THURSDAY, NOVEMBER 6, 1913.

GERMAN SCHOOL CHEMISTRY.

Methodik des chemischen Unterrichts. By Dr. Karl Scheid. Pp. xv+448. (Leipzig: Quelle und Meyer, 1913.) Price 20 marks.

EDUCATIONAL restlessness, so characteristic of the times in England, prevails to a scarcely less degree in the country to which we are so often directed to turn for pedagogic inspiration; and the agitation about methods of teaching science is not the least remarkable example of the contemporary stir in the educational world of Germany.

The present volume is the fourth of a series constituting a handbook of scientific and mathematical instruction issued under the editorship of Dr. J. Norrenburg, and is written by a professor of the Realgymnasium mit Oberrealschule at Freiburg in Breisgau. "Knapp und einfach in der Form," it is declared to be by the editor; "Knapp" it may be by Teutonic standards, but it extends to about 450 large pages, and it "grinds exceeding small," as books on Methodik are apt to do in every language. However, the work is of much interest, and to a large degree readable. It refers to German boys' schools, and the terminology of the German system, with its slight and subtle variations, presents some difficulty to the English reader.

The first or general part of the book gives an account of the history of chemistry teaching in German schools, a description of its present condition, and of the various recommendations and criticisms that have been made by scientific, medical, or industrial authorities. The general educational principles involved in science teaching are discussed at considerable length with a great deal of division and sub-division. The second or special part of the book gives the outline of a suggested course of school chemistry.

The chief impression produced by reading this account of German school science is the comfortable one that we in England are well in advance of Germany in our attempts to make science worthy of its place in the school curriculum. It is somewhat remarkable that a German writer should have paid such little attention to what has been going on in other countries. There is a eulogistic reference to Faraday's "Chemistry of a Candle," but no allusion to the very great work that has been done in England during the last twenty-five years towards improving school science.

The difficulties recounted by Dr. Scheid, the unsatisfactoriness of the traditional methods, and the obstacles to reform, are very much the same as we have known here. There has been a strong academic prejudice against the intrusion of science into the school curriculum; the science that has been taught has been diluted university science administered dogmatically; sciences have been artificially severed; they have been detached from living nature and from human interests; they have resulted in a thing of shreds and patches that has been of no account for any terrestrial or celestial purpose. Against all this a rebellion has been fermenting; the demonstration is condemned; the pupils are to work in laboratories; they are to be put into the position of discovering rather than of being told; things, in fact, are moving as they have moved here, but they have not moved so fast.

There are many wise things said in the book, which, if they are not new, are the things that need to be said again and again. Dr. Scheid insists, for example, that the school teacher must remember that he has not got a collection of prospective chemists before him; that the method of teaching is more important than the range of matter; that every occasion must be taken to connect school teaching with the realities of life and industry; that the artificial tendency, not imposed by nature, between natural history and the exact sciences must disappear, if the realistic (*i.e.* modern) schools are to be true educational institutions in a thorough cultural sense. Only then will the Ober-realschulen and Realgymnasien be in a position to give a scientific education equivalent to the humanistic one. The distribution of different branches of science to different teachers, the severance of physics from chemistry, are deprecated. Chemistry dissociated from physics, says the author, is resolved into a mosaic of details. Boyle, Dalton, and Davy were chemists and physicists in one person.

The course of chemistry outlined by Dr. Scheid is not quite like those which have supplanted the old academic courses that prevailed in this country. He begins with limestone, and makes it the object of some fundamental observations, partly quantitative, passing then to air and combustion. Sulphur and sulphuric acid lead to hydrogen, and then comes water. Flame, salt, and hydrochloric acid, quantitative experiments on the laws of combination, carbon and carbon dioxide, carbonates, nitrogen compounds, phosphorus, silicon, and the heavy metals—these complete the topics of the lower course. The higher is more like the traditional systematic course. Proposals for the treatment of organic chemistry begin with alcohol, and include a restricted list of the substances and topics related more especially to everyday life.

Whilst the course suggested is in many respects interesting, and no doubt a great improvement on much that has prevailed, it does not seem to be better than many that are now being followed in this country.

It is well known that the prominent position taken by Germany in chemical science is in no degree due to the quantity or quality of the chemistry in its schools. We still hear, indeed, from time to time, of the pronouncement made a score of years ago by a group of eminent German chemists to the effect that a classical education was to be preferred above all else as a preparation for the serious study of science. This pronouncement is akin to many that are heard in the world of education, and is of the nature of those half-truths which are so particularly mischievous. Just as in this country, so long as modern studies were disdained and were the resort of the less intellectually gifted, and so long as modern studies were being taught on a vicious model, ancient studies might well seem to be the best preparation for every kind of higher training.

It will be interesting to see the face of German education when Dr. Scheid and his coadjutors have achieved their reform of its school science. Meanwhile it matters much less in Germany than here whether school science is good or bad, for in Germany there is plenty of education, and of good education, of some kind; there is a sincere belief in it; there is a sincere belief in science; and there are plenty of men sufficiently well trained to keep the country eminent in science and pre-eminent in the application of scientific knowledge to the welfare of the State.

ARTHUR SMITHELLS.

ZOOLOGICAL BIBLIOGRAPHIES AND CATALOGUES.

(1) *Catalogue of the Books, Manuscripts, Maps, and Drawings in the British Museum (Natural History).* Vol. iv., P—SN. Pp. 1495–1956. (London: British Museum (Natural History); Longmans, Green and Co., 1913.)

(2) *A Bibliography of the Tunicata*, 1469–1910. By John Hopkinson. Pp. xii+288. (London: The Ray Society; Dulau and Co., Ltd., 1913.) Price 15*s*. net.

(3) *Catalogue of the Noctuidæ in the Collection of the British Museum.* By Sir G. F. Hampson. Plates cxcii–ccxxi. (London: British Museum (Natural History); Longmans, Green and Co., 1913.)

(4) *Catalogue of the Ungulate Mammals in the British Museum (Natural History).* Vol. 1, Artiodactyla, Family Bovidæ, Subfamilies Bovinæ to Ovibovinæ. By R. Lydekker, F.R.S. Pp. xvii+249. (London: British Museum (Natural History); Longmans, Green and Co., 1913.)

(1) THE British Museum of Natural History continues to issue at frequent intervals a series of extremely useful catalogues, guides to the collections, or other valuable volumes. Not the least welcome of these to workers in the museum, although probably not of general interest to the public, is the "Catalogue of the Books, Manuscripts, Maps, and Drawings." This, under the superintendence of Mr. B. B. Woodward, the librarian, is still in course of completion, and vol. iv. now lies before us. Starting at P, it brings the entries under authors' names down to SN. We learn from the director's preface that the first sheet was passed for press in October, 1910, and the issue of this volume marks a distinct advance in cataloguing a library, the value and richness of which is probably known to very few of the public.

(2) A catalogue of a very different nature is Mr. John Hopkinson's "Bibliography of the Tunicata," from 1469–1910, compiled for the Ray Society. This was commenced for the private use of its author in connection with the publication by the Ray Society of the late Messrs. Alder and Hancock's "British Tunicata." During the course of its completion it was found to contain so many references not in any previous bibliography that it appeared to Mr. Hopkinson that if printed it might be useful to others—a surmise which we expect will prove correct, as the bibliography, which must have involved immense labour, has been very carefully prepared.

(3) A second volume issued by the British Museum contains plates 192–221 of Sir George Hampson's "Catalogue of the Noctuidæ." In this a large number of species are illustrated, the work having been carefully executed by Messrs. West, Newman and Co. The colours have been very well reproduced; each species is named, and a reference given to its habitat and the page on which it is described.

(4) The first volume of Mr. R. Lydekker's "Catalogue of the Ungulate Mammals" deals with the cattle, sheep, goats, chamois, takin, and musk-oxen. Owing to the large size of most of the species and the relatively small number of specimens available, the work is written on lines different from those governing other catalogues. Real systematic detail and thorough conciseness of description cannot be attained until a much larger series of specimens can be accumulated. Instead, although the principle of priority in scientific nomenclature has been adhered to, an

attempt has been made to render the descriptions as little obtuse as possible, so that they may be of interest to sportsmen as well as to scientific naturalists, to the former of whom the Ungulates are of special interest.

Recent minute study and careful comparison of specimens has led to such multiplication of species that new arrangements of them are unavoidable. In most modern works an attempt is made to group the known forms by instituting new and narrower genera which are often identical with old-time species. Mr. Lydekker attempts to attain the same end by classing nearly-related forms as races of a single species. We are not sure that we approve of this method, which involves a greater use of trinomials, where binomials would often suffice, and is, we think, a hopeless struggle against modern tendencies. In the case of the musk-oxen this practice gains nothing; nor does it seem a great advantage to grade all the sheep inhabiting the North American continent as subspecies of *Ovis canadensis*. In other respects we have nothing but praise for a work which will certainly be valued by those for whom it is intended.

THE SCIENCE OF FORESTRY.

(1) *The Theory and Practice of Working Plans (Forest Organisation)*. By Prof. A. B. Recknagel. Pp. xii + 235 + 6 plates. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1913.) Price 8*s*. 6*d*. net.

(2) *The Important Timber Trees of the United States: A Manual of Practical Forestry*. By S. B. Elliott. Pp. xix + 382 + plates. (London: Constable and Co., Ltd., 1913.) Price 10*s*. 6*d*. net.

(3) *A Handbook of Forestry*. By W. F. A. Hudson. Pp. ix + 82. (Watford: The Cooper Laboratory, n.d.) Price 2*s*. 6*d*. net.

THE output of forestry literature in America is becoming remarkable. In addition to several admirable periodical publications like the *Forest Quarterly* and the Proceedings of the Society of American Foresters, as well as the numerous bulletins, circulars, and miscellaneous works issued by the Forest Service at Washington, there are constantly appearing now useful text-books on the different branches of the science of forestry. These are especially valuable to us, as, with the exception of the standard works of Nisbet and Schlich, which are necessarily limited and stereotyped in scope, scarcely any serious books on forestry have appeared of late years in England. In arboriculture, which is the study of individual trees, on the contrary, English writers still keep up the tradition of Loudon and are in the first rank.

(1) Forest organisation is the subject of an excellent book by Prof. Recknagel, of Cornell University. The works in English on this important branch of forestry hitherto available have been practically two only, Schlich's "Manual," vol. iii., somewhat limited in scope, and D'Arcy's "Working Plans," confessedly confined to Indian practice. We have had no treatise which gave a general discussion of the subject. The merit of Prof. Recknagel's work is the clear and concise way in which he treats of the different methods of estimating the yield of the forest, and the ample details which he gives concerning the modes of management in Germany, Austria, France, and the United States. The author agrees with Schlich in considering that Judeich's method is the most rational of the seventeen methods described for determining the yield, *i.e.*, of calculating the actual amount of timber that should be cut annually in a forest, which is worked so as to give a constant annual return. This method, with obvious simplifications, can be adapted to ordinary estates in England, on which there is a considerable area of woods of different ages. On p. 53, line 9, there is an obvious error: 49,000 should read 24,500.

(2) It is significant of the depletion of the timber supplies of the United States that numerous books are now being published there which deal with the formation of new woods by planting methods. The latest of these, by Mr. Elliott, is designed for the use of private landowners in America. The first part (pp. 1–129) deals with the ordinary details of sylviculture, and contains nothing novel, though the account of nursery work, as it is carried on in Pennsylvania, with illustrations of the State Forest Nursery, is of considerable interest.

The second part of the book (pp. 130–357) is a description of the important timber trees which are suitable for planting for profit in North America. There is scarcely any information in this which will be of much service to English foresters, as the author's experience is mostly drawn from the eastern part of the United States, while for us it is the Pacific Coast trees that are of value. His knowledge of the latter is limited, as evidenced by the perfunctory way in which the Douglas fir is treated, and the omission of the Sitka spruce. The statement that "one who purchases Western hemlock believing it to be Oregon pine is not much wronged" is quite erroneous. The latter tree (*Pseudotsuga Douglasii*) is, of course, much superior to the hemlock, both in rate of growth and in the quality of the timber produced. The account of the cultivation in America of Scots pine, European larch, and Norway spruce is of considerable interest. All three grow well for a time, but never make good trees in the eastern parts of the United States.

(3) The "Handbook of Forestry," which has been issued by the Cooper Laboratory at Watford, is inconvenient to handle, being a thin folio of 82 pages, with 25 illustrations of very unequal merit. While generally sound in regard to practice, it contains nothing that has not been said before in several small, handy text-books, and is startling in its omissions. While the London plane is included as a forest tree, the Corsican pine, which is the most valuable of its genus for many soils and situations, is omitted. In the chapter entitled "conditions affecting growth" nothing is said about the important questions of altitude, exposure to wind, situation near the sea or inland, and latitude, all important factors influencing the choice of species and the formation of new plantations. The "Black Poplar" (*Populus nigra*) is correctly drawn; but in the description it is confused with the "Black Italian Poplar" (*Populus serotina*), the fast-growing hybrid tree, which should always be planted in preference to the former, when timber is required.

Such statements as (p. 64) that the lime is not indigenous, and names like *Tilia magnifolia,* show that the author is not well acquainted with forest botany. The two native birches are distinguished by drawings, but nothing is said of their very different soil-requirements.

OUR BOOKSHELF.

Practical Stone Quarrying: a Manual for Managers, Inspectors, and Owners of Quarries, and for Students. By A. Greenwell and Dr. J. Vincent Elsden. Pp. xx + 564. (London: Crosby Lockwood and Son. 1913.) Price 12*s*. 6*d*. net.

WHEN our hard-headed forbears were roving Piltdown, the art of the quarryman could scarcely have been in its infancy; yet we have far to travel in the mazes of the past if we must find its beginnings, and the work of some of the early masters of the craft still remains to excite our wonder. From the nature of the material ancient methods were very like our own, and probably differed mainly in speed.

Old though the art may be we are still in doubt as to what a quarry is; most likely the ancient quarryman was not troubled with this question, but now, what with Acts of Parliament, judicial embellishments, and the sanction of custom, it has become impossible to define "quarry." The authors of this volume have made a brave effort to clear up the confusion; it is very interesting, but scarcely successful. They have had almost as much difficulty with "stone"; however, by including some "mines" among the quarries and omitting to take account of some materials which would come under their own definition of stone, they have succeeded in producing an eminently satisfactory book on the subject, one for which there was a real need.

After an adequate discussion of the occurrence of stone, the distribution of quarries in the United Kingdom, and divisional planes in rocks, there follows some excellent advice on the location of quarries and their proper development, a subject of the greatest importance.

A large amount of space is devoted to methods of extraction, tools, blasting, cableways, and haulage systems. The table, p. 300, giving the amounts of different explosives used in the United Kingdom, would have been more valuable if the explosives had been classified according to the kind of rock and the uses of the stone.

A short chapter treats of the preparation of stone for the market, another with the dangers of quarrying, and the book concludes with some remarks on quarry legislation which may be commended to the notice of those in authority. The volume is very well illustrated, and there is a fair index.

The Microtomist's Vade-Mecum. A Handbook of the Methods of Microscopic Anatomy. By A. B. Lee. Seventh edition. Pp. x + 526. (London: J. and A. Churchill, 1913.) Price 15*s*. net.

WE gladly welcome the new edition of this work which has become indispensable in all laboratories of biology. The general plan and the size of the book remain unaltered, but the author has managed by judicious "pruning," and some exclusion of out-of-date matter, to introduce much new matter, more than seven hundred additonal entries appearing in the index.

Goldmann's *intra-vitam* staining methods, and improvements in the silver fibril stains of Bielschowsky and Ramón y Cajal are detailed. Gibson's new mounting media, which dispense with the use of clearing agents, and confer on unstained or feebly stained objects just the required degree of visibility, are described. The sections relating to the blood and blood parasites have been rewritten. Not the least useful part of the contents are the full references given to the literature of the subject. Those who have worked with former editions will find that the present one maintains in all respects the high standard of its predecessors. R. T. H.

Astronomy Simplified. By Rev. Alex. C. Henderson. (London: James Clarke and Co., 1913.)

THE object of this book is, as the author states, "to extend a knowledge of the sublimest of the sciences," and he intentionally reminds the reader many times throughout the pages that while man is striving to find out the laws which govern the behaviour of matter in space, there is a greater

Power who not only created the laws, but formed matter and space.

The book consists of three chapters, covering seventy-five pages, followed by a series of subsidiary chapters, which are termed notes, which extend another seventy-one pages. The three chapters deal with general information about the sun, moon, and stars, diurnal motions of the heavenly bodies and comets. The treatment is quite elementary, clear, and brief, and the information accurate. The notes, which are twenty-six in number, treat of a miscellaneous set of subjects relating to astronomy, and may be considered in some cases as brief essays. The headings of some of these notes are as follows:—Auroræ, magnetic storms, sun-spots, and prominences; seven methods of obtaining accurate time; eclipses; proofs of the earth's rotundity, &c.

The book is neatly produced, contains numerous illustrations, and will no doubt serve a useful purpose in drawing youthful minds to the subject of astronomy.

LETTERS TO THE EDITOR.

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

Philosophy of Vitalism.

I THINK that I voice the feelings of all London zoologists when I say how grateful we all are both to the Zoological Board of the University of London and to the governing body of King's College for the opportunity which they have afforded us of hearing the new philosophy of vitalism so brilliantly expounded by Prof. Hans Driesch.

Perhaps you would spare me a little space if I try to set forth some reasons why Prof. Driesch's conceptions do not appear to me to be of much service in assisting the progress of zoology.

At the outset, one or two preliminary remarks may be made. The question whether for any consistent system of philosophy, or attempt to explain the universe, an idealistic attitude must be adopted, and the question whether at the present juncture idealistic conceptions ought to be imported into zoological science are two entirely different things.

The task of zoologists is not to explain the universe; it is the much humbler one of endeavouring to compare together zoological phenomena and to ascertain the rules governing them. All "explanation" is merely comparison; we endeavour so far as we can to express the more complex phenomena in terms of the simpler, and so to find uniformity and order beneath an apparent welter of unconnected details.

Now Prof. Driesch offers us an "entelechy," *i.e.* a non-material, non-mechanical "*arranging*" power, a rudimentary "psychoid" which knows its purpose and uses the materials at its disposal in order to effect that purpose. Does the conception of entelechy help us to collate zoological facts or not?

It was invented to account for the remarkable fact that when the first two blastomeres of the egg of a sea-urchin are separated from one another each will give rise to a perfect larva of diminished size. Driesch argued that since in normal circumstances one of these blastomeres would have given rise to half a larva, therefore when it is separated from its fellow some innate power must be at hand to rearrange the materials of the blastomere so as to give rise to a whole larva. But if the conception of an entelechy will cut the Gordian knot of this difficulty, there are a great many cases where the facts seem to be totally inconsistent with the existence of an entelechy.

If the tail of a lizard be broken off a little bud is formed at the injured surface, from which in due time a new tail is developed. But if this bud be slightly indented by a prick from a knife *two* tails and not one are developed from the bud.

What is the entelechy doing in this case? Is its purpose altered, and has it decided to use the materials to make two tails? Are we not justified in saying that if an entelechy was invented to explain why one blastomere of a sea-urchin's egg forms a whole larva, it must be rejected because it utterly fails to explain why the injured bud on a lizard's tail makes two tails?

Again, if, when the egg of a frog has divided into two blastomeres it be tightly clipped between two glass slides in order to prevent its rotating, and if the whole preparation be inverted, then there will often result a ghastly two-headed tadpole. Why does the entelechy allow its purpose to be upset by so small a thing as the inversion of the egg? Is this not a much less violent change than cutting the egg in two? Instances of this kind might be multiplied indefinitely, and they show that at the best the conception of an entelechy is of quite limited application. There is another conception which is far more helpful in binding together phenomena, and that is the idea of "organ-forming substance." In the egg of Cynthia, an Ascidean, the development of which has been worked out by Conklin, these organ-forming substances can be seen in the living egg. This case was not alluded to by Prof. Driesch, as it is one which is almost impossible to reconcile with his theory. In the egg of Cynthia there is a yellow substance in the outer layer of the protoplasm. This collects round the entering spermatozoon when the egg is fertilised, and eventually forms a crescent in one quadrant of the egg. As development proceeds it is relegated to certain cells in the segmenting egg, and is eventually used up in forming the longitudinal muscles of the tail of the Ascidean tadpole. Now it is possible to kill the cells containing this substance on one or both sides of the segmenting egg. If the cells on one side be killed then there results a larva devoid of muscles on one side of its tail.

Now if we assume that normal development depends on the juxtaposition of certain organ-forming substances in certain spatial relations to one another, then when the two-cell stage of the egg of a frog is inverted these substances can partially or totally rearrange themselves, not under the influence of an entelechy, but under the influence of gravity. So also in the regenerating lizard's tail, the spatial relations of the organ-forming materials with respect to one another are altered by the indentation produced by the knife, and so two tails and not one develop.

Whence do these organ-forming substances come? The development of the egg of Cynthia teaches us that they arise from the nucleus of the ripe egg, and that they are definitely arranged (in some cases at least) under the influence of the spermatozoon. The ectoderm-forming substance of the egg of Cynthia is contained in the nuclear sap of the unripe egg and is emitted when the nuclear membrane breaks down. "But," Driesch will reply, "I have shown that the nuclei of a segmenting egg can be displaced from their normal positions without altering the result." Granted. When once fertilisation has been effected and the arrangement of materials in the cytoplasm fixed, the nuclei which result from the division of the zygote nucleus enter on a period of inactivity so far as influence on the cytoplasm is concerned. But this inactivity does not last for ever, for though the Cynthia tadpole is incapable of regenerating anything, that same tadpole metamorphosed into an adult Ascidian will regenerate any part that is cut off—even its head. In the same way Roux showed that when one blastomere of a frog's egg is killed the surviving blastomere will give rise to half a tadpole; but that half-tadpole, if it lives, will *post-generate* the missing half, and this belated regeneration is accompanied by a migration of nuclei into the injured half.

It may be objected that it is difficult to imagine what kind of chemical composition an "organ-forming substance" possesses. This is true; it may be difficult to compare it with chemical substances found in dead matter, but our knowledge of the possible complications of organic substance in living matter is as yet small. This at least may be said, the active agent in development and regeneration can be displaced from its original position, and can be divided into two, and such attributes are much more easily connected in our minds with a substance than with a non-material entity, which, Prof. Driesch assures us, is not in space.

E. W. MACBRIDE.

Imperial College of Science, October 28.

The Piltdown Skull and Brain Cast.

IN suggesting that a reconstruction of the Piltdown skull, made by the use of casts of the actual fragments, is not trustworthy (NATURE, October 30, p. 267), Prof. Elliot Smith does Dr. Smith Woodward and Mr. F. O. Barlow less than justice. The casts now in circulation are most accurate representations of the originals, and reflect the greatest credit on the modeller, Mr. Barlow. Anatomists have had no difficulty in gaining the freest access to the actual specimens; even those who, like myself, regard the original reconstruction of the skull and brain cast as fundamentally erroneous, have had every privilege granted to them on repeated visits to see the Piltdown fragments in Dr. Smith Woodward's keeping. A reconstruction made from casts is then just as trustworthy as one made from the original fragments.

You have already (NATURE, October 16, p. 197) permitted me, by the use of a diagram, to demonstrate the errors in the original reconstruction; I also availed myself of that opportunity to show diagrammatically the only reconstruction which gives an approximate symmetry to the right and left sides of the head, and, at the same time, places the parts in their proper anatomical positions. It is clear, from his letter (NATURE, October 30, p. 267) that Prof. Elliot Smith knows of another method, one which fulfils the same conditions, but gives a much smaller brain-capacity. All that is necessary to convince me that he is right and I am wrong is a drawing of that reconstruction: one comparable with the drawings in my previous letter. I have articulated the fragments in the manner suggested in his letter, and find that the degree of asymmetry in his suggested reconstruction is as great as in the original. It is possible that I have misinterpreted some of the indications given in his letter. Any error of this kind would be cleared up by a drawing.

ARTHUR KEITH.

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Pianoforte Touch.

PRESSURE of other work has prevented me from replying earlier to Prof. Pickering's letter in NATURE for July 31. It is, of course, difficult to express any definite opinion about an experiment without fuller knowledge of the circumstances than can be acquired from a mere written description; at the same time it appears to me very easy to suggest explanations for the failure of the experiment. To strike the same note a hundred times in succession is certainly a very severe test to impose on a person's powers of discrimination. In this connection it would be interesting to perform, for the sake of comparison, one hundred tests of a totally different character, say the well-known tests of blindfolding a person and making him taste tea and coffee, according to a prearranged succession. It would be giving the hearer a fairer chance if the experiment were performed by playing over a short sequence of notes, say a simple melody a number of times in succession. I have always performed the test in this manner, and it has generally been successful.

Then, again, there is evidently a certain knack about producing these touch effects, and though one may try to strike a note sometimes in a pressing or caressing manner, and sometimes sharply, it is quite easy to fail to produce the desired effects, especially if the note is struck by the fingers. The best results I have been able to get in this way have usually been produced by holding the wrists high above the keyboard for a brilliant tone and right below the keyboard (so as almost to pull the keys down) for a soft tone. In producing the same effects with a pneumatic player, variation of the load on the regulating bellows by means of my sliding weight or some equivalent method produces sufficient differences, but the action of the feet in pedalling has so much effect on the touch that even here it is easy to fail, especially in experimenting where the performer consciously attempts to produce a particular effect and thinks of what he is doing. In the course of playing a composition the touch control is easier, as the necessary movements of the hands and feet are performed unconsciously, the performer only being conscious of the effect produced and not thinking of why or how he moves his levers and pedals to produce that effect.

Another point which has been overlooked in this discussion is that different makes of piano respond in very different degrees to small differences of touch. I recently tested a number of different pianos, and found that the make which I always use was by far the most sensitive, while one of the least sensitive was similar to the piano used by our local musical society, thus accounting for the comparative harshness of some of the professional performances compared with my pneumatic effects.

It is, of course, necessary to distinguish carefully between variations in quality of individual notes and variations in the quality of *chords*. The possibility of producing the latter variations in the pneumatic player is proved beyond doubt, and, to my mind, it is very largely the failure of either the instrument or the performer to produce a pleasing balance between the various components of a chord that renders the playing so mechanical and uninteresting. The usual effect is to produce with soft playing a heavy bass drowning a dull treble, and with loud playing a shrill treble drowning a weak bass. This effect is probably due to a large extent to the action of the regulating bellows, which in the ordinary players are controlled by springs. In playing a chord a number of different striking hammers of unequal mass have to be set in motion by means of the air pressure, or rather tension, acting on the "playing pneumatics" or small bellows which operate the fingers, and the duration of the impulse necessary to produce the maximum effect is greater for the bass than the treble hammers. Now the regulating bellows are in a continual state of vibration, producing rapid fluctuations of tension every time a note is played. If these fluctuations synchronise with the impulses required to produce the maximum effect in a particular part of the scale, it is evident that the corresponding part of the chord will predominate. Now, in playing softly the regulating bellows are only slightly compressed, and they open and shut slowly; in playing loudly they are much more highly compressed, and they collapse and open sharply. Thus the unpleasing want of balance in the quality of chords is easily accounted for. This difficulty I get over by varying the load on the regulating bellows, and also the inertia by means of a sliding weight, as well as by controlling its vibrations by hand. I have seen a patent in which it is sought to control the regulating bellows by enclosing it in an air chamber in which the tension can be varied by means of valves, and attempts have also been made to vary the tension in a spring controlling the bellows; but this can only be done by compressing the spring by a corresponding amount, and the time required to produce this compression appears to be too long to render the method efficacious.

The usual method of concealing this want of balance is to operate the two halves of the keyboard with separate controls. This system produces effects which are pleasing at first, but are very artificial and limited in character, and a person who is accustomed to this method of "faking" his chords is scarcely likely ever to learn how to balance their different parts with due regard to the effects required. Possibly this explanation may clear up some of the obscure points in my descriptions referred to by Prof. Morton. At the same time, I have heard professional pianists of considerable reputation whose range of control did not extend beyond that obtainable by damping down the halves of the keyboard or accenting notes by means of punch-holes.

Prof. Pickering's references to the sustaining pedal or lever are calculated to suggest the inference that Prof. Pickering may not have had much experience in manipulating his piano-player. If he finds it necessary to listen for each note before he knows when to operate his sustaining lever it would appear that he has not yet learnt *to play each note at the exact instant that he wishes it played,* and in this case it is not easy to see how it would be possible to play accompaniments in which it is necessary to listen to and keep in time with the soloist. Personally, I have always considered that the sustaining lever played a far more important part in pneumatic playing than in hand playing, one reason being that the necessary movements can be regulated with much greater rapidity and precision by hand than by foot. The right hand operating the speed regulator fixes the exact instant at which each note is going to be played, the left hand operates the sustaining levers and other controls at the correct predetermined instant. Probably, as Prof. Pickering says, an experienced pianist can also work hand and foot together, and I have known one musician who could operate the sustaining pedal of the piano three times in succession in holding down a single chord. This would be quite easy with a piano-player, and I certainly often use the lever twice if not three times in playing a chord. But it must be much more difficult to do the same in playing with fingers, and with the majority of amateurs the main use of the loud pedal appears to be to compensate for the loss of resonance caused by boxing up the piano and covering it with rugs, vases, and photograph frames.

The slight sound of suction through the air-holes is, of course, an inevitable defect, but one soon ceases to notice it. As regards "thud," well, fingers as well as pneumatics sometimes produce this.

G. H. BRYAN.

The Light Energy Required to Produce the Photographic Latent Image.

THE amount of light energy required to produce a latent image on a modern high-speed photographic plate is known to be extremely small. The energy per silver grain may be roughly calculated without difficulty, and the calculation leads to some interesting conclusions regarding the nature of the latent image.

Consider an exposure sufficient to produce a deposit of unit density, that is, one which will transmit but one-tenth of the incident light. A negative has unit density when the silver deposit is 10 milligrams per square decimetre, or 0·1 mg. per sq. cm. (Sheppard and Mees, "Investigations of the Theory of the Photographic Process," p. 41). This amount of silver represents roughly 10^{12} molecules, or 10^7 grains 3 μ in diameter. Now the amount of light energy required to produce an exposure giving unit density is of the order of 10^7 watt-sec. (erg) per sq. cm., and therefore 10^{-14} erg per grain, or 10^{-26} erg per molecule. The probable uncertainty in these values is not greater than a factor of 10.

The effect of the light on the plate is to permit the chemical reduction of silver halide to metallic silver with an additional expenditure of energy less than that required to reduce the unexposed silver bromide. Development we know to proceed by whole-grain units, hence we reason that one molecule in a grain (10^{12} molecules) is so affected by exposure that the whole grain is developable.

The simplest assumption to be made is that one electron per grain is detached from one molecule; such a liberation would require (Davis, *Phys. Rev.*, xx., p. 145, and others) 5×10^{-12} erg, or less (*Astroph. Journ.*, xxi., p. 404), a quantity consistent with that calculated above from the known exposure and mass of silver. Hence the hypothesis is reasonable that the latent image consists of halide salt in each grain of which one electron has been liberated by exposure to light.

P. G. NUTTING.

Research Laboratory, Eastman Kodak Co., Rochester.

An Aural Illusion.

MR. ALLISTON refers in NATURE of September 18 (p. 61) to a certain aural illusion, and wonders if anyone has thought of it before.

Two or three years ago, in a letter to *Knowledge,* I commented on the fact that if a flash of lightning 2 or 3 miles long happened to occur "head on" to an observer, the result of the flash travelling so far quicker than the sound would be that he would hear first the thunder caused by the part of the flash nearest to him, which arose last, and then in succession the earlier sounds, until finally he would hear the opening crash, like a phonographic record reversed. Sometimes I have noticed that a thunder peal ends up with a sudden and more violent crash, and I wonder if this is owing to the explosion which begins a peal of thunder being louder and more abrupt than the after noise

T. B. BLATHWAYT.

Cape Town, October 10.

NATURAL HISTORY AND TRAVEL.[1]

THE latest addition to Messrs. Witherby's well got-up series of volumes on the life-histories of British birds, four of which, dealing with the golden eagle, the osprey, the spoonbill, the stork, and some herons, have already been issued, is quite equal to its predecessors as a contribution to ornithology. The four species of terns (1) are its subject-matter; and the author, Mr Bickerton, is to be congratulated for the excellence of his photographs showing the eggs, the young and adult birds, and the nesting-sites, as well as for the time and labour devoted to securing them, and to compiling the voluminous notes embodied in the text. To the ordinary reader the text is naturally somewhat tedious on account of its prolixity and repetitions, unavoidably due to the similarity in mode of life of the species described; and the value of the volume would have been increased by the addition of a short chapter summarising the results, and pointing out briefly the differences in habit between the several species. This is the only criticism, however, we have to offer of an admirable and painstaking piece of work; and we trust Mr. Bickerton will be able to find the leisure to observe and record the habits of other groups of British birds in a similar way.

"The Charm of the Hills" (2) is mainly a collection of reprints of articles already published in various periodicals, such as the *Scotsman* and *Country Life*. The book is divided into two parts, chapters i. to xxxi. being a miscellaneous series of disconnected chapters dealing mostly with certain aspects of bird-life in the Scotch highlands, while the second part, entitled, "The Year on the Hills," also devoted mainly to birds, recounts observations upon their habits in the Cairngorm mountains in spring, summer, autumn, and winter. Mr. Seton Gordon is an enthusiastic and trustworthy field-naturalist, and while he writes feelingly and well about his own personal experiences, his book contains a great deal that is interesting and instructive to those for whom wild life in the mountains has a fascination.

"The Flowing Road" (3) is full of facts of interest both to the naturalist and the geographer. It is an account of five expeditions, mostly by canoe, along the rivers and streams of the northern countries of South America. Two of these were undertaken with the object of visiting a native people in the south-eastern corner of Venezuela, reported to be savage and unknown. The others, however, as the author tells us, were instigated "neither by a wish to hunt the beasts of the jungle . . . nor to report on the social or industrial conditions of the land, nor even to add to the sum of knowledge of the 'scientific' world—but solely to satisfy the hunger which incites me every now and again to go and 'see things'—the curiosity which Prof. Shale has called the primal instinct." Despite this modest disclaimer, nevertheless Mr. Whitney's narrative, setting forth the true nature of the areas traversed, and of the inhabitants found there, is a really valuable contribution to many branches of knowledge; because there are certainly few districts in the world lying beyond the beaten tracks of travel less accurately known than those drained by the Amazon and the Orinoco and their tributaries, and probably none, according to the author's experience, which have been so frequently and persistently misrepresented in printed accounts inspired by self-interest or based on the superficial observations of casual tourists.

FIG. 1.—The Arctic tern—admirably protected by the surroundings on which it has settled. From "The Home life of the Terns or Sea Swallows," by W. Bickerton.

Those who have heard Mr. Dugmore lecture would expect him to write entertainingly and well about the habits and characteristics of the animals with which he has had personal experience; and those who have read his "Camera Adventures in the African Wilds," will find "Wild Life and the Camera" (4) equally readable and trustworthy, although widely different in its subject-matter, which is confined to North American species.

The greater number of the chapters are given

[1] (1) "The Home-life of the Terns or Sea Swallows." Photographed and Described by W. Bickerton. Pp. 88+xxxii mounted plates. (London: Witherby and Co., 1912.) Price 6*s*. net.
(2) "The Charm of the Hills." By S. Gordon. Pp. xiv+248. (London: Cassell and Co., Ltd., 1912.) Price 10*s*. 6*d*. net.
(3) "The Flowing Road." Adventuring on the Great Rivers of South America. By C. Whitney. Pp. 319. (London: W. Heinemann, 1912.) Price 12*s*. 6*d*. net.
(4) "Wild Life and the Camera." By A. R. Dugmore. Pp. xi+332. (London: W. Heinemann, 1912.) Price 6*s*. net.
(5) "The Feet of the Furtive." By C. G. D. Roberts. Pp. 277. (London: Ward, Lock, and Co., Ltd., 1912.) Price 6s.
(6) "Insect Workers." By W. J. Claxton. Pp. xii+62. (London: Cassell and Co., Ltd., 1912.) Price 1*s*. net.
(7) "Letters from Nature's Workshop." By W. J. Claxton. Pp. 192. (London: G. G. Harrap and Co., 1912.) Price 1*s*. 6*d*. net.

up to birds; but there is much to interest anglers in those devoted to salmon- and trout-fishing. Mammals are in a minority; but perhaps the chapter describing caribou migration in Newfoundland is the most valuable in the book from the naturalist's point of view. A few chapters containing instructions and hints on bird and mammal photography, and on camping out, will be most helpful to those who wish to follow in Mr. Dugmore's steps and attempt to do what he has done under similar physical conditions.

"The Feet of the Furtive" (5) contains several well-written stories of a kind much in vogue at the present time, wherein the author weaves interesting facts in natural history into an attractive fabric of fiction. The habits of familiar North American mammals are the theme Mr. Roberts presents so cleverly in this guise; but while giving full play to his imagination and to his powers of linguistic expression, he never oversteps the bounds of probability, and carefully avoids that pitfall authors too frequently dig for themselves and their readers, by attempting to humanise the species whose mode of life they wish to portray. Many of the stories recall others that have already been published by American authors; but there is a distinct air of novelty about the one called "The World of Ghost Lights," which gives a vivid picture of one aspect of life in the ocean depths.

In his little book for children, called "Insect Workers" (6), Mr. Claxton tells once again the story of the burying beetle, trapdoor spider, ants and aphides, wasps, and other common and familiar species of articulated animals the industries of which never fail to appeal to the imagination of children and to arouse their interest in creatures they are mostly taught by their elders to fear and destroy.

The purpose of awakening and fostering a taste for nature-study also underlies "Lessons from Nature's Workshop" (7), by the same author. This book, however, is rather more pretentious in scope than the last, and is written for readers of maturer mind, many of the chapters being devoted to more or less abstract questions in natural history, such as the struggle for existence in plants, assimilative coloration, scenery, and so forth.

R. I. P.

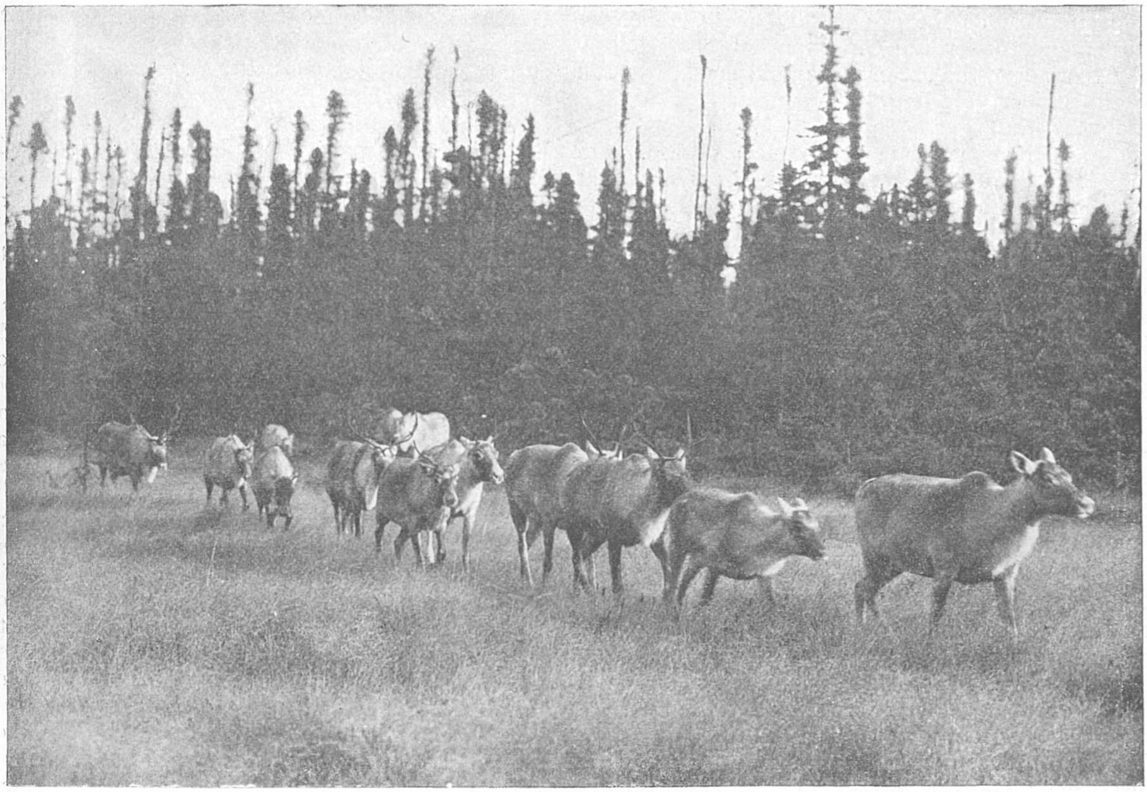


FIG. 2.—The Newfoundland caribou in migration. Going at a quick walk, or swinging trot, or at times a gallop, they usually travel in single file along the well-worn leads or paths that have been used for centuries. In nearly all cases a doe leads the herd. From "Wild Life and the Camera."

PROF. NOGUCHI'S RESEARCHES ON INFECTIVE DISEASES.

THE Royal Society of Medicine mostly limits the record of its work to its own Proceedings and the medical journals; and it does well to observe this wise rule. But from time to time it receives some communication of the highest importance to the general welfare, and on such occasions it is mindful of its immediate duty to the public. It lately held a special meeting, at which Prof. Noguchi, of the Rockefeller Institute, demonstrated the results of his researches into syphilis, general paralysis of the insane, epidemic infantile paralysis, and rabies. None who heard Prof. Noguchi and saw the great crowd of physicians and surgeons listening to him could fail to recognise the profound significance of this occasion.

No man of science works alone or in isolation: and a vast amount of cooperative work is being done in diverse parts of the world on what may be called the "higher types" of germs. Let us note the development of the work. Let us go back half a century, to the earliest methods of Pasteur. We may take 1855 as an approximate date for the beginning of the founding of "the germ-theory." For many years the only method which Pasteur had for the growth of germs in pure culture was the use of fluid media, such as broth; and, under the conditions of bacteriology fifty years ago, the use of these fluid media was full of difficulties. He had to wait until 1872 for the discovery that germs could be grown on solid media, such as gelatine or slices of potato. He had to wait until 1875 for the discovery that germs could be stained with aniline dyes so as to distinguish them, under the microscope, from their surroundings.

Pasteur lived until 1895—that is, ten years after the first use of his protective treatment against rabies, and two years after the first use in practice of diphtheria antitoxin—but he did not live to see more than the beginning of the study of the higher types of germs. At the time when he died, many of the lower types—the bacilli and the micrococci—had been discovered, isolated, grown in pure culture on solid media, and proven, by the inoculation of test animals, to be the very cause of this or that infective disease. But the higher types, such as the *plasmodium* of malaria, were still waiting to be worked out. Then, after Pasteur's death, came Ross's fine work on malaria; and then came two discoveries of no less importance—the discovery (Schaudinn, Hoffmann) of *Spirochaeta pallida* in cases of syphilis, and the discovery (Forde, Dutton) of *Trypanosoma gambiense* in a case of sleeping sickness. These two discoveries brought syphilis and sleeping sickness, at last, within the range of practical bacteriology. Long ago, Moxon had said of syphilis that it was "a fever cooled and slowed by time"; but the cause of that fever was unknown until the *Spirochaeta pallida* was discovered.

But to prove that it does not merely accompany, but actually causes the disease, it had to be grown in pure culture, and inoculated into test animals, producing in them some characteristic sign. Syphilis must be studied as diphtheria, tetanus, typhoid fever, and tubercle had been studied. That is the meaning of all the work done by Ehrlich and his school upon salvarsan—that, in particles of tissue from a rabbit in which the disease has been produced, the *Spirochaeta pallida* is present, under the microscope, before a dose of salvarsan, and is absent after it.

The work has been of immeasurable complexity, and there is much still to be done. There are many species of spirochætes discoverable in this or that condition of bodily life, besides *Spirochaeta pallida*; indeed, Prof. Noguchi demonstrated seven species. But he has cleared the way in this field of bacteriology. He has distinguished those which need some air for their growth from those which cannot grow in air; he has discovered the method of adding a fragment of sterilised animal substance to each tube of pure culture: and these methods are of great value.

But that is not all. For he has detected *Spirochaeta pallida* in the brain, in general paralysis of the insane. He has found it in twelve out of seventy specimens. There is no need to underline the importance of that statement.

Also, Prof. Noguchi has obtained in pure culture the germs of anterior polio-myelitis (epidemic infantile paralysis). Of all the many diseases of childhood in which the art of medicine, apart from its science, is of no great use, few are more unkind than infantile paralysis. It is the Rockefeller Institute that we must thank here. First came Flexner's magnificent work on epidemic cerebro-spinal meningitis, and his discovery (1908) of the special antitoxin for that disease; then came the study of epidemic infantile paralysis. To have in one's hands, in a test-tube, infantile paralysis, is a grand experience for a man who has attended a children's Hospital, year in year out, long before the Rockefeller Institute was born or thought of. It is enough to make him believe that the doctors some years hence may be able to stop the disease before it can inflict irremediable injury on the nerve cells of the spinal cord.

Finally, Prof. Noguchi spoke of rabies (hydrophobia). He has been able to obtain, in pure culture, the microscopic bodies which Negri discovered in the brain in that disease. He demonstrated to the Royal Society of Medicine, on the lantern-screen, photographs showing the cycle—not unlike that of the *plasmodium malariae*—through which these bodies pass until, like miniature shrapnell, they break, setting free their constituent granules; and each granule becomes a "Negri body," and starts the cycle again. Happily, the protective treatment against rabies did not have to wait for the discovery of these Negri bodies. Pasteur worked at rabies, as Reed and Lazear worked at yellow fever, knowing that the virus was there, and able to control, fight, and beat it, without seeing it under the microscope.

The Royal Society of Medicine deserves the thanks of the public for inviting Prof. Noguchi to give this demonstration in London. He is indeed, in width and originality of work, equal to his fellow-countryman, Prof. Kitasato. He has helped to make it possible for men of science to extend to other diseases those methods of study which brought about the discovery of diphtheria antitoxin, and the protective treatments against cholera, typhoid fever, and plague.

STEPHEN PAGET.

EDWARD NETTLESHIP, F.R.S.

MR. E. NETTLESHIP, whose death on October 30 we have to deplore, was well known to the public as a distinguished ophthalmic surgeon, and to men of science as an enthusiastic worker on the subject of heredity. He was one of the six sons of Henry John Nettleship, solicitor, of Kettering. Three of his brothers became noted. The eldest, Henry, held the Corpus professorship of Latin at Oxford with great distinction. The second, John Trivett, was well known for his accurate and realistic pictures of wild animals, and was the author of the first serious study of Browning. The youngest, Richard Lewis, was a Fellow of Balliol College, Oxford.

Edward Nettleship was born in 1845, and after a preliminary education at Kettering became a student of the Royal Agricultural College at Cirencester, and of the Royal Veterinary College. Though he qualified as a veterinary surgeon, he soon relinquished that branch, and studied at King's College and the London Hospital Medical Schools, taking the Fellowship of the Royal College of Surgeons of England in 1870. He specialised in ophthalmic surgery at a time when most ophthalmic surgeons still practised general surgery. He was appointed surgeon to the South London Eye Hospital, but his real life-work was carried out at St. Thomas's Hospital and the Moorfields Eye Hospital.

At St. Thomas's Hospital that remarkable personality, Liebreich, who still lives an artistic life in Paris, had laid the foundation of an ophthalmic clinic. Nettleship continued his work, and brought it to a state of perfection previously unequalled in England. At Moorfields he had been assistant to the late Sir Jonathan Hutchinson, where he rivalled his teacher and life-long friend in his enthusiasm for clinical work, and in his abounding inquisitiveness into the mysteries of eye diseases.

Papers full of acute observation and accurately authenticated facts came rapidly and continuously from Nettleship's pen. He thus built up a reputation which ranks with that of the greatest ophthalmic clinicians of the past—Mackenzie of Glasgow, von Graefe of Berlin, and Sir William Bowman of London, the founders of modern clinical ophthalmology. His magnetic personality attracted many of the best students to his side, and he thus founded a tradition for careful observation and accuracy of detail which is being carried on by his successors. He did not suffer fools gladly, and his somewhat brusque manner towards them kept his little band select, whilst it unfortunately aroused some enmity in those who had not the opportunity of testing intimately his sterling character and warm friendliness. He built up a very large private practice, one of his most distinguished patients being Mr. Gladstone, on whom he operated successfully for cataract.

About fifteen years ago Nettleship retired from practice and settled down in his country house at Hindhead. It was not a retirement to ease and luxury, but merely a deviation into scientific work little less laborious than his earlier work. He devoted himself especially to the study of heredity, and his painstaking and illuminating researches in this subject require no other testimonial than that they were rewarded by the Fellowship of the Royal Society in 1912.

These are his greatest works, but he was full of lively interest in all that pertained to ophthalmology. Much of his time and energy was given up to colour-vision, and he did most valuable service as a member of the departmental committee of the Board of Trade on sight tests for the mercantile marine.

Mr. Nettleship was somewhat reserved, and only those who gained his confidence and learnt to know him well succeeded in penetrating to the fires of friendship which glowed within him. He has passed away, leaving behind him a record of work which lives and will continue to live.

J. HERBERT PARSONS.

NOTES.

AT the meeting of the Royal Society of Edinburgh, held on November 3, 1913, the following were elected honorary fellows:—Prof. Horace Lamb, F.R.S., professor of mathematics in the University of Manchester; Sir W. T. Thiselton-Dyer, K.C.M.G., F.R.S., formerly director of the Royal Botanic Gardens, Kew; Dr. G. E. Hale, director of the Mount Wilson Solar Observatory (Carnegie Institution of Washington); Prof. Emil C. Jungfleisch, Mem.Inst.Fr., professor of organic chemistry in the College of France, Paris; Prof. S. Ramón y Cajal, professor of histology and pathological anatomy in the University of Madrid; Prof. V. Volterra, professor of mathematics and physics in the University of Rome; Prof. C. R. Zeiller, Mem.Inst.Fr., professor of plant palæontology in the National Superior School of Mines, Paris.

THE Physical Society's Annual Exhibition will be held on Tuesday, December 16, at the Imperial College of Science, and will be open both in the afternoon and evening.

ANNOUNCEMENT is made from Paris that Prof. Charles Richet, professor of physiology in the University of Paris, and member of the Academy of Medicine, has been awarded the Nobel Prize for science.

THE eighty-eighth Christmas course of juvenile lectures, founded at the Royal Institution in 1826 by Michael Faraday, will be delivered this year by Prof. H. H. Turner, F.R.S., his title being "A Voyage in Space."

THE brain of the late Prince Katsura, which, according to his wishes, has been removed to the Imperial University Museum in Tokio, was found to weigh 1600 grams—the same as that of Kant.

THE death is reported, in his seventy-ninth year, of Dr. P. R. Uhler, an American entomologist and geologist of repute. For three years he was an assistant to Prof. Louis Agassiz, at Harvard, and afterward explored parts of the island of Hayti for him. Since

1862 he had been officially connected with the Peabody Institute, Baltimore. Dr. Uhler was the author of many contributions to scientific journals, and his collection of locusts, presented several years ago to the U.S. Government, was considered one of the best ever made.

THE death is announced, at sixty-seven years of age, of Dr. H. F. Parsons, formerly of the Medical Department of the Local Government Board. An obituary notice in *The Times* reminds us that Dr. Parsons served on many Departmental Committees, including those on water, gas, regulations as to cremation, the work of the Geological Survey, and the medical inspection and feeding of children in public elementary schools. He contributed papers to the Transactions of the Epidemiological Society, of which he became president, and to those of other scientific bodies. He was a fellow of the Geological Society, and among his works were memoranda on the sanitary requirements of cemeteries, disinfection by heat, a report on the influenza epidemic of 1899–90, and an examination of the comparative mortality of English districts.

THE jubilee of the practical realisation of the ammonia-soda process by the chemist, Ernest Solvay, was recently celebrated in Brussels, and was marked by munificent gifts of five million francs for scientific purposes by the veteran inventor, who on the same occasion celebrated his seventy-fifth birthday. The Institute of Applied Chemistry of the faculty of sciences at Paris received 500,000 francs, and the same sum was allotted to the University of Nancy to create a chair of electrotechnics. A fund of 500,000 francs was also put aside for a quadrennial prize to be awarded by the International Congress of Hygiene for researches in transmissible disease. On the occasion of the jubilee, M. Solvay delivered an enthusiastic eulogy of pure science and its results, and made the interesting avowal that the pursuit of science was the *rêve doré de toute sa vie,* and had it not been for the necessity of providing for a family he would probably have taken it up as his profession. On the occasion of this jubilee King Albert honoured M. Solvay by naming him a grand officer of the Order of Leopold.

IMPORTANT proposals for another British Antarctic Expedition, to start next year, are made public by a letter to the Press from Sir Clements Markham, and by Mr. J. F. Stackhouse, who is to lead the expedition. The completion of work in the McMurdo Sound region by the expeditions under Shackleton and Scott directs attention elsewhere in the British section of Antarctica, and Sir Clements Markham regards as one of the next most important problems the investigation of the connection between King Edward VII. Land and Graham Land. It is proposed by Mr. Stackhouse to begin his work at the eastern or Graham Land end of the British quadrant, and to follow the coast, hoping to prove or disprove its continuity, and thus to solve a leading question regarding the physiography of Antarctica in outline. The scheme depends largely upon the incidence of an open season, when the ice-pack leaves a passage along the coast; Scott himself held the chances of such an opportunity to be good. Financial support is invited, and headquarters for the expedition have been established at Sardinia House, Kingsway, W.C.

THE National Council of Public Morals has established a private commission to inquire into the extent and character of the decline in the birth-rate, its causes, its effects, and its economic and national aspects. This commission is both a strong and representative one, and the fact that Dr. Stevenson, the Superintendent of Statistics for the Registrar-General, and Dr. Newsholme, Medical Officer to the Local Government Board, have joined it gives one confidence that it will be able to obtain and use in an effective manner the best statistical data available to anyone. It will be remembered that these two authorities published in 1906 a paper on the decline in human fertility, which attracted considerable attention. The commission is also to be congratulated on obtaining as members several well-known lady doctors, including Dr. Mary Scharlieb and Dr. Ettie Sayer, who through their professional work have had special opportunity for studying fertility and its absence from the woman's point of view. Economic science, medicine, law, and journalism are all well represented, and the biological aspects of the questions to be discussed will not be forgotten with Mr. Walter Heape to stand for this branch of science. As might perhaps have been expected, the clerical element somewhat predominates. Bishop Boyd-Carpenter is the chairman of the commission, and the Rev. James Marchant the secretary, and there is besides a galaxy of bishops, deans, and well-known preachers. Among these we are glad to find the Dean of St. Paul's, whose sane and broad-minded treatment of such subjects as eugenics has done so much to focus the attention of serious people on them.

The Falmouth Packet of September 17 contains an account of the recent visit of the surveying ship *Carnegie,* of the Carnegie Institution of Washington, in charge of Capt. W. J. Peters. This is the second visit paid by the vessel to Falmouth for the purpose of magnetic observations, the first having been paid four years ago. From Falmouth the *Carnegie* left for New York, whence she set out in June, 1910. The cruise has extended over a large part of the world, calls having been made at, amongst other places, Rio de Janeiro, Cape Town, Colombo, Mauritius, Manila, Fiji, Falkland Islands, and St. Helena. Its geographical position and the presence of a magnetic observatory have in the past rendered Falmouth a specially favourable port for linking up observations on the Atlantic with land observations in western Europe. The discontinuance of magnetic work at Falmouth has been so recent that its usefulness as a base has scarcely as yet been impaired, but in future years unfortunately greater uncertainty will prevail as to the secular change there of the magnetic elements.

THE opening meeting of the Institution of Electrical Engineers for the present session will be held on November 13, when the premiums awarded for papers read or published during the session 1912–13 will be presented, and an address on pressure rises will be given by Mr. W. Duddell, F.R.S., the president of the institution. In the list of papers to be read at meetings during the first half of the session we notice one by Mr. H. R. Speyer on the development of electric power for industrial purposes in India. The papers in preparation for the second half of the session are to deal largely with electric traction, and great prominence is to be given to the general question of the electrification of railways. The fifth Kelvin lecture is to be delivered by Sir Oliver Lodge on January 22, 1914. Much of the good work accomplished by the institution is done by the local sections, which meet regularly. The local branches which have been inaugurated up to the present are the Birmingham, Dublin, Manchester, Newcastle, Scottish, Western, and Yorkshire Sections. The Newcastle Section sometimes meets at Newcastle, and sometimes at Middlesbrough; the Scottish alternately at Glasgow and Edinburgh; the Western alternately at Bristol and Cardiff, and the Yorkshire Section at Leeds.

THE Natal Sugar Growers' Association has for some time past been in communcation with the Durban Technical Institute with the view of establishing a sugar school, the aim of which would be to prepare young men for the technical control and investigation of the manufacture of cane-sugar. The original scheme was to establish three lectureships—in chemistry, bacteriology, and entomology respectively. These, together with the lectureships already in existence, would supply a good technical training. The three specialists appointed would also conduct research in connection with the processes of manufacture and growth of cane-sugar. A wide field is open in this direction. There are problems in the sugar-house awaiting solution which are of great interest in themselves, and the solution of which will be of prime importance to the sugar industry, as something like 20 per cent. of the available sugar is at present lost. In this field it is hoped that the specialists will do pioneer work. Two lecturers—one in the chemistry and one in the bacteriology of cane-sugar—are soon to be appointed, the appointments in the first instance to be for three years at a salary of 400*l*. per annum in each case. Applications should be sent to Mr. B. M. Narbeth, principal of the Durban Technical Institute, Durban, Natal.

GUSTAF ISAK KOLTHOFF, who died on October 26, in his sixty-eighth year, had considerable reputation as a scientific hunter and as a pioneer in the realistic methods of exhibiting natural groups of animals in Museums. His chief monument is the large cyclorama at Stockholm, known as the Biological Museum, in which, with the assistance of the Swedish artist, Bruno Liljefors, he has presented the Swedish vertebrate fauna under the successive conditions of spring, summer, autumn, and winter. A small, but perhaps more genuinely instructive example of his work in this direction is the Biological Museum at the University of Upsala, in which University he was appointed zoological curator so long ago as 1878. In addition to these and to the museum which, about 1865, he created in the boys' school at Skara, near his own home, Kolthoff was responsible for the installation of six other collections of Swedish mammals and birds in various places in Sweden. He was without scientific training of the academic kind, and picked up the technique of his profession while still a youth in the workshops of the State Zoological Museum. By his own study, however, he became a skilled practical ornithologist and entomologist, and in that capacity accompanied Baron A. E. Nordenskjöld's expeditions to Greenland in 1883 and 1887. He also joined Prof. A. G. Nathorst on his voyages to Beeren Island, Spitsbergen, and King Karl's Land. In 1890 he himself led an expedition to Spitsbergen and north-east Greenland. In addition to many popular accounts of his travels, he was responsible, together with Dr. L. Jägerskiöld, for a work entitled "Birds of the North," which appeared during the years 1895 to 1899. In 1907, at the Linnean festival, he received from the University of Upsala the honorary degree of doctor of philosophy.

IN the Transactions of the Hull Scientific Field Naturalists' Club (vol. iv., Part 5), Mr. T. Sheppard describes the excavation of an Anglo-Saxon cemetery at Hornsea, the objects obtained having been deposited in the Hull Museum. Some of the corpses were buried in the crouched position, which seems to be a not unusual feature in Anglo-Saxon interments in east Yorkshire. Among the "finds" is a series of bronze brooches, similar to examples found in Norway, with very naturalistic representations of horse heads. A bell formed of very thin metal is, from comparison with an example from Papcastle, Cumberland, now in the British Museum, assigned to the Roman period. The "food vases" found are interesting because they are unlike the typical Anglo-Saxon cinerary urns, being quite plain, without any trace of ornamentation, and very similar to ordinary domestic utensils. They evidently contained food when placed with the burials.

IN the October number of *Science Progress* Mr. A. G. Thacker contributes an interesting article on the significance of the Piltdown discovery. The era of *Homo sapiens*, he states, should include the Aurignacian epoch and all that comes after; before that epoch we are among kindred but unfamiliar creatures. He suggests, therefore, that the Aurignacian and three subsequent ages should be classed as Deutolithic, and the previous epochs grouped as Protolithic. A discussion follows of the possible relationships of *Pithecanthropus erectus*, the Java ape-man; *Homo heidelbergensis*, the Heidelberg man; *Eoanthropus dawsoni*, the Piltdown woman; *Homo neandertalensis* or *Homo primigenius*, the Neanderthal man of Acheulian and Mousterian times; and *Homo sapiens*, garrulous man. "The power of speech was a crying need of the advancing primates . . . it was language that transformed the horde into the tribe. The creatures were probably widely dispersed on the earth, whilst they were yet speechless . . . rudimentary powers of speech may thus have been acquired independently by more than one species; and this, not blood-relationship, may have been the explanation of the man-like symphysis of the Heidelberg jaw." On this hypothesis the common ancestor is conceived as possessing a simian mandibular symphysis, a massive jaw, large teeth, and probably a low forehead. From this ancestor the Heidelberg and Piltdown types may have come along diverging branches; the former leading up to Neanderthal man, the latter to *H. sapiens*. The author is strongly inclined to think that both the apes and Pithecanthropus have a low forehead, not because they are degenerate, but because they are immediately descended from monkeys. And even in its more plausible application to Neanderthal man, he views the degeneracy theory with considerable suspicion.

UNTIL quite recently holothurians (sea-cucumbers) were known from the older rocks merely by their hard spicules and plates, which were long ago identified in the Scottish Carboniferous. From certain very fine-grained Middle Cambrian beds in British Columbia there have, however, been obtained impressions of soft-bodied organisms which Dr. C. H. Walcott (Smithson. Miscell. Collect., vol. lvii., No. 3) identified as holothurians, under the generic names of Eldonia, Loggania, Louisella, and Mackenzia. But his determination was not suffered to pass without criticism, and in *Science* of February 16, 1912, Dr. Lyman Clark expressed very strong doubts as to whether any of these genera are really holothurian, stating confidently that Eldonia is not. These criticisms are discussed in the August number of *The American Naturalist* by Mr. Austin Clark, who arrives at the conclusion that, with the exception of Mackenzia, which is regarded as a zoantharian, the original identification is correct, two of the genera being assigned to the existing deep-sea family Elpidiidæ, while the third (Eldonia) represents an allied pelagic family. In bodily form the last-named type recalls a medusa, but the resemblance may probably be regarded as a parallel adaptation to a free-swimming existence.

IN the October number of *Bedrock*, Prof. Poulton replies to Prof. Punnett's criticism of the theory of mimicry in the July number of the same review. After pointing out that de Vries himself holds that small variations may be inherited and selected, he brings instances to show that such transmission does actually occur. The case of *Acraea alciope* is adduced as demonstrating that an incipient mimetic feature may arise as an occasional variation in one part of the area inhabited by a given species, which feature may be further developed in distinctness, and in the relative number of individuals possessing it, in the presence of a distasteful model occupying another part of the range of the mimicking species. These facts, it is contended, support the conclusion that "the mimetic pattern was attained by steps and not suddenly." A more elaborate instance is afforded by *Papilio polytes*, with its two mimetic females. Here, apparently, the pigments of mimic and model have different genetic antecedents. By a detailed analysis of the patterns of the forms in question, and by a comparison of their numerical relation with the non-mimetic form in regions where the respective models are present, rare, or absent, Prof. Poulton arrives at the conclusion that these forms have been derived from the ancestral condition by gradual stages, and that his opponent is not justified in the statement that natural selection is non-existent in so far as concerns the comparative numbers of the mimetic and non-mimetic females of this species.

The Scientific American for October 18 contains an article on earthquakes and the Panama Canal, by Mr. D. F. MacDonald, geologist to the Isthmian Canal Commission. The recent occurrence of two earthquakes in the Isthmian zone has directed attention to a subject that might be of considerable importance with regard to the safety of the canal works. Mr. MacDonald, however, concludes that little danger is to be feared from earthquake disturbances (see NATURE, vol. xcii., p. 174), and he gives two main reasons for his view. The first is connected with the geological structure of the isthmus. Though numerous small faults along the course traversed show that readjustments of the crust have taken place in times past, the district is one from which high mountains and all evidences of recent displacement are alike absent. Again, though a large number of tremors are recorded every month by the Bosch-Omori seismograph at Ancon, the isthmus is entirely free from serious earthquakes. The seismic record of the isthmus dates from the Spanish conquest, and during more than three centuries there have been only two earthquakes of any consequence. One in 1621 destroyed many buildings in Panama, while another in 1882 damaged several buildings and bridges, and in places threw the railway track out of alignment. But neither of these shocks, it is probable, would have damaged seriously even the most delicate parts of the canal.

To *Symons's Meteorological Magazine* for October Mr. R. C. Mossman contributes an article on correlations at St. Helena, the fifth of these interesting investigations. The results are not considered as conclusive, but some suggestive resemblances and contrasts have been disclosed. During the years 1893–1903 there was an undoubted relation between the rainfall in the vicinity of Fort William from January to March, and the mean temperature at St. Helena for the months May to August following, but from 1904–11 the correlation breaks down. A relation could also be traced between the mean temperature at St. Helena during January to April and the mean barometric pressure at Punta Arenas (Magellan Straits) during the four months following, but during the last six years (1906–11) the results, for reasons given, were not very conclusive. With respect to temperature at St. Helena and rainfall at Mexico City, the curves pursued the same course from 1892 to 1898, while from 1899 to 1909 they were the reverse of each other. It will probably be remembered that Dr. W. N. Shaw pointed out (NATURE, December 21, 1905, "The Pulse of the Atmospheric Circulation") an apparent connection between the seasonal variation of wind-force at St. Helena and the rainfall in the south of England.

VOL. x. of "Contributions from the Jefferson Physical Laboratory of Harvard University" consists of reprints of eleven papers on physical subjects which appeared during 1912 in the Proceedings of the American Academy, *The Philosophical Magazine, The Astrophysical Journal,* and our own columns. The researches described have been aided by the Rumford fund of the American Academy, the Bache fund of the National Academy, and the Thomas Jefferson Coolidge fund of the University. More than half the volume is occupied by the researches of Dr. P. W. Bridgman on the thermodynamic properties of liquids at high pressures. To this work, which takes its place as one of the classics in this field, we have directed our readers' attention, as it has been published. Other important papers are those by Profs. Pierce and Evans showing that carborundum crystals possess electrostatic capacity owing to the alternation of insulating and conducting strata within them, by Profs. Kennelly and Pierce, showing how the motion of the diaphragms of telephone receivers affect the impedances of the instruments, and by Prof. Peirce on the maximum magnetisation in iron, to which we referred in our issue for July 24. From this list of first-class work it will be seen that Harvard is not one of those universities which overlooks its duty of increasing knowledge in its anxiety to impart knowledge and test it by examination.

THE enzymic activity of the sap of a number of vegetables such as cabbage, onions, ginger, and radishes has been investigated by T. Tadokoro, and the results published in a contribution to the Journal of the College of Agriculture, Tohoku University, vol. v., part 2. The capacity of the sap to induce certain enzymic changes appears to vary widely with the plant, peptolytic action being more pronounced in the case of onions and ginger than in the other six plants studied. Diastase was detected in every case with the exception of onions, and urease was present in ginger and yam-roots, although not to any great extent. Catalase and oxydase action was obtained with each sap, but the power to hydrolyse amygdalin and salicin was confined to that of the yam and cabbages.

AT a meeting of the Institute of Chemistry on October 29, the first of two lectures was delivered by Mr. W. P. Dreaper on the research chemist in the works, with special reference to the textile industry. The total gross value in 1907 of the textile materials and fabrics manufactured in the United Kingdom amounted to 333,000,000*l.*, and 1,253,000 persons were employed in their manipulation. On a basis of one chemist for every 2000 persons employed, no fewer than 600 chemists should be utilised in this industry alone, each of whom would deal with an annual gross output valued at more than 500,000*l.* One large aniline dye combine on the Continent already employs 700 chemists. The lecturer insisted that the industrial chemist who remains in his laboratory is lost. Knowledge of chemistry alone is an insufficient equipment; modern research requires a knowledge of physics and the power to apply it. The work of the textile chemist was considered in detail, and specially illustrated by reference to the developments in mercerising and schreinering. The chemist working under industrial conditions at once realises the success achieved by the "rule-of-thumb" man in the past; by systematically studying his methods and seeking to discover points he has not fully realised the chemist may often be able to improve upon them. The nature of the methods and machinery used for producing artificial fibres, and more recently artificial fabrics were reviewed. In conclusion the lecturer dealt with the influence of theory and the chemist's work on actual industrial operations.

MESSRS. A. GALLENKAMP AND CO.'s new catalogue (section 1, part iii.), recently issued, deals mainly with the requirements of engineering chemistry. Fuel calorimeters of all descriptions are dealt with very fully, a special feature being a full description of the method of using each of the better known types of instrument. Gas calorimeters are also well represented, including two self-recording types. Five types of CO_2 recorders are illustrated, including all the instruments in common use, and this is supplemented by apparatus for draught measurement and flue gas analysis. The section dealing with oil testing includes viscosimeters, both the flow and friction types, flash-point and distillation apparatus. Apparatus for iron and steel analysis includes an electric tube furnace, apparatus for the determination of carbon by the wet combustion process, and for the estimation of arsenic, phosphorus, and sulphur. The last quarter of the catalogue is devoted to pyrometers; this includes instruments of every type. The principles utilised in the various instruments and their mode of use are briefly but accurately summarised.

WE learn from *The Builder* for October 31 that the Liverpool Corporation has held recently a competition for a sanatorium of phthisis patients. This is one of the first municipal sanatoriums to be tackled by the architectural profession, and it was extraordinary to note the great diversity of planning shown by the thirty-one sets of designs submitted. Tuberculosis sanatorium planning is as yet in its infancy, and this fact accounts for these differences in treatment. It is probable that we shall not arrive at anything like a standard type until several have been built and their actual working arrangements tested. The first premium was awarded to Messrs. T. R. and V. Hooper, of Redhill. In their design, nearly all the blocks are isolated, with the exception of the actual wards; these are combined into one long wing. The children's wards are separate, and comprise practically a small self-contained sanatorium; this block is particularly good, and forms a one-storey bungalow. There is a good deal to be said in favour of aiming at a cheerful collegiate-like character in such a building, rather than going on the lines of the regular and somewhat dreary infirmary type, and this is perhaps the best feature in favour of Messrs. Hooper's design.

THREE new volumes in Messrs. T. C. and E. C. Jack's compact little series, "The People's Books," have recently reached us; and they merit a word or two of description in addition to the announcement of their publication, in our weekly list of books received. Mr. E. W. Maunder contributes a popular account of astrophysics in a volume having the title, "Sir William Huggins and Spectroscopic Astronomy." Dr. W. D. Henderson has written a volume on "Biology," in which he gives in language as free from technicalities as possible, a broad account of the main facts of the science of life; and Mr. J. Arthur Hill writes with dignity and philosophic power upon the subject of "Spiritualism and Psychical Research." Each volume contains about 96 pp., and is published at the price of 6*d.* net.

OUR ASTRONOMICAL COLUMN.

COMET NEWS.—The latest comet discovered, namely 1913*e*, (Zinner), has been identified as a return of 1900 III. (Giacobini), so that it has made two revolutions since its original discovery, the period being 6·435 years. Being of about the tenth magnitude and its declination a large southerly one, namely, greater than 19°, it is not a favourable object for observers in high northern latitudes. An ephemeris extending to November 14 is given in *Astronomische Nachrichten*, No. 4690.

Herr T. Banachiewicz, as *Astronomische Nachrichten*, No. 4689, states, reported a light change in comet 1913*c* (Neujmin) on October 6, while on October 8 the comet could no longer be seen. Dr. Graff also looked for the comet in vain.

Writing to the *Astronomische Nachrichten*, No. 4690, on September 11, Prof. Barnard describes an unusual appearance of this comet on September 9. He at first thought that a small star was involved in the north preceding side of the comet, but further observation indicated that the star was travelling with the comet; in fact, it was the nucleus. Using the 40-in. and a power of 460 the nucleus was still stellar, but with 700 it became ill-defined and not so readily taken for a star. He concludes in the following words:—"The nucleus was estimated to be 11·5 magnitude. It was so clear cut and distinctly star-like that one would not for a moment have suspected any real connection with the faint nebulosity apparently attached to it south following. I have not before seen such a striking case of a comet being essentially all nucleus."

Comet 1913*d* (Westphal) does not gain in brightness, as was anticipated, in spite of its distance from the sun being reduced. The following is a continuation of the ephemeris printed in *Astronomische Nachrichten*, No. 4687:—

12h. M.T. Berlin.

	R.A. (true) h. m. s.	Dec. (true) ° ′	Mag.
Nov. 6	20 35 17	+27 27·5	8·6
7	34 46	28 2·0	
8	34 18	28 36·1	
9	33 54	29 9·9	8·6
10	33 32	29 43·4	
11	33 14	30 16·7	
12	33 0	30 49·8	
13	20 32 48	+31 22·6	8·7

According to Miss S. M. Levy, of Berkeley, California, the above ephemeris reads about 23 seconds too great in R.A., and about 3·4′ too small in declination for November 13. During the current week the comet passes from Vulpecula into Cygnus, and is in a good position for observation.

SPECTRA OBTAINED BY MEANS OF THE TUBE-ARC.—Another important spectroscopic research has just been published by Prof. A. S. King (Contributions from the Mount Wilson Solar Observatory, No. 73), who has been studying the relation of the arc and spark lines by means of a tube-arc. In this paper he presents in some detail the leading features of the spectrum of this form of arc, and by a comparison with other sources he infers the probable character of the radiation involved. The results discussed and finely illustrated are based on fifty plates taken with instruments of different degrees of dispersion. This paper follows the one described in this journal in July last (Vol. xci., p. 541), and the main results of the inquiry may be briefly summarised as follows:—In the study of the tube-arc spectrum a region near the centre of the tube's cross-section was found to give the hydrogen spectrum and the enhanced lines of metals most strongly, with some variation among different elements as to how rapidly their enhanced lines diminish in intensity towards the wall. The arc lines of two groups of elements, represented by iron and calcium, show different degrees of response to the conditions most favourable for enhanced lines. The arc lines of titanium and vanadium differ from those of the other elements studied, as they show their greatest strength close to the wall. On the question of dissymmetry of lines produced in the central part of the tube, the dissymmetry is usually towards the red, but some lines show little or no effect. In the cases of $\lambda 4481$ (Mg.) and $\lambda 4267$ (C.) the dissymmetry is explained by the observation that both these lines are double. Tests on the ionisation of the vapour and on its conductivity compared to that of the tube material, together with the spectroscopic phenomena of the tube arc, indicate that the effects may largely be due to the impact of electrons emitted by the highly heated carbon, the resultant effect of these impacts becoming stronger near the centre of the tube.

KODAIKANAL PROMINENCE OBSERVATIONS AND DISCUSSIONS.—Two bulletins, Nos. 31 and 33, of the Kodaikanal Observatory, have come to hand dealing with the routine observations of prominences and a discussion of past data. No. 31, by the director, Mr. J. Evershed, is confined to the summary of prominence observations for the first half of the present year. Compared with the previous six months the mean frequency remained practically unaltered, while the mean height slightly increased, and the mean extent somewhat diminished. The eastern limb showed a slight preponderance in numbers and areas over the western. Only five metallic prominences were observed. Other observations recorded include the displacements of the hydrogen lines, prominences projected on the disc as absorption markings, &c.

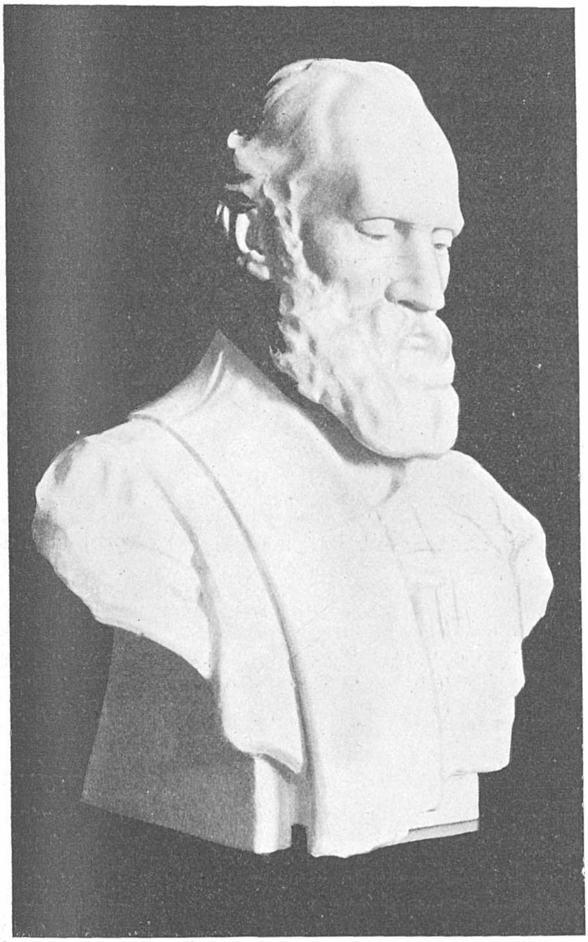
Bulletin No. 33 is written by the assistant-director, Mr. T. Royds, and deals with prominence periodicities, the investigation being a construction of the periodograms of prominences in the same way as Schuster investigated the sun-spot data. Mr. Royds confined the Kodaikanal data to the years 1905–1912, and determined the mean daily areas by dividing the total prominence areas for each month by the effective number of days of observation in each month. The prominence periodogram finally obtained displayed the presence of three periods of large intensity, two nearly homogeneous, of $6\frac{1}{3}$ and $7\frac{1}{2}$ months, and the third, provisionally fixed at $13\frac{1}{3}$ months, the highest of the band. The mean daily frequencies for each month from the year 1881 to 1912, deduced from observations at Palermo and Catania, were similarly analysed, as a check, and they indicate distinct peaks at the same points as the Kodaikanal curve. The amplitudes of these short periods in terms of a percentage of the average of mean daily areas are given as follows:—

Period	$13\frac{1}{3}$ months.	Percentage	13·6
,,	$7\frac{1}{2}$,,	,,	9·1
,,	$6\frac{1}{3}$,,	,,	10·1

Mr. Royds concludes by adding that other independent prominence data which are sufficiently complete and continuous are, however, highly desirable in order to establish firmly the reality of these periods.

PRESENTATION OF BUST OF LORD KELVIN.

AT the general statutory meeting of the Royal Society of Edinburgh, held on October 27, a marble bust of the late Lord Kelvin, by Mr. A. M'Farlane Shannan, which had been given by Lady Kelvin



Marble bust of Lord Kelvin.

to the society, was formally presented and received. Sir William Turner, the retiring president, occupied the chair, and there was a large and representative gathering of the fellows and the general public. Prof. Crum Brown made the presentation in the name of Lady Kelvin. After referring to Lady Kelvin's thoughtful kindness in giving this beautiful bust as a permanent possession of the Royal Society of Edinburgh, and to his own lifelong friendship with Lord Kelvin, Prof. Crum Brown referred especially to Lord Kelvin's "supreme love of truth and of his intense interest in everything, however apparently trivial, connected with the constitution or with the working of the physical universe. These were the prime motives to his work, and he carried it out in the same spirit. Having formulated a problem, he followed the straightest course to its solution. Of course, he encountered difficulties; these he did not evade, he surmounted them. To do so he had often to invent and construct special instruments of wholly novel type. . . Lord Kelvin was a great mathematician. He was never at a loss to find the mathematical key. . . . Lord Kelvin was no intellectual miser. When in the course of his scientific work he came across something which could be so applied as to be of practical use, he developed this application, and thus became the inventor of instruments, truly scientific instruments, differing in character from those he made for purely scientific purposes only in this, that they were also used and very highly prized by those who were not necessarily scientific, who perhaps did not care about the dissipation of energy or vortex motion. These practical men, by using Lord Kelvin's inventions, came to see that pure science was not vain; they came to know something of the tree from its fruit. Lord Kelvin was quite free from selfishness or jealousy. He rejoiced in his own work and discoveries; he also rejoiced in the discoveries of others. In questions of first importance to man, where science gave no help, Lord Kelvin was a humble and devout disciple. In Lady Kelvin's name I hand over to the Royal Society of Edinburgh, through you, sir, as president, this beautiful work of art and striking likeness of Lord Kelvin, one of the greatest discoverers in pure science, a true benefactor of mankind, our honoured president and dear friend."

In accepting the bust in the name of the society, Sir William Turner referred more particularly to Lord Kelvin as a fellow of the Royal Society of Edinburgh. He joined the society in 1847, and continued so to be for the remaining sixty years of his life. His early communications were on the theory of heat, and their Transactions contained a valuable record of that brilliant work. Numerous communications followed, and his last paper was communicated in 1906, just a year before his death. This was upon the initiation of deep-sea waves, and, as all knew, the sea and the deep-sea formed important features in his practical career. Lord Kelvin occupied the presidential chair for three different periods, from 1873 to 1878, from 1886 to 1890, and from 1895 to his death in 1907. The second period was only for four years, the council of the society relieving him from the full five years at that time in order that he might be able to accept the invitation of the Royal Society of London to act as their president, an arrangement which was carried out by mutual understanding between the two councils. He asked Prof. Crum Brown to be good enough to convey to Lady Kelvin their most devoted and hearty thanks for that admirable bust of her late husband, which would be one of their precious possessions.

ORNITHOLOGICAL NOTES.

TO the *Bull. Soc. Imp. Nat. Moscou* for 1912 Prof. P. P. Suschkin contributes an article of more than 200 pages on the bird-fauna of the Minussinsk district of the Upper Yenisei, the Sahan Mountains, and the Urhanchen country, an area of special interest on account of being the meeting-place of several sections of the Eastern Holarctic fauna. To the north and east, for instance, is the realm of the East Siberian fauna, while on the west we enter the great plain of western Siberia, with a fauna differing but slightly from that of Europe. To the southward is the fauna of Central Asia, and, finally, to the south-west that of Turkestan.

The local distribution of the large number of species of birds found in this vast tract is shown in elaborate tables, which indicate not only the area visited by each, but likewise whether this includes steppe, wooded steppe, or alpine country. The paper should be of great value to students of zoological distribution.

In this connection may be noticed a paper by Mr. T. Iredale in the Transactions of the New Zealand Institute for 1912 (vol. xlv.) on the bird-fauna of the Kermadec Islands, in which stress is laid on the affinity between the birds of New Zealand on one hand, and those of New Caledonia on the other. It is suggested that the Kermadec Islands should be regarded as one province of the Australian region, exhibiting marked Polynesian affinities, Norfolk and Lord Howe Islands as a second, and New Caledonia as a third.

Turning to Australia, reference may be made to a coloured plate in the July number of *The Emu,* illustrating the remarkable variation in shape, size, colour, and marking displayed by the eggs of the piping-crow, or Australian magpie (*Gymnorhina tibicen*), which, it is claimed, exceeds that in any other bird. Nine specimens are figured, each from a different clutch, and each more or less unlike the rest, the variation in colour ranging from greenish-blue to reddish and sandy, and the markings from blackish spots to reddish scribblings. In an accompanying note Mr. A. F. B. Hall states that, unlike those of many sea-birds, all the eggs of any particular clutch are practically similar, and this similarity extends to all the clutches laid by each individual bird. This, it may be added, has an important bearing on the theory of "wagtail-cuckoos," "reed-warbler-cuckoos," &c.

Footprints of the larger species of moas are, it appears, but very rarely found, the two chief, if not only, recorded instances of their discovery having taken place at Turangui, Poverty Bay, in 1871, and on the Manawater River, Palmerston North, in 1894. At the latter locality four other footprints were exposed in 1911 by a flood, which washed away a bank 15 ft. high, revealing at its base a bed of clay containing four prints. These are described and figured by Mr. K. Wilson in the aforesaid volume of the Transactions of the New Zealand Institute. The tracks measure 18 in. across the foot, 12 in. from point of middle toe to heel, and 30 in. from heel to heel. Plaster casts have been taken.

In the first number of vol. ii. of *The Austral Avian Record* Mr. J. B. Cleland directs attention to abnormal coloration in the palate and pharynx of certain Australian birds, the variation taking the form of black and grey tints in some groups, and of yellow or orange in others. No suggestion as to the reason for this departure from the normal flesh-colour is suggested.

The autumn number (vol. v., No. 7) of *Bird Notes and News* is illustrated by a reproduction in black and white of an exquisite painting by Mr. H. Grönvold of the white heron, or egret, with the legend, "Where are my companions? Save me." The issue includes a chronological sketch of the movement against the plumage trade, from its rise in 1869 to the present day, with the text of the Government Plumage Bill. Reference is also made to the protection of birds at lighthouses, the slaughter of swallows in France, and bird-catching in this country.

In the October number of *British Birds,* Mr. H. F. Witherby records the results of a series of careful observations made by himself with the object of ascertaining the cause of the baldness of the area round the base of the beak in adult rooks. The investigation also included the moults undergone by the plumage generally. In rooks of the year the area which is bare in their parents is fully feathered; but Mr. Witherby records that a number of hair-like "filoplumes" grow amid the narial bristles, and that larger filoplumes, as well as down-like plumules, are hidden among the contour-feathers of the chin and throat. In the first—July and August—moult the feathers are renewed all over the head in the normal manner, although those on the area which eventually becomes bare are of a somewhat abnormal type. In the following January, however, or somewhat later, the feathers of this area are gradually shed, and not replaced—although most of the filoplumes and plumules persist—while the feather-papillæ undergo an abnormal development into curious pin-like growths over the now permanently bare area. R. L.

THE SYNTHESIS OF GLUCOSIDES BY MEANS OF FERMENTS.

AT the closing session of the eleventh International Congress of Pharmacy, recently held at the Hague, Prof. Emile Bourquelot, of Paris, delivered a lecture on the synthesis of glucosides by means of ferments, in which he described the results of his recent researches on this subject.

Hitherto it has not been proved that enzymes have anything but an analytical action; Prof. Bourquelot, who has been working on the ferments for something like twenty years, has, however, obtained results which justify the conclusion that the decomposing action continues up to a certain point only, and that at this point a synthetic action begins. He gives as an example the action of emulsion on arbutin; one of the products of decomposition is hydroquinone, but the action ceases before the whole of the arbutin is decomposed. This he shows to be due to the presence of the products of decomposition, for when hydroquinone is added to a solution of the enzyme and the glucoside, the decomposing action of the enzyme is greatly retarded.

Having established this fact, Prof. Bourquelot allowed ferments to act upon methyl alcohol in the presence of glucose, and succeeded in forming methylglucoside β. He next dealt with other alcohols, and succeeded in synthesising a series of glucosides, and determined the conditions under which synthesis could be effected. By combining different sugars with the same alcohol, a number of hitherto unknown glucosides was synthesised, and the synthesis of many others is possible.

PHYSICS AT THE BRITISH ASSOCIATION.

THE meetings of Section A of the British Association at Birmingham were of great interest to the general scientific public and of considerable value to those more specially interested in the particular problems discussed and the papers read at the sectional meetings. English physicists, astronomers, and mathematicians attended the meeting in force. Among those who were present may be mentioned Lord Rayleigh, Sir J. J. Thomson, Sir Joseph Larmor, Prof. Rutherford, Prof. Bragg, Prof. Poynting, Prof. Hobson, Prof. H. H. Turner, Sir D. Gill, Dr. Glazebrook, Principal E. H. Griffiths, Prof. Lamb, Prof. Love, Prof. S. P. Thompson, and Mr. J. H. Jeans. A distinguished company of foreigners also attended, amongst whom were Madame Curie, Prof. H. A. Lorentz, Prof. E. Pringsheim, Prof. Arrhenius, Prof. R. W. Wood, and Dr. Bohr. With the president of the association a physicist, and Dr. H. F. Baker as sectional president, the *personnel* of the meeting was of great interest in itself, and in consequence the papers and discussions were of a very high order of excellence.

The address of Sir Oliver Lodge was of special interest, as in it he touched on the main subjects of discussion in the section. The address has been published in full in an earlier number of NATURE, so that there is no need for further remark here. The sectional president's address has also appeared in full in NATURE, and there is similarly no call to deal with it further in this place. It was listened to by a crowded audience, and formed a fitting opening to a meeting that proved itself of great importance, and in which the interest was kept up till the last day.

The address of Dr. Baker, after a vote of thanks proposed by Sir Oliver Lodge and seconded by Lord Rayleigh, was followed by a paper by Prof. Barkla on the nature of X-rays. This subject has practically ceased to be controversial except as it has passed over into the general subject of radiation. Prof. Barkla gave an outline of the evidence in favour of the undulatory theory, of which he has always been a keen exponent, and which is now accepted by all physicists. Sir J. J. Thomson and Prof. Rutherford spoke in the following discussion, the former paying a well-deserved compliment to Prof. Barkla on the large amount of our knowledge of X-rays which is due to him. Prof. Rutherford laid stress on some of the still outstanding difficulties in the subject. The discussion was not so interesting as it would have been a year ago, when the supporters of the corpuscular theory would have been in force. This paper was followed by one from Sir J. J. Thomson on the structure of the atom. This was a brilliant attempt to construct an atom which would account for some of the evidence for the quantum theory of energy. The paper was delivered with the clearness and boldness now always expected from Sir J. J. Thomson, and it will be long before his illustration of the quantum theory by pint-pots is forgotten.

The next paper was by Prof. H. A. Lorentz. Prof. Lorentz is known to all physicists as the leading exponent of all questions involving the interactions of æther and matter. His presence at the Birmingham meeting added greatly to the interest and value of the discussions. His command of English, his extraordinary capacity for exposition, and his quiet humour made his paper and his speeches in discussion one of the most enjoyable features of the proceedings of Section A. The subject of the paper was, "The Relation between Entropy and Probability." The entropy of a body in a certain state is intimately connected with the probability of that state. Boltzmann has deduced the expression of the relation in his well-known formula, in which the entropy is proportional to the logarithm of the probability of the state. Prof Lorentz's paper was to investigate how the probability is to be evaluated. The method of calculation, closely connected with Gibbs's microcosmical ensembles, gives the entropy of Boltzmann's formula as the thermodynamical entropy. On account of the enormous number of molecules contained in a body, Boltzmann's formula has the remarkable property that great changes in the value assigned to the probability have no appreciable effect on the entropy.

A special case considered was that of a monatomic gas. If the number of molecules is n, P the probability $= Cv^n e^{\frac{3n}{2}-1}$. C being a determinate constant factor; hence if we omit the corresponding term in the entropy S, this $= n\frac{R}{N}\log(ve^{\frac{3}{2}-\frac{1}{n}})$, which since n is very large $= n\frac{R}{N}\log(ve^{\frac{3}{2}})$, an expression which is neither very large nor very small when the mass of the gas is comparable with a gram-molecule. Now it is clear if P be multiplied by n, or even a high power of n, say n^{100}, this produces no appreciable effect on S, for $\log n$ is very small compared with n for large numbers. Boltzmann's formula is therefore insensible to such factors as n^{100} in the value of P. Again, if the n molecules be supposed distributed at random over a volume v, the probability that they all lie in one half of it is $\frac{1}{2^n}$, whereas it is 1 if all possible distributions are considered. The corresponding difference in the entropy is no more than $n\frac{R}{N}\log 2$. The result of this property is that we are to a large extent free in the choice of a value of P. Thus, in order to calculate the entropy, we may as well take the probability of the most probable state of things as the much higher value that is obtained if all possible states are included.

After Prof. Lorentz, another paper on the structure of the atom was read by Prof. Rutherford. The author took the opposite view to that represented by Sir J. J. Thomson's atom. The Rutherford atom consists of a charged nucleus of minute dimensions, in which most of the mass is concentrated. This nucleus is surrounded by a distribution of electrons. The evidence for this structure of atom lies in the large angle scattering of high-speed particles like the α and β particles from radio-active matter. New experiments were described by Prof. Rutherford on the scattering of α particles by the simple gases. It was unfortunate that there was no time for a fuller discussion of the interesting points raised by this paper and that of Sir J. J. Thomson.

The last communication, taken on Thursday, was one by Dr. Swann—who has just left Sheffield for America—on the resistances of thin metallic films. Some of the hitherto unexplained facts in connection with the conductivity of thin films were explained on the hypothesis that the film deposited by the electric discharge does not consist of a continuous and homogeneous distribution of molecules, but of patches or groups of molecules more or less definitely separated from each other. This distribution was taken account of in the paper, and a formula calculated to allow for the resulting alteration in the mean free path of electrons concerned in conduction. The agreement of the theory with experimental results is as close as could be hoped for.

On Friday morning the most important discussion of Section A, if not of the whole meeting, took place. The subject was radiation, and it was opened by Mr. J. H. Jeans in a masterly and concise manner. The discussion turned on the question of the validity of the laws which have hitherto been believed to be the ultimate laws of nature. The problem at its simplest occurs in the case of black body radiation. Mr. Jeans regarded the work of Poincaré as conclusive when starting with the mean energy of each vibration of specified wave-length he deduces the quite definite result that the exchange of energy must take place by finite jumps. This leads directly to the quantum hypothesis which the opener assumed in its entirety. He went on to consider what other phenomena bear witness to its truth. The most important is the photoelectric effect: the energy imparted to an electron appears to be exactly the right amount required by the quantum hypothesis. Mr. Jeans quoted in this connection the recent work of Dr. Bohr, who has arrived at a convincing and brilliant explanation of the laws of spectral series.

Against the quantum theory seem to be arranged most of the well-established results of the undulatory theory of light. The great difficulty is the reconciliation of the two sets of facts. The boldest and simplest attempt lies in abandoning altogether present conceptions of the æther, and relying on some purely descriptive principle, such as relativity. But the attempt at a dynamical explanation should be made, and Mr. Jeans concluded by a suggestion as to the meaning of the Planck constant h. This constant is connected with e, the charge of an electron. We may, perhaps, imagine that the equations of the æther involve e or h as well as the Maxwell terms. These terms may be eliminated in forming the equations for wave propagation for certain cases, and in that event there will be no discrepancy between the quantum theory and the undulatory theory. But where the equations are applied to interactions between matter and æther, the older theory will not apply, and the terms involving h must remain in.

The second speaker was Prof. Lorentz. He accepted the quantum theory, and sought a method of accounting for it. Some kind of discontinuity in the transfer of energy is experimentally proved, but the individual existence of quanta in the æther is impossible. He considered the scheme of transference of energy from matter to resonators and to the æther. The transfer from a resonator to the æther of a quantum can be easily conceived, but it is difficult to understand how the quantum can be transferred back to the resonator from the æther, for once in the æther it becomes distributed indefinitely. Prof. Lorentz suggested that the quanta are necessary in some transference, and that perhaps the solution was to be found in assuming them operative in transferences from matter to the resonator and *vice versa*, and not in the interchange between resonators and the æther. The difficulty in this view is to distinguish clearly the two classes, matter and resonator. Prof. Lorentz was again clear and very interesting. His humour again appeared, as when referring to Sir J. J. Thomson's atom he remarked that "it was highly ingenious—as it could not otherwise be—but the point was, did it represent the truth?"

Prof. Pringsheim followed, and confined his remarks to the experimental bearing of the problems raised. The constants of radiation are not accurately enough known—for example, Stefan's and Planck's constants. He also referred to the question of the radiation from other sources than the black body. Dr. Bohr, of Copenhagen, was the next speaker. His work had been referred to by previous speakers, and he gave a short explanation of his atom. His scheme for the hydrogen atom assumes several stationary states for the atom, and the passage from one state to another involves the yielding of one quantum. Dr. Bohr also emphasised the difficulty of Lorentz's scheme for distinguishing between matter and the radiator. Planck's resonator has all the ordinary properties of matter, and it is difficult to keep up the distinction. Prof. Lorentz intervened to ask how the Bohr atom was mechanically accounted for. Dr. Bohr acknowledged that this part of his theory was not complete, but the quantum theory being accepted, some sort of scheme of the kind suggested was necessary.

Prof. Love represented the older views, and maintained the possibility of explaining facts about radiation without adopting the theory of quanta. He criticised the application of the equi-partition of energy theory, on which part of the quantum theory rests. The evidence for the quantum theory of most weight is the agreement with experiment of Planck's formula for the emissivity of a black body. From the mathematical point of view, there may be many more formulæ which would agree equally well with the experiments. A formula due to A. Korn was dealt with, which gave results over a wide range, showing just about as good agreement with experiment as the Planck formula. In further contention that the resources of ordinary theory are not exhausted, he pointed out that it may be possible to extend the calculation for the emissivity of a thin plate due to Lorentz to other cases. For this calculation no simple analytical expression represents the results over the whole range of wave-lengths, and it may well be that in the general case no simple formula exists which is applicable to all wave-lengths. Planck's formula may, in fact, be nothing more than an empirical formula. Lord Rayleigh spoke next. He did not attempt to discuss the question, but welcomed the discussion. It was interesting to see Lord Rayleigh at the meeting, and references to his historic work on the subject of radiation were made by several of the speakers.

Sir J. Larmor spoke about the theory of the equipartition of energy. In an isolated region of the æther there is no way open for the interchange of energy at all between one type of radiation and another, so that the assumption of "other things being indifferent" is not applicable. The structure of an electron and the mechanism by which it reacts with the æther is totally unknown. In the very intense kinetic phenomena which occur when transferences of energy take place, the energy may not be expressible as a sum of squares, as the equipartition theory requires. A transfer may be even discontinuous. Sir J. Larmor went on to show that equi-partition need not therefore be necessary as regards free radiation, and atomic vibrations which are set up by its agency and must be in equilibrium with it need not come under the equi-partition theory. The new knowledge we have of specific heats at very low temperatures has also led to further speculations and extension of theoretical schemes, but it can be held that there is nothing destructive of older principles of physics. He looked to a reconciliation between the older and newer views from further knowledge of the interactions between free æther and electrons.

Sir J. J. Thomson further discussed the equipartition theory, and was prepared to give it up if it was the cause of all the difficulty. Referring to statistical methods, he recalled De Morgan's saying that if a calculation in probability required more than half a sheet of notepaper, its result should not be received without further independent evidence.

Sir Oliver Lodge spoke also, and pointed out that the ordinary laws could not apply in the interior of an electron or a positive charge, for if they did the charge would fly to pieces because of the mutual repulsion of its parts.

Prof. Lorentz again spoke, and remarked that a theory that explained both the phenomena of specific heat and the absorption spectrum was not to be disposed of on purely mathematical grounds. He emphasised the fact that the Planck constant was there, and that it had some very definite meaning which had to be interpreted.

Dr. S. D. Chalmers gave an account of an atom model which agreed with the results of the quantum theory, and also with the magneton hypothesis. Mr. Jeans closed the discussion with replies to some criticisms, and again pointed out that from the experimental point of view Prof. Lorentz's discrimination of matter and radiators was impossible. No distinction between them could be made.

This discussion went on from ten o'clock to one, and the interest was kept up till the end. It was of great value, as all points of view were represented, and gave a much clearer notion of the trend of thought on this fundamental subject to those who have not been able to follow the literature very carefully. We understand that the discussion is to be published in full in the reports. This will be a valuable addition to the literature of the subject.

Sir Joseph Larmor gave a short account of a paper on lightning and protection from it. He discussed the relation of the field of force near a lightning conductor and the mechanism of the discharge. It was unfortunate that there was only a few minutes for the subject, as there was no discussion, and the views brought forward were of great practical importance. It is to be hoped the paper will appear in full and will have the attention it deserves.

Prof. W. H. Bragg spoke on X-rays and crystals, which was of great interest and importance. The paper was discussed at a special meeting of the section on Tuesday afternoon. It was unfortunate that some of those most interested—Profs. Pope, Barlow, and Armstrong, for example—were unable to be present at the discussion. Prof. Bragg gave an account of the new method of using characteristic Röntgen rays and crystals. With his son, Mr. W. L. Bragg, he had obtained as many as five orders of spectra by reflection at certain planes of the crystals. If in a crystal there are planes specially rich in atoms, these planes, spaced at definite distances, act somewhat in the manner of an echelon grating, and spectra are produced. From the characters of the spectra of different orders—absence, diminished intensity, and so on—the spacing of the planes can be determined, and so we have a new method of determining the arrangement of atoms in crystals. The diamond has been thoroughly examined, and a model of its structure was shown. The method is a singularly beautiful one, and apparently not open to criticism. The method also provides, in the words of Prof. Bragg, a spectroscope for X-rays, and measurements could be made without doubt to an accuracy of 1 part in 1000. For the discussion of the paper Prof. Bragg specially came back to Birmingham and gave further details of the method. Prof. Arrhenius congratulated the authors, and remarked that it was the beginning of a new crystallography. Reference was made to the work of Pope and Barlow, and Prof. Bragg explained that in his view the differences between the structures obtained by the new method and by the old might be reconciled. He made no claim to have contradicted the work resting on the theory of close packing. The paper and discussion were listened to by large audiences, and formed one of the most interesting parts of a successful meeting.

On Friday, after the radiation discussion, the department of mathematics met separately, when two papers on mathematical physics were read. Prof. Eddington spoke on the dynamics of a globular stellar system. The problem attacked is that of the determination of different possible distributions of velocity which correspond to a steady state. In the paper a number of simpler cases are worked out. It is of special interest to find a system in which there is a strong preference for motion to and from the centre (following Prof. Turner's suggestion for explanation of the two star streams). Systems satisfying this kind of motion, and also requiring only a finite density at the centre of the system, have been found. The other paper at this meeting was by Dr. Swann on the expression for the electrical conductivity of a metal deduced from the electron theory.

On Monday the department of general physics held a joint discussion with Section G (engineering) on the investigation of complex stress distribution. This discussion was more on the engineering side than the physical, and will be dealt with in the special article on the proceedings in Section G. The department of cosmical physics met at the same time, and several important papers were contributed. Mr. C. E. St. John, of Mount Wilson Observatory, gave an important account of some late results of solar work at Mount Wilson. He made out a clear connection between the radial velocity of gases in the solar atmosphere and the intensity of the lines which are used in the velocity determinations. That is to say, a connection has been demonstrated between radial velocity and the level in the solar atmosphere. The displacements of Fraunhofer lines in the penumbræ of sun-spots thus is shown to give a means of sounding the solar atmosphere and of assigning relative levels to the sources of the lines. The results obtained clearly open a wide field for further solar research.

Dr. S. Chapman gave an interesting paper on the lunar influence on terrestrial magnetism and its dependence on solar periodicity. On Schuster's theory of the variation of magnetic force Dr. Chapman considered the effect of the lunar tide in the earth's atmosphere. This effect can be detected in the observations. The solar effect is due to the ionisation and conductivity in the upper atmosphere depending on the sun's hour angle. The study of the lunar period is valuable, as it enables us to separate the two effects, periodicity in the atmosphere and periodicity in the conductivity. No apparent relation has been detected between the conductivity and the eleven-year solar cycle. A paper on solar and terrestrial magnetic disturbances was read by the Rev. A. L. Cortie, S.J.

Two interesting papers on meteorology were read—Mr. J. I. Craig on a temperature see-saw between England and Egypt, and on temperature frequency curves by Mr. Gold and Mr. F. J. W. Whipple. There were two papers on seismology: "The Distribution of Earthquakes in Space and Time," by the Rev. H. V. Gill, S.J.; and "Notes on the Construction of Seismometers," by the Rev. W. O'Leary, S.J. A communication of general interest was read by Dr. J. S. Owens, dealing with methods for measuring the amount of atmospheric pollution by suspended matter, such as smoke and dust. Prof. H. H. Turner gave a paper on the Fourier sequence as a substitute for the periodogram. Mr. J. H. Reynolds's communication on arrangements for a reflecting telescope was taken as read. After the joint discussion, the department of general physics met for another important session. Prof. Pringsheim gave his paper on a theory of luminescence and the relation between luminescence and pure temperature radiation. It was interesting to the section to hear in Prof. Pringsheim another distinguished foreign visitor, and one whose name is intimately connected with the experimental results that form the foundation of the new theories of radiation.

The next paper was by Prof. R. W. Wood, of Baltimore, who is well known as one of the most brilliant experimentalists of our day. He described some experiments on resonance spectra under high dispersion. As is expected of Prof. Wood, most interesting and amusing details of experiments were related. The method of removing spider-webs from the long buried tube of the spectrograph by sending "the household pussy cat" through is an original and effective method of attaining the desired end. Amongst the many interesting details of the work, which will be fully described elsewhere, may be mentioned the method of exciting the resonance spectrum of iodine by monochromatic illumination filtered through bromine vapour to supply light of a small enough range of wave-length to include only one line of the iodine spectrum. The paper was full of the kind of experimental perfection that is to be found in so much of Prof. Wood's work.

Prof. S. B. Maclaren gave a paper on a theory of magnets. This paper dealt with some of the difficulties of magnetic theory, and pointed out how an explanation of paramagnetism and diamagnetism may be arrived at. Magnetic induction is explained by means of tensions in the field acting on matter, and the molecular magnetic field is not explained as due to the circulation of electric current sheets. Prof. Coker gave a demonstration of large polarising apparatus for lantern projection. Beautiful pictures result, but the apparatus has been described before, and there is no need for details in this place.

In the middle of the same morning the department of pure mathematics met, when communications were read by Prof. J. C. Fields, Prof. Hilton, Lieut.-Col. Allan Cunningham, Prof. A. C. Dixon, and Mr. M. D. Hersey. A paper by Prof. A. W. Conway was taken as read.

On Tuesday morning there was a joint meeting with Section E (geography), when four papers on geodetic subjects were read. An account of this joint meeting will appear in the article describing the work of the geographical section, which will shortly be published in NATURE. At the same time the department of general physics met and had another series of important papers and discussions. Dr. W. H. Eccles read an account of some experiments on contacts between electrical conductors. The paper explained the absence of a linear relation between current and electromotive force when the current passes across a "loose contact." The behaviour of the contact was explained by purely thermal actions in the matter near the point of contact. The Joule, Peltier, and Thomson effects all play a part.

Prof. Poynting read a paper on the twisting of indiarubber. By means of an exceedingly delicate piece of apparatus he had measured the changes in length and cross section of steel and copper wires under torsion, and had tried the same with indiarubber. Indiarubber showed no observable change in volume when twisted, but a very large increase in length when compared with steel. Sir J. J. Thomson, in discussing the subject, suggested a connection in the behaviour of these materials under magnetic influence.

Two papers—one by Sir J. J. Thomson on X_3 and the evolution of helium, the other by Mr. F. W. Aston on a new elementary constituent of the atmosphere—created great interest. A number of chemists came to hear of this fresh invasion of their territory by Sir J. J. Thomson. The gas X_3, which has been described before, is now considered by Sir J. J. Thomson to be H_3. Evidence was given in the paper which though in detail perhaps not convincing, yet has great cumulative weight. The chemists present were prepared to accept the possibility of an H_3 molecule. As to the evolution of helium, there seems little doubt that it comes from the material bombarded by the kathode rays in the tube. Here there is a divergence between the views recently put forth that such helium results from a transformation of the gas in the discharge tube. In the discussion Sir Oliver Lodge emphasised the importance of these experiments, as in his opinion it was the first case of the artificial production of atomic disintegration. Mr. Aston dealt with an investigation of the existence of an element with atomic weight about 22. Sir J. J. Thomson's positive ray method had detected such an element, and the paper was an account of the partial separation of neon into two gases of approximate atomic weights, 19·9 and 22·1. The method was one of diffusion attested by a change of density. The method of determining the density was by means of a specially constructed quartz balance of small size hung inside the tube containing the gas. By adjustment of the gas pressure the quartz beam could be balanced and the density of the gas determined with great accuracy. The smallness and compactness of the apparatus enabled very small quantities of gases to be dealt with. No physical differences except in density had been discovered between the two gases.

Dr. E. E. Fournier D'Albe gave an account of the minimum quantity of light discoverable by selenium. Very faint illuminations can be detected, and it was suggested that there might be a possibility of direct measurement of the Planck quantum of energy. A paper by Mr. H. B. Keene on the transmission of X-rays through metals was of interest, especially as it was allied to Prof. Bragg's paper on X-rays and crystals. Other papers were by Mr. J. F. Forrest on the electric arc as a standard of light, and by Dr. G. A. Shakespear on the resistance of air to falling spheres and on a method of increasing the sensitiveness of measuring instruments. The method was to throw the image of a Nernst filament lamp from the mirror of any deflected instrument on to a radiomicrometer strip; any change in the direction of the original reflected beam of very small amount results in a large deflection of the radio-micrometer. The method can be repeated, and any increase in sensitiveness obtained except for the difficulty of keeping steady conditions. Mr. J. S. Anderson described a new method of starting mercury lamps. Papers by Mr. W. H. F. Murdoch on a magnetic susceptibility meter, Mr. A. J. Lotka on a new process for enlarging photographs, and Prof. H. Stansfield on the sensitiveness of the human skin as a detector of low-voltage alternating electrostatic fields were taken as read. The discussion on Tuesday afternoon of Prof. Bragg's paper has already been referred to.

On Wednesday the first business was the presentation of reports. On the report of the Seismological Committee Prof. Turner spoke of the loss to seismology and science generally in the death of Prof. John Milne. The work of British seismology and seismology generally owes nearly everything to Milne; as a resolution of the committee expressed it, he may be said to have created a new science. For many years past he had himself presented the annual report of the Seismological Committee, and the report presented by Prof. Turner had been drawn up by him just before his death.

After the reports, papers were read by Mr. J. S. Anderson on a new method of sealing electrical conductors through glass, and by Mr. J. J. Shaw on a seismograph. This instrument had been exhibited during the meeting, and was of the Milne type, with its natural oscillations damped by means of an aluminium strip attached to the boom swinging between the poles of magnets. The instrument is of importance, and had a further interest in the fact that it was designed and constructed with the cooperation of Prof. Milne just before his death. Papers by Dr. Vaughan Cornish on a method of determining the period of waves at sea, by Mr. Lotka on the dynamics of evolution, by Mr. Hookham on microscope crystals with epidiascope illustrations, and by Prof. T. R. Lyle on the Goldschmidt dynamo were taken as read. It was unfortunate that Dr. Vaughan Cornish, owing to a misunderstanding, arrived just after the sectional meeting was formally closed, but an informal meeting was held, which heard the paper with interest.

The meetings of the section were well attended all through, and on several occasions the room, although holding 350 people, was not large enough for those who desired to hear certain papers. The programme was too crowded, and there was not sufficient time for discussion. The remedy is in the sectional committee's own hands. Two afternoon sessions in the week would remove all congestion, and it is difficult to see why Section A should not adopt a course followed by several other sections. This course was urged by the Recorder at the Committee, but rejected. The experiment of a discussion of a particular paper—Prof. Bragg's—in the afternoon was a complete success, and to hold such afternoon meetings would be a better method than to restrict the number of papers contributed. It would be a loss to the usefulness of the section if less important papers were altogether crowded out. One function of the association is to provide some opportunity and encouragement to younger and less well known men, and it would be a pity for such a function to be lost altogether.

Some important work was done in the sectional committee and in research committees. The report of the Seismological Committee has been already referred to. The Seismological Committee had to consider what steps should be taken in order to carry on the work that has hitherto been done under Prof. Milne. It was felt that it was impossible to raise enough money to carry on the work at Shide as an independent station, and the committee decided to try to obtain sufficient funds to enable the observational work to go on. Prof. H. H. Turner undertook to exercise a general supervision over the station at Shide, and for the present this seems a satisfactory arrangement. But it is unfortunate that the work cannot be carried on with proper equipment and *personnel*. Seismology owes so much to Milne that it would be a fitting tribute to his memory for his observing station to develop into a thoroughly equipped institution. In the meantime, the subject is under great obligation to Prof. Turner for taking over the general supervision.

A report was received from the Electrical Standards' Committee announcing its own dissolution. This committee has done immensely important service in the past. Its work has appeared in a more readily obtainable form. The reports from 1861 to the present time are republished in one volume. Prof. H. H. Turner moved a resolution calling attention to the historic character of this committee, and expressing on behalf of the Committee of Section A the sense of its importance and value. Dr. Glazebrook, the secretary of the Standards' Committee, replied.

An important research committee on radiotelegraphic investigations presented its first report and outlined a programme of work. Certain problems, especially those of "strays" and of the differences between night and day signalling, can only be investigated by cooperative work at widely scattered stations. The committee has obtained the cooperation of most of the large institutions connected with wireless telegraphy, and hope that exceedingly valuable work may be done in the near future. Both this committee and the seismological committee hope to be able to carry on their work by means of grants from the Caird Fund.

Reports were also received from the committees for investigation of the upper atmosphere, for the tabulation of Bessel and other functions, for the establishment of a solar observatory in Australia, for administering a grant for the international tables of constants, and for the disposal of "the binary canon." The list of grants made to research committees has already appeared in the columns of NATURE.

The local arrangements for the meeting of the section were admirable. The rooms devoted to Section A were in the Mason College, and served their purpose excellently. The large room on some occasions was not quite large enough, but it would be difficult to find anywhere a suitable lecture-room to hold the number who would have liked to hear some of the papers. Great credit is due to those who had the arrangements in hand, especially to Dr. Shakespear, for the smooth working of such a large and complicated section. A word of congratulation may also be given to *The Times* for the excellent way in which some of the meetings, especially the radiation discussion, were reported.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

BIRMINGHAM.—A course of ten lectures on social anthropology, by Mr. A. R. Brown, of Trinity College, Cambridge, has been arranged for the winter and spring terms. This course is the outcome of a suggestion made in the Anthropological Section of the British Association during the recent meeting, and is intended as a tentative experiment to determine to what extent there is a demand for such a course in addition to the existing course in physical anthropology.

CAMBRIDGE.—Mr. W. E. Hartley, of Trinity College, has, with the consent of the Vice-Chancellor, been appointed chief assistant at the observatory.

Mr. F. W. Aston, of Trinity College, has been elected to the Clerk Maxwell scholarship.

Mr. T. L. Wren and Mr. F. Kidd have been elected to fellowships at St. John's College.

An examination for the award of the Sheepshanks astronomical exhibition will be held in the Lent term, 1914. The exhibition is open to all undergraduates of the University of Cambridge, but any person elected, if not already a student of Trinity College, shall thereupon become a student of Trinity College. Candidates may offer themselves for examination in one or more of the following subjects:—(*a*) astronomy and allied subjects as defined in Schedule A of part ii. of the mathematical tripos; (*b*) spherical astronomy and combination of conservations; (*c*) celestial mechanics; (*d*) use and optical theory of astronomical instruments; (*e*) astrophysics. A paper of essays on astronomical subjects and an examination at the observatory in elementary practical astronomy will be compulsory on all candidates.

AMONG numerous bequests under the will of the late Dr. F. G. Smart is one of "10,000*l*. to Gonville and Caius College, Cambridge, for two 'Frank Smart Studentships' in natural history or botany, and if this sum shall be more than sufficient to provide for these studentships the balance is to be used to promote the study of these subjects in that college."

MR. J. A. PEASE, President of the Board of Education, speaking at Camberwell on October 31, forecasted largely increased grants from the Treasury for education. In the course of his remarks he said:—"Local authorities know only too well that educational expenditure has increased and is increasing, and I must tell them that it will have to increase still farther if we are to get the economic equivalent for what we spend. The gravest of all defects in our educational system is not in elementary education, but in intermediate education. Every child in the country has an equal chance of developing his abilities up to a certain point. It is when that point is reached and passed that the defects of our present system make themselves manifest. You keep a child at school for eight or nine years, and just at the critical time when his natural aptitudes are taking their bent and his character is forming his education is broken off, and the boy and the girl who might have done good service in some profession or skilled industry drops into idleness or loafing, or adds one to the millions of casual and unskilled labourers. I say with conviction that the first upward step must be the improvement of our intermediate education, because that is the branch in which we are most lacking. You may not always find a genius—a genius is rare—but remember that if you do find him you will have repaid yourselves more than a hundredfold. Remember the economic value of a great inventor covers the educational expenditure of a whole town. I think Sir Henry Bessemer was a fellow-townsman of yours here in Camberwell, and Sir Henry Bessemer's chief invention, we know, was equal in productive power to the labours of a hundred thousand men. Now, that is why I say that we must be prepared for further expenditure if we are to get the economic equivalent for what we have spent already. We must be prepared as a country to foot the bill, just as the Government will be prepared to make the proposals to the country. The Government policy is a large policy, and I may say that it is our intention not only to increase the amount of the grant, but to change the manner of its distribution, so that of two areas equally efficient the poorer will receive the larger grant, and of two areas equally necessitous the more efficient will receive the larger grant."

A SUGGESTIVE paper was read by Mr. Cloudesley Brereton at a conference of employers of labour on October 28, in connection with the recent National Gas Congress and Exhibition. Mr. Brereton pointed out that although until recently education in England has busied itself far too little, upon the whole, with the problems of the work-a-day world, yet even the older English Universities of Oxford and Cambridge in actual practice have always been to a considerable extent technological institutions. Their work has been mainly, not so much the imparting of book knowledge, but of "mancraft," the art of handling men, gained through daily contact with their fellows. In so far as the studies of candidates for theology, medicine, and law are concerned, these Universities are to all intents and purposes purely technological colleges. At the present time in the older, and to a far greater extent in the younger, universities we find training in technique provided in many subjects, not merely in law, medicine, and theology, but also in engineering, applied chemistry, the textile industries, gas and electricity, and certain branches of commerce. Whatever the grade of educational institution may be the problem of suitable curricula can only be solved by first considering what will be the probable career of the pupil. The elementary school is already moving in the direction of first diagnosing the pupil's future needs and then prescribing for him. Even the older universities and the public schools are showing signs of being affected by similar influences. Employers, in consequence of the increasing pressure of competition and the invasion of industry by science, are as vitally interested in the production of pupils of the right type as the educationist is, or ought to be. Mr. Cloudesley Brereton gave a valuable summary of the principal steps which have been taken by employers to foster the continued education of their employees, *e.g.* by the award of prizes for attendance and success at examinations, the payment or repayment of fees, making attendance at evening classes compulsory upon junior employees, meetings at works during the hours of employment, and the formation of advisory committees containing representatives of employers and workmen. Important educational results are accruing from such organised schemes of training as those at Sunderland for engineering apprentices, and at the Bournville works. With regard to the question of raising the age of attendance at school to sixteen or seventeen, he suggested that one great difficulty, apart from the cost, is the growing dissatisfaction with the mainly literary type of education, and the conviction that our present system does not give value for the public money now granted.

AT the distribution of prizes to successful students of the City and Guilds Institute at the Mansion House on October 29, the President of the Board of Education delivered an address. Mr. Pease dealt with the question of a worthy university for London. He said that the Government, after careful consideration, has decided that the scheme set out in the report of the recent Royal Commission is calculated to produce a University of London worthy of the name. Everything possible is to be done to carry out the scheme with all reasonable dispatch. To this end a Departmental Committee has been appointed. The underlying principles of the Commission's scheme are to be regarded as accepted. Modifications in detail and machinery may be found desirable, but the fundamental principles must be accepted if any advance is to be made now. If London shows that it is anxious and willing to have a reconstituted University on the lines laid down in the report of the Royal Commission, the Government will play their part in supplying the money necessary. Continuing, Mr. Pease said:—"The whole history of the development of modern universities shows that the prime essential of success is local patriotism. Local patriotism means, of course, money, but it means a great deal more besides. It implies a belief in the necessity for a great university and in the immensity of the influence the university can exercise—an influence which, especially in the case of an Empire metropolis, must always extend far beyond the narrow limits of the area which the university primarily serves. Its functions will be Imperial, even international, as well as local. But without the active support and confidence of the locality no modern university can exist, let alone flourish. Acts of Parliament and State-aid cannot alone create a university." In the case of the University of London, Mr. Pease laid it down that the principles on which any permanently satisfactory scheme must be based are simple:—(1) Educational and financial control of all the most important colleges to be in the hands of the University; (2) the creation of a University quarter by concentration of as much of the University work as possible, together with its administration, on a central site [the Imperial College must remain where it is]; (3) government of the University by a small Senate, predominantly lay, and not representative of special interests; (4) control of the teaching and examination in the hands of the teachers; (5) continuance of access to University examinations by external students. The place of the Imperial College in a reconstituted University is one of the first points the Departmental Committee proposes to investigate.

SOCIETIES AND ACADEMIES.

CAMBRIDGE.

Philosophical Society, October 27.—Prof. Hobson in the chair.—R. D. **Kleeman**: The dependence of the relative ionisation in various gases by β rays on their velocity, and its bearing on the ionisation produced by γ rays.—N. P. **McCleland**: Note on a dynamical system illustrating fluorescence.

PARIS.

Academy of Sciences, October 27.—M. P. Appell in the chair.—The President announced the death of M. Lucas Championnière.—Maurice **Hamy**: An arrangement of spectrograph with an objective grating suitable for the measurement of radial velocities.—H. **Deslandres** and L. **d'Azambuja**: Laws relating to the structure of band spectra and to the deviations from their arithmetical series. A study of the second group of nitrogen bands. The formula expressing the results differs from that applicable to line spectra.—Ch. **Moureu**, P. Th. **Muller**, and J. **Varin**: Refraction and magnetic rotation of compounds containing the acetylene group. Experimental data are given for ninteen substances containing the group $-C\equiv C-$.—M. **Depéret** was elected a non-resident member.—A. **Claude** and L. **Driencourt**: A coincidence micrometer free from the personal equation. This method is based on the use of a deformable micrometer network, one set of wires being capable of moving, retaining their parallelism; the distance between the wires is equal to the path described by the image of an equatorial star in the principal focal plane during an integral number of beats of the chronometer. So soon as the star enters the field, the first wire is set to coincide with the image at a beat of the chronometer. If the adjustment is exact, the passage over the next wire will also coincide with a beat, and this can be repeatedly verified. The method of observation is capable of a very high precision.—P. **Chofardet**: Observations of the new comet 1913*e* (Zinner) made at the Observatory of Besançon.—Jean **Chazy**: Certain trajectories of the problem of *n* bodies.—MM. **Chipart** and **Liénard**: The sign of the real part of the roots of an algebraic equation.—Georges **Rémoundos**: The theorem of Picard in a circle of which the centre is a critical algebraic point.—Maurice **Janet**: The existence and determination of solutions of systems of partial differential equations.—Henri **Villat**: The validity of the solutions of the problems of hydrodynamics.—Emile **Borel**: Kinematics in the theory of relativity.—M. **Girousse**: The electrolysis of lead and iron in the soil: a discussion of the effects of stray currents from tramway systems. It is pointed out that the usual rule, a drop of potential of not more than one volt per kilometre, is insufficient. The essential point is the difference of potential between the metallic substances capable of being attacked and the tramway rails. It is shown that the amount of moisture in the soil is one of the main factors of the problem. The resistance of the contact surface is also important; the contact of lead with earth is much more resistant than the contact of iron with earth. No critical potential is required to produce electrolytic effects.—G. **Sagnac**: Luminous æther demonstrated by the effect of the wind relative to the æther in an interferometer in uniform rotation.—L. **Gay**: The pressure of expansibility of normal liquids.—M. **Taffanel**: The combustion of gaseous mixtures and gaseous velocities.—Clément **Berger**: The preparation of aluminium ethylate. Amalgamated aluminium reacts with alcohol in presence of a small quantity of sodium ethylate, and pure aluminium ethylate can be isolated from the resulting solution.—Ch. **Boulanger** and J. **Bardet**: The presence of gallium in commercial aluminium and its separation. The spectrographic examination of commercial aluminium showed strong gallium lines, and a successful attempt was made to isolate gallium from this product. 1·7 kilograms of the metal were dissolved in hydrochloric acid, treated with sulphuretted hydrogen first in hydrochloric acid and then in acetic acid solution, and the product heated with potash solution to remove iron. 0·3895 gram of gallium oxide was obtained, or 0·017 per cent. of metallic gallium on the aluminium taken. The purity of the product was proved spectroscopically.—R. **Bossuet** and L. **Hackspill**: A group of metallic phosphides derived from the hydrogen phosphide P_5H_2. Rubidium phosphide, Rb_2P_5, dissolves readily in liquid ammonia, and this reacts with a solution of lead nitrate in the same solvent, giving the corresponding lead phosphide, PbP_5. Other metals give similar phosphides, but their purification offers great difficulties.—Roger **Douris**: The addition of hydrogen to a secondary alcohol derived from furfurol in presence of nickel. A study of the reduction products of ethylfurfurylcarbinol.—P. **Lemoult**: Leucobases and colouring matters derived from diphenylethylene. The action of the ethyl and methyl magnesium iodides upon Michler's ketone.—Marcel **Mirande**: The existence of a cyanogen compound in *Papaver nudicaule*.—P. **Sisley** and Ch. **Porcher**: The elimination of artificial colouring matters by the lacteal glands. Various harmless dyestuffs (uranine, B-rhodanine, methylene blue, dimethyl-amino-azobenzene) were administered to goats and dogs, both by ingestion and injection. The colouring matters were almost completely arrested by the lacteal glands, little or no colour appearing in the milk.—Em. **Bourquelot**, H. **Hérissey**, and J. **Coirre**: The biochemical synthesis of a sugar of the hexabiose group, gentiobiose.—Sabba **Stefanescu**: The phylogeny of the crown of the molars of mastodons and elephants.

BOOKS RECEIVED.

The Ocean. By Sir John Murray. (Home University Library.) Pp. 256+xii plates. (London: Williams and Norgate.) 1*s.* net.

Higher Algebra. By Dr. W. P. Milne. Pp. xii+586. (London: E Arnold.) 7*s.* 6*d.* net.

Graphical Methods. By Prof. C. Runge. Pp. viii+148. (New York: Columbia University Press; Oxford University Press.) 6*s.* 6*d.* net.

Handbuch der vergleichenden Physiologie. Edited by H. Winterstein. Band iii., 37 Lief. (Jena: G. Fischer.) 5 marks.

The Use of Vegetation for Reclaiming Tidal Lands. By G. O. Case. Pp. iv+36. (London: St. Bride's Press, Ltd.) 2*s.* net.

The Divine Mystery. By A. Upward. Pp. xv+309. (Letchworth: Garden City Press, Ltd.) 10*s.* 6*d.* net.

A Shorter Algebra. By W. M. Baker and A. A. Bourne. Pp. viii+320+lix. (London: G. Bell and Sons, Ltd.) 2*s.* 6*d.*

Bell's Outdoor and Indoor Experimental Arithmetics. First Year's Course. Pp. 31. Second Year's Course. Pp. 32. Third Year's Course. Pp. 39. Fourth Year's Course. Pp. 39. Fifth Year's Course. Pp. 48. (London: G. Bell and Sons, Ltd.) 3*d.* and 4*d.*, 3*d.* and 4*d.*, 3*d.* and 4*d.*, 4*d.* and 6*d.*, and 4*d.* and 6*d.* respectively.

Bergens Museums Aarbok 1913. 1 and 2 Heft. (Bergen: J. Griegs Boktrykkeri.)

In the "Once upon a Time." By L. Gask. Pp. 283+plates. (London: G. G. Harrap and Co.) 3*s.* 6*d.* net.

Chemistry, Inorganic and Organic, with Experiments. By C. L. Bloxam. Tenth edition, rewritten and revised by A. G. Bloxam and Dr. S. J. Lewis. Pp. xii+878. (London: J. and A. Churchill.) 21*s.* net.

Die Strudelwürmer (Turbellaria). By Drs. P. Steinmann and E. Bresslau. Pp. xi+380. (Leipzig: Dr. W. Klinkhardt.) 9 marks.

Tintenfische mit besonderer Berücksichtigung von Sepia und Octopus. By Dr. W. T. Meyer. Pp. 148. (Leipzig: Dr. W. Klinkhardt.) 4 marks.

Camp Fire Yarns of the Lost Legion. By Col. G. Hamilton-Browne. Pp. xiii+301. (London: T. W. Laurie, Ltd.)

Bird Life throughout the Year. By Dr. J. H. Salter. Pp. 256. (London: Headley Bros.) 7*s.* 6*d.* net.

Elementary Theory of Alternate Current Working. By Capt. G. L. Hall. Pp. vi+195. (London: *The Electrician* Printing and Publishing Co., Ltd.) 3*s.* 6*d.* net.

Department of the Interior. Weather Bureau. Annual Report of the Director of the Weather Bureau for the Year 1910. Parts 1 and 2. Pp. 171. (Manila: Bureau of Printing.)

Memoirs of the Indian Meteorological Department. Vol. xxii., part 2. Monthly and Annual Normals of Number of Rainy Days. By Dr. G. T. Walker. Pp. 203–403. (Calcutta: Superintendent, Government Printing, India.) 1 rupee 8 annas.

Vorlesungen über Pflanzenphysiologie. By Dr. L. Jost. Dritte Auflage. Pp. xvi+760. (Jena: G. Fischer.) 16 marks.

The Moose. By A. Herbert. Pp. viii+248+8 plates. (London: A. and C. Black.) 5*s.* net.

Wild Life on the Wing. By M. D. Haviland. Pp. iv+244+8 plates. (London: A. and C. Black.) 5*s.* net.

Highways and Byways of the Zoological Gardens. By C. I. Pocock. Pp. xii+192+plates. (London. A. and C. Black.) 5*s.* net.

The Tutorial Algebra (Advanced Course), Based on the Algebra of Radhaknishman. By Drs. W. Briggs and G. H. Bryan. (Eighth Impression.) Fourth edition. Pp. viii+647. (London: W. B. Clive.) 6*s* 6*d.* net.

Practical Science for Engineering Students. By H. Stanley. Pp. vii+166. (London: Methuen and Co., Ltd.) 3*s.*

Wisconsin Geological and Natural History Survey. Bulletin No. xxvi. Educational Series, No. 3. The Geography and Industries of Wisconsin. By Prof. R. H. Whitbeck. Pp. v+94+xx plates. (Madison, Wis.)

Das kleine botanische Praktikum für Anfänger. By E. Strasburger. Siebente Auflage. By Dr. M. Koernicke. Pp. x+264. (Jena: G. Fischer.) 6.50 marks.

DIARY OF SOCIETIES.

THURSDAY, NOVEMBER 6.

ROYAL SOCIETY, at 4.30.—The Soil Solution and the Mineral Constituents of the Soil: A. D. Hall, W. E. Brenchley, and L. M. Underwood.—Studies in Heredity. II. Further Experiments in Crossing British Species of Sea Urchins: Prof. E. W. MacBride.—Synthesis by Sunlight in Relationship to the Origin of Life; Synthesis of Formaldehyde from Carbon Dioxide and Water by Inorganic Colloids acting as Transformers of Light Energy: Prof. B. Moore and T. A. Webster.—The Trypanosomes causing Dourine (Mal de Coit or Beschälseuche): Dr. B. Blacklock and Dr. W. Yorke.—Postural and Non-Postural Activities of the Mid-Brain: T. G. Brown.—The Nature of the Coagulent of the Venom of *Echis carinatus*: J. O. W. Barratt.

FRIDAY, NOVEMBER 7.

JUNIOR INSTITUTION OF ENGINEERS, at 8.—Wood Waste, &c., as Fuel for Gas Producers: G. E. Lygo.

GEOLOGISTS' ASSOCIATION, at 8.—Annual Conversazione.

SATURDAY, NOVEMBER 8.

BRITISH PSYCHOLOGICAL SOCIETY, at 3.30.—A Comparative Study of Normal and Sub-normal Children by Means of Mental Tests: Dr. A. R. Abelson.—A Reaction Pendulum, and a Disc, illustrative of Weber's Law, for Use in Class Teaching: Prof. J. Brough.—Observations on the Process of Learning and Relearning in Mice and Rats: Miss M. E. Macgregor.—*A priori* Argument for the Existence of a Cerebral Centre for Affection: Dr. A. Wolgemuth.

MONDAY, NOVEMBER 10.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—The Work and Adventures of the Northern Party of Captain Scott's Antarctic Expedition: Raymond E. Priestley.

TUESDAY, NOVEMBER 11.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Construction of the "White Star" Dock and adjoining Quays at Southampton: F. E. Wentworth-Sheilds.

ZOOLOGICAL SOCIETY, at 8.30.—On Freshwater Decapod Crustacea (Families Potamonidæ and Palæmonidæ) collected in Madagascar by the Hon. Paul A. Methuen: Dr. W. T. Calman.—On a Collection of Reptiles and Batrachians made by Dr. H. G. F. Spurrell, in the Colombian Choco: G. A. Boulenger.—A Revision of the Cyprinodont Fishes of the Subfamily Pœciliinæ: C. Tate Regan.—Sponges in Waterworks: Prof. W. N. Parker.—Two new Actinians from the Coast of British Columbia: Prof. J. Playfair McMurrich.

MINERALOGICAL SOCIETY, at 5.30.—A Crystalline Basic Copper Phosphate from Rhodesia: A. Hutchinson and A. M. MacGregor.—(1) On the Meteoric Stone of Wittekrantz, South Africa: (2) On the Remarkable Similarity in Chemical and Mineral Composition of Chondritic Meteoric Stones: Dr. G. T. Prior.—Notes on the Minerals occurring in the neighbourhood of Meldon, near Okehampton, Devonshire: A. Russell.—On a Calcium-iron-garnet from China: J. B. Scrivenor.

THURSDAY, NOVEMBER 13.

CONCRETE INSTITUTE, at 7.30.—Presidential Address: E. P. Wells.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Pressure Rises: W. Duddell.

ROYAL SOCIETY, at 4.30.—*Probable Papers:* The Preparation of Eye-preserving Glass for Spectacles: Sir William Crookes.—On an Inversion Point for Liquid Carbon Dioxide in regard to the Joule-Thomson Effect: A. W. Porter.—Negative After-Images and successive Contrasts with Pure Spectral Colours: A. W. Porter and Dr. F. W. Edridge-Green.—The Positive Ions from Hot Metals: Prof. O. W. Richardson.—(1) The Diurnal Variation of Terrestrial Magnetism.—(2) A Suggestion as to the Origin of Black Body Radiation: G. W. Walker.

FRIDAY, NOVEMBER 14

ROYAL ASTRONOMICAL SOCIETY, at 5.

PHYSICAL SOCIETY, at 8.—On the Thermal Conductivity of Mercury by the Impressed Velocity Method: H. R. Nettleton.—On Polarisation and Energy Losses in Dielectrics: Dr. A. W. Ashton.—A Lecture Experiment to illustrate Ionisation by Collision and to show Thermoluminescence: F. J. Harlow.

ALCHEMICAL SOCIETY, at 8.15 (at The International Club, Regent Street, S.W.)—The Hermetic Mystery: Mme. Isabelle de Steiger.

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