded by Rhümbler, is a composite sketch, involving three separate and generally recognised specific organisms: Stages I. to III. represent the life-history of *Crithionina mamilla* (A. Goes); stage IV. is *Psammosphoera fusca* (Schulze), an extremely variable species, which occurs both free and sessile, but is in all its stages normally recognisable by the absence of a general aperture; stages V. to VII. represent the complete life-cycle of *Saccammina sphaerica* (Sars), so far as it is a shell-bearing organism.—Rev. Hilderic **Friend**: British Henleas. The Henleas are microscopic annelids belonging to the family of Euchytræids. The genus was created in 1889 by Michaelsen, and contained four authentic species and four which were doubtful. The present paper gives an enumeration of no fewer than nineteen species, eighteen of which are found in England and one in Ireland. Of these, seven new to science were found at Hastings in December last, and three have been found in Nottingham during the present year.—J. **Murray**: African

Tardigrada. This paper adds thirteen species to the list of African Tardigrada; twelve were described in the author's previous paper, and Daday added a new species, *M. tetronyx*.

**Institution of Mining and Metallurgy,** November 21.—Mr. Edward Hooper, president, in the chair.—Allan J. **Clark** and W. J. **Sharwood**: The metallurgy of the Homestake ore. The round of operations after delivery of the mined ore to the mill bins may be summarised briefly as follows:—The ore is fed to mortars fitted with one inside amalgamation plate, when it is crushed wet by gravitation stamps and thence passes over a series of amalgamating plates. A special cone system separates a small proportion of the coarsest sand, which is reground and returned. A system of cone classifiers, the last of the series provided with bottom water feed, separates successive portions of the fine slime. The sand is collected, drained, and treated with cyanide solution, in vats from which the residues are discharged by sluicing. The slimes overflowing the various cones are thickened in classifying tanks having conical bottoms and peripheral overflow, and the thickened slime is conveyed by a pipe line to a cyanide plant, where it is collected and treated in filter presses, which are discharged without opening by means of an automatic sluicing device. Solutions are precipitated by zinc dust. Concentration proper is not practised, and no ore is sorted. From the time the ore leaves the mine, no elevation is necessary, and only a small proportion of the water has to be pumped back at certain stages. Of the total ore value 94 per cent is recovered, about 72 per cent. as amalgam, and 22 per cent. by the cyanide process.—J. W. **Ashcroft**: The flotation process, as applied to the concentration of copper ore at the Kyloe Copper Mine, New South Wales. An adjourned discussion on this paper, which had been introduced at a previous meeting, gained additional interest from the fact that a working model of the particular flotation process referred to in the paper was exhibited, and samples of well-known ores were treated before the members present.

CAMBRIDGE.

**Philosophical Society,** November 11.—Sir J. J. Thomson in the chair.—Sir J. J. **Thomson**: The theory of the motion of charged ions through gases.—Dr. G. F. C. **Searle**: A simple method of determining the viscosity of air. Air is compressed into a vessel of volume S c.c. (about 10 litres) and is then allowed to escape through a capillary tube of length $l$ cm. and radius $a$ cm. into the atmosphere, the pressure of which is P dynes per sq. cm. The pressure in the vessel falls from $p_1$ to $p_2$ during $t$ secs. Over a considerable range of initial pressure the value of $t/\lambda$ is found to be constant. The temperature of the air in the vessel is maintained nearly constant by the surrounding atmosphere. The method is convenient as a rough and ready method in a large practical class.—R. **Whiddington**: Note on the Röntgen radiation from kathode particles traversing a gas. During some experiments with a lime kathode it was noticed that even when the beam of kathode particles was not permitted to strike a target a comparatively strong radiation could be detected, proceeding apparently from the path of the kathode particles. The evidence goes to show that this is a Röntgen radiation arising from the encounters taking place between the kathode particles and the molecules of the residual gas within the discharge tube. It has been shown that a metal plate insulated and exposed to the action of these rays may charge up positively, emitting negative particles of very nearly the same velocity as the kathode particles traversing the discharge tube. The potential applied to the discharge tube varied in these experiments between 90 and 300 volts.—W. L. **Bragg**: The diffraction of short electromagnetic waves by a crystal. The paper deals with the interference phenomena observed by Herren Friedrich, Knipping, and Laue when a crystal is traversed by a narrow beam of rays from an X-ray bulb. The theory which is put forward by Laue to account for these phenomena postulates the existence of definite wave-lengths in the incident radiation, in order to explain the interference pattern of spots obtained. The paper shows that, on the contrary, the pattern obtained with the crystal of cubical zinc blende used by Laue is in reality the most general one possible for a continuous range of wave-lengths in the incident radiation, if the arrangement of atoms in the crystal is in accordance with the theory of valency volumes of Pope and Barlow. The incident radiation is regarded as a series of independent pulses, and the interference maxima as formed by reflection of these pulses in ideal planes in the crystal in which the atoms can be arranged, this point of view leading to greater simplicity of calculation.—H. E. **Watson**: Experiments on the electrical discharge in helium and neon.—H. C. **Pocklington**: Some diophantine impossibilities.—G. N. **Watson**: A class of integral functions defined by Taylor's series.—A. J. **Berry**: Notes on the volatilisation of certain binary alloys in high vacua. Experiments have been performed on the behaviour of certain binary alloys when heated in high vacua with the object of isolating intermetallic compounds (compare Roy. Soc. Proc., 86A, 1911, 67). In the case of alloys of copper and cadmium it was found that these two metals are quantitatively separable. When alloys of cadmium and magnesium are heated *in vacuo*, both metals volatilise together, but no definite relation between the composition of the residue and the distillate was established. The behaviour of the magnesium lead alloys indicates that the compound $Mg_2Pb$ is largely dissociated in the vaporous state.

MANCHESTER.

**Literary and Philosophical Society,** October 29.—Prof. F. E. Weiss, president, in the chair.—Dr. Kurt **Loewenfeld**: Importance of autograph documents in the history of science (part i.). The author dealt with the usefulness of historical studies for the student of natural history, and the value of such studies for education as a whole. The documents exhibited and discoursed upon included many connected with John Dalton, the last table of atomic weights as drawn up by Dalton, between 1818 and 1827, amongst others; also letters by William Henry. A letter by Charles William Henry, inasmuch as it contradicts a statement in his own biography of Dalton, proves that he is not a trustworthy historian, and, as Charles William Henry's biography supplies some of the most valuable material for the important question of the genesis of the atomic theory, Dr. Loewenfeld considered this incident of importance.

DUBLIN.

**Royal Irish Academy,** November 11.—Count Plunkett, vice-president, in the chair.—W. J. **Dakin** and Miss **Latarche**: The plankton of Lough Neagh. The paper gives the results of the first detailed quantitative plankton research carried out on the lakes of the British Islands. Owing to the large area of the lake surface and the moderate depth (40 ft.) Lough Neagh is of particular interest. It is already famous for the presence, in very large numbers, of the Schizopod *Mysis relicta*. The authors have traced the seasonal development and interrelation of both the animals and plants by means of quantitative catches

made at frequent intervals throughout a year. The seasonal variation is compared with that known for various European lakes. An interesting resemblance of Lough Neagh to the Danish lakes is discussed, and the contrast between the plankton of the Scottish lakes and Lough Neagh treated. The investigation has shown that so far as both the animals and plants are concerned Lough Neagh plankton contains a mixture of Arctic and Central European forms. Seasonal *form* variation has been observed in the case of several species, and the whole question of form variation is discussed. The authors cannot accept the Wesenburg-Lund-Ostwald theory that changes in shape in pelagic organisms are called forth directly by changes in the viscosity of the water. *Mysis relicta* has been found in thousands in the *surface* water of the lake at midnight. It was not previously known that *M. relicta* was a common plankton form.—Rev. T. **Roche**: The quadratic vector functions. The most general form of the quadratic vector function is taken to be

$$aS\rho\phi_1\rho+\beta S\rho\phi_2\rho+\gamma S\rho\phi_3\rho,$$

$\phi_1$, $\phi_2$, $\phi_3$ being symbols of linear vector functions, which may be taken as self-conjugate. A discussion on the properties of the function $k_1\phi_1+k_2\phi_2+k_3\phi_3$ is prefixed by way of introduction. Some very interesting relations are found between the invariants and associated functions of three linear functions. Then an attempt has been made to classify the functions, cases of degeneration to binomial and monomial forms are examined, and a few paragraphs have been added on the problem of inversion. The general problem does not seem capable of a solution; two particular cases are worked out fully. The number of roots for which the function vanishes has been investigated, this problem being a special case of the general problem of inversion. The last paragraph deals with the "central axes" of the quadratic function.—In connection with the Clare Island Survey the following reports were read:—G. H. **Carpenter**: Pycnogonida.—W. F. **Johnson**: Myriopoda.—A. D. **Cotton**: Marine algæ, part ii.—P. H. **Grimshaw**: Diptera. This paper embodies the results obtained from the examination of more than 4000 specimens collected mainly during the summer months of 1910 and 1911. The number of species identified is 519, of which 160, or rather more than 30 per cent., are new to the fauna of Ireland. Some forty-four families are represented, and five species are new to Britain. Critical remarks are made regarding several of the species in the more difficult families, *e.g.* the Tendipedidæ (Chironomidæ) and the Anthomyiidæ, and it is hoped that such will prove an aid to future workers. The fauna of Clare Island includes, as at present known, 211 species, as compared with 476 recorded from the adjacent mainland. The species common to the island and the mainland number 168, while forty-three are recorded from the island alone.

CAPE TOWN.

**Royal Society of South Africa**, October 16.—Dr. T. **Muir**: Note on double alternants.—Dr. T. F. **Dreyer**: *Xenopus laevis* (the Plathander).—J. **Walker**: A short note on the occurrence of Aspergillosis in the ostrich in South Africa. The occurrence of Aspergillosis in the ostrich is recorded, and the author believes this to be the cause of mortality in chicks and to a less extent in adults. The fungus concerned was *Aspergillus fumigatus*. The seat of lesions is principally the lungs (pneumomycosis).—Dr. J. R. **Sutton**: A preliminary survey of the meteorology of Kimberley. A contribution to a study of the meteorology of the tableland of South Africa. An account is given of the principal meteorological elements of Kenilworth (Kimberley), all of which, with the exception of the rainfall, are expressed in deviations from the normal monthly means derived from observations made during the last fifteen years.—C. **Moorsom**: Some geodetic elements.—Dr. E. S. **Goddard** and D. E. **Malan**: (1) South African Oligochæta. Part i., a Phreodrilid from Stellenbosch Mountain. The anatomy of a new genus of *Phreodrilid oligochaeta* is described, and constitutes the first record of the family in Africa. The specimens were obtained on the top of Stellenbosch Mountain. The new genus—Gondwanædrilus—is of interest since its occurrence in Africa completes the circumpolar distribution of the family. Its anatomy is important since it fills in the last gap in the series of peculiar relations of the spermathecæ, and leads to an understanding of modifications such as the "autospermatheca" of Phreodriloides—an Australian form.—(2) Part ii., description of a new species of Phreodrilus. An account of a new species of Phreodrilus taken on Table Mountain. It is interesting since it is related to *P. beddardi* and *P. subterraneus*. The peculiar anatomical features concern the dorsal position of the spermathecal pores, and a large hollow penis. The new form suggests that Phreodrilus is the central type of the family. (3) Contributions to knowledge of South African Hirudinea. Part ii., some points in the anatomy of *Marsupiobdella africana*. An account of the anatomy of Marsupiobdella, a new Glossiphonid leech, with a large internal brood pouch. The main points are concerned with the distortion and displacement of the digestive, nervous, and reproductive systems by the great development of the brood pouch.—Dr. L. **Péringuey**: Portuguese commemorative pillars erected on the South African coast. During the reign of John II., King of Portugal, the Portuguese navigators sailed for the first time provided with commemorative pillars, or "Padraos" to be erected at the furthest point reached. Diogo Cam is the first of these navigators who left Portugal with these regulation pillars. Portuguese historians attribute to him the erection of three, the most southern of which, erected at Cape Cross in 15° 40′ S. in 1486, was rediscovered in 1893. But the old chroniclers are not clear about the number of Padraos erected by Bartholomew Dias, and hitherto three only were mentioned, whereas it would appear that he put up five. Of all these pillars two only are now known to be in existence, Cam's pillar at Cape Cross, and a fragment of the Padrao Santiago, from Angra Pequena, is in the Cape Museum. The object of this note is to direct attention to the possibility of finding some remnants of the others.

## BOOKS RECEIVED.

Smithsonian Institution. Bureau of American Ethnology. Bulletin 52: Early Man in South America. By A. Hrdlička and others. Pp. xv+405. (Washington: Government Printing Office.)

The Ways of the Planets. By M. E. Martin. Pp. v+273. (New York and London: Harper and Brothers.) 5*s*. net.

Le Origini Umane. By G. Sergi. Pp. xi+202. (Torino: Fratelli Bocca.) 3.50 lire.

Le Principle du Mouvement des Eaux Souterraines. By J. Versluys. Dutch translation by F. Dassesse. Pp. 147. (Amsterdam: W. Versluys.) 7 francs.

In the Shadow of the Bush. By P. A. Talbot. Pp. xiv+500+plates+map. (London: W. Heinemann.) 18*s*. net.

New Trails in Mexico. By C. Lumholtz. Pp. xxvi+411. (London: T. Fisher Unwin.) 15*s*. net.

A Systematic Course of Practical Science for Secondary and other Schools. By A. W. Mason. Book I. Pp. vi+126. (London: Rivingtons.) 1*s*. 6*d*. net.

Lehrbuch der Paläozoologie. By Prof. E. F. Stromer v. Reichenbach. II. Teil, Wirbeltiere. Pp. viii+325. (Leipzig and Berlin: B. G. Teubner.) 10 marks.

Die erklärende Beschreibung der Landformen. By Prof. W. M. Davis. German edition by Dr. A. Rühl. Pp. xviii+565. (Leipzig and Berlin: B. G. Teubner.) 11 marks.

Lehrbuch der Physik für Mediziner und Biologen. By Prof. E. Lecher. Pp. vii+451. (Leipzig and Berlin: B. G. Teubner.) 8 marks.

The Doctor's Dog: a Poem against Vivisection. By R. Dailley. Pp. 62. (London: G. Allen and Co., Ltd.) 1s. net.

Index Zoologicus. No. II. Compiled (for the Zoological Society of London) by C. O. Waterhouse and edited by D. Sharp. Pp. iv+324. (London: The Zoological Society of London.) 15s.

The Principles of Applied Electrochemistry. By Dr. A. J. Allmand. Pp. x+547. (London: E. Arnold.) 18s. net.

Electroplating. By W. R. Barclay and C. H. Hainsworth. Pp. viii+399. (London: E. Arnold.) 7s. 6d. net.

Astronomy. By G. F. Chambers. Pp. xxiv+272+plates. (London: Hutchinson and Co.) 5s. net.

The Infancy of Animals. By W. P. Pycraft. Pp. xiv+272+plates. (London: Hutchinson and Co.) 6s. net.

The Essentials of Physics. By Prof. G. A. Hill. Pp. viii+346. (London: Ginn and Co.) 5s.

Elementary Applied Chemistry. By L. B. Allyn. Pp. xi+127. (London: Ginn and Co.) 3s.

New Analytic Geometry. By Profs. P. F. Smith and A. S. Gale. Pp. x+342. (London: Ginn and Co.) 6s. 6d.

Daytime and Evening Exercises in Astronomy. By Dr. S. F. Whiting. Pp. xv+104. (London: Ginn and Co.) 3s. 6d.

The Scientist's Reference Book and Diary, 1913. (Manchester: J. Woolley, Sons and Co., Ltd.)

A Course of Elementary Practical Physics. By H. V. S. Shorter. Part i., pp. 111; part ii., pp. 216. (Oxford: Clarendon Press.) 2s. and 3s. respectively.

The "Wellcome" Photographic Exposure Record and Diary, 1913. (London: Burroughs, Wellcome and Co.)

## DIARY OF SOCIETIES.

*THURSDAY*, DECEMBER 5.

ROYAL SOCIETY, at 4.30.—A Gregarine, *Steinina rotundata*, nov. sp., present in the Mid-gut of Bird Fleas of the Genus Ceratophyllus: Dr. J. H. Ashworth and Dr. T. Rettie.—(1) The Size of the Aorta in Warm-blooded Animals and its Relationship to the Body Weight and to the Surface Area expressed in a Formula; (2) The Size of the Trachea in Warm-blooded Animals and its Relationship to the Weight, the Surface Area, the Blood Volume and the Size of the Aorta: Prof. G. Dreyer, W. Ray, and E. W. A. Walker.—Studies of the Processes Operative in Solutions. (1) The Conversion of Ammonic Cyanate into Urea, especially as Influenced by Alcohols: E. E. Walker; (2) The Hydrolysis of Cane Sugar by Dilute Acids; (3) The Hydrolysis of Cane Sugar by Sulphuric Acid, with a Note on Improvements in Polarimetic Apparatus; (4) The Hydrolysis of Methylic Acetate by Acids: F. P. Worley; (5) The Nature of Hydrolytic Process: Dr. H. E. Armstrong and F. P. Worley.—The Direct Production of Characteristic Röntgen Radiations by Kathode Particles: Dr. R. T. Beatty.—The Penetrating Power of the $\gamma$ Rays from Radium C: A. S. Russell.—The Photo-electric Behaviour of Iron in the Active and Passive State: Dr. H. S. Allen.—A Determination of the Radiation Constant: H. B. Keene.—Physiological Observations made on Pike's Peak, Colorado, with Special Reference to Adaptation to Low Barometric Pressures: C. G. Douglas, Dr. J. S. Haldane, Y. Henderson and E. C. Schneider.—Notes on the Life History of *Trypanosoma gambiense*, with a Brief Reference to the Cycles of *Trypanosoma nanum* and *Trypanosoma pecorum* in *Glossina palpalis*: Muriel Robertson.

LINNEAN SOCIETY, at 8.—Notes on Two Orchids New to East Sussex, and on several Rarer Species of Orchidaceæ: E. J. Bedford.—The Hebridean Diagona described as "Syntethys," and other Exhibits from the Cruise of the S.Y. *Runa* in 1912: Prof. W. A. Herdman.—Nature Camera Work, an Attempt to Combine Photography with Drawing in Body-colour: Miss Maud Umfreville Clarke.—Coloured Drawings of South African Plants: Miss Mary W. Johnstone.

SOCIETY OF DYERS AND COLOURISTS, at 7.30.—The Fellmongering of Sheep Skins and its Bearing on Leather Dyeing: M. C. Lamb.

*MONDAY*, DECEMBER 9.

ROYAL SOCIETY OF ARTS, at 8.—Methods of Economising Heat: C. R. Darling.

*TUESDAY*, DECEMBER 10.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.30.—Ancient and Modern Nubas: D. E. Derry.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Generation and Distribution of Producer-gas in South Staffordshire: H. A. Humphrey.

FARADAY SOCIETY, at 8.—The Electromotive Forces of Concentration Cells: Principal A. P. Laurie.

*WEDNESDAY*, DECEMBER 11.

ROYAL SOCIETY OF ARTS, at 8.—Natural and Synthetic Rubber: Dr. F. Mollwo Perkin.

AËRONAUTICAL SOCIETY, at 8.30.—The Mathematical Theory of Aëroplane Stability: E. H. Harper.

*THURSDAY*, DECEMBER 12.

MATHEMATICAL SOCIETY, at 8.—Recent Advances in the Theory of Surfaces. Address by the ex-President (Dr. H. F. Baker), postponed from the November Meeting.—A Connection between the Functions of Hermite and Jacobi: H. E. J. Curzon.—The Equations of the Theory of Electrons Transformed Relative to a System in Accelerated Motion: H. R. Hassé.—The Convergence of Series of Orthogonal Functions: E. W. Hobson.—The Determination of the Nature of a Function from a Knowledge of One of its Derivatives: W. H. Young.—Mersenne's Primes: J. McDonnell.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—A Single Phase Motor with Pole Changing Windings: J. S. Nicholson and B. P. Haigh.

ROYAL SOCIETY OF ARTS, at 4.30.—Delhi, the Metropolis of India: Sir Bradford Leslie, K.C.I.E.

CONCRETE INSTITUTE, at 7.30.—The Effects on Concrete of Acids, Oils and Fats: Robert Cathcart and Laurence Gadd.

*FRIDAY*, DECEMBER 13.

ROYAL ASTRONOMICAL SOCIETY, at 5.

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ST. MARTIN'S STREET, LONDON, W.C.

*Advertisements and business letters to be addressed to the Publishers.*

*Editorial Communications to the Editor.*

*Telegraphic Address:* PHUSIS, LONDON.
*Telephone Number:* GERRARD 8830.