THURSDAY, MAY 28, 1914.

GREEK PHYSICS AND DYNAMICS.

Le Système du Monde: Histoire des Doctrines Cosmologiques de Platon à Copernic. By Prof. Pierre Duhem. Tome Premier. Pp. 512. (Paris: A. Hermann et Fils, 1913.) Price 18.50 francs.

THIS book contains a good deal more than one might expect from the title. It not only gives an account of the cosmical systems of the Greeks from Pythagoras to Ptolemy, but discusses in considerable detail the views of the different schools of the same period as to the constitution of matter, and their principles of dynamics. As was to be expected from the author's previous publications on the history of natural philosophy, he shows himself well acquainted with ancient literature, and also (with a few exceptions) with the very extensive modern literature of monographs on Greek science. The most recent editions of the classical writers are always quoted, but with one notable exception, Diels's edition of the Doxographi Græci not having been made use of.

The astronomical chapters, which fill less than half the book, do not call for any extended notice, as the subject treated in them has been dealt with in more than one book accessible to English readers, the last being Sir Thomas Heath's book on Aristarchus, published only a year ago. As to the origin of the heliocentric idea, the author follows in the main the theory of Schiaparelli, that it was really due to Herakleides, fifty years before the time of Aristarchus, and he seems unconvinced by the weighty arguments brought forward against it by subsequent writers.

The most valuable part of M. Duhem's book is undoubtedly that dealing with the physics and dynamics of the Greeks, especially of Aristotle, and it gives a very clear and thorough account of this difficult subject. While Plato's views on nature were characterised by doubts as to facts learned by perception, as the immutability which is regarded as the essence of things is not revealed thereby, Aristotle rehabilitated experience and observation, though often led astray by preconceived notions. In his dynamics the idea of mass does not enter; every moving body is necessarily subject to two forces, a power and a resistance; without a power it would not move at all, without resistance the motion would be accomplished in an instant. The velocity with which the body moves depends both on the magnitude of the power and on that of the resistance; if both are constant the resulting motion is supposed to be uniform; if the resistance decreases the velocity will increase, if the same power be employed to move resisting bodies, the velocities which it communicates to them are inversely proportional to the resisting weights.

Velocity is therefore proportional to the ratio of power to resistance, and yet, how can motion cease when they become equal? Aristotle sees this difficulty and tries to get over it by remarking that because a certain power moves a body through a certain length it does not follow that any fraction of the power will move the body through the same fraction of the length. A body falling through air or water represents to Aristotle the simplest motion we can conceive; the power is here the weight of the body, while the resistance is caused by the medium it traverses, and the velocity of the fall is proportional to the weight. On the other hand, by the fundamental principle of Aristotelian dynamics, the velocity is inversely proportional to the resistance, and Aristotle seems to admit that this resistance is proportional to the density of the medium. But he maintained that if a fall in empty space were possible (which he denies), bodies of different weight would not fall with the same velocity. "This," he says ("Physics." iv. 8, p. 216a), "is impossible, for what should then cause one body to move faster? This is necessarily the case in a medium because the body which has the greater power divides the medium more quickly, but in the void all bodies would have the same velocity, which is impossible."

The author also discusses very fully the theories prevalent after Aristotle so far as John Philoponus in the sixth century. In opposition to Aristotle, Philoponus taught that weight is something which belongs to a body and represents the downward motion it would have in empty space; the resisting medium prolongs the time of the fall, but if the resistance is diminished to zero the fall does not become instantaneous, the limit of the velocity being that with which it would fall through empty space. This doctrine, so different from that of Aristotle, was not accepted in the Middle Ages, though it was not without some influence on the views of Simplicius, who otherwise was a severe critic of Philoponus. We shall look forward with interest to M. Duhem's second volume, in which he will doubtless discuss the views of Thomas Aquinas and other philosophers of the Middle Ages, which did not always coincide completely with those of Aristotle.

J. L. E. D.

A MODIFIED ALPHABET FOR ENGLISH.

Sounds and Signs: a Criticism of the Alphabet with Suggestions for Reform. By Archer Wilde. Pp. 180. (London: Constable and Co., Ltd., 1914.) Price 4*s.* 6*d.* net.

THE main object of this book is to advocate modifications in our present alphabet, so as to make it suitable for representing English sounds. On plates facing pp. 142 and 144 the suggested alphabet is portrayed; the capitals are practically identical with the small letters, but slightly more ornate. A characteristic is that no letter projects above or below the line; nor are parts of each letter thicker or thinner than others; the character is what is termed "Doric." The uniformity in height of the letters makes it possible to bring the lines of print closer together, and so to save space. But, in the opinion of the reviewer, legibility is thereby sacrificed; Russian type, in which the general effect is that of printing in capitals, is not so quickly read by Russians as is English or French by Englishmen or Frenchmen. In the example given on p. 20, of printing in Doric capitals, the effect is to dazzle the eyes; it is not easy reading. The author is not sanguine as to the adoption of his scheme; but he opens the interesting question whether if our alphabet is to be modified, convenience is to be increased by carefully choosing the form of the letters.

He is a strong advocate of spelling reform, and looks on the proposals of the Simplified Spelling Society as good, having regard to the restrictions with which they have limited themselves, viz. no accents; no new letters; and as little change as may be, provided consistency is attained. The system of Ellis and Pitman, phonotype as it was called, narrowly escaped achieving success in the 'seventies; had Ellis's health not broken down, and had his type not been destroyed by a fire, it is not unlikely that steps might have been taken to introduce its use into schools. The type is easily read; it is also easily written, for the script hand is not difficult; and there is a saving of nearly 20 per cent. in space compared with ordinary spelling and alphabet. One of the most remarkable pieces of evidence in its favour is an account of an experiment by an Edinburgh schoolmaster, Mr. Williams, who "proved that children averaging five years of age could learn to read printed books in phonetic type in one-third or one-fourth the time in which children of six or seven years of age could, without the intervention of the phonetic system, learn to read the common 'Romanic' books; and when these younger children had been one session (between ten and eleven months) learning to read through the phonetic system, they could read books printed in the 'Romanic' type quite as well as the elder class which had been engaged during two sessions, or double the time, learning to read without the intervention of the phonetic system."

A considerable amount of space is occupied in a discussion of the English phonetic alphabet; that is, what English sounds should be characterised by separate characters. The point of view is that of a southern Englishman; it is too often forgotten that among English speakers they are in a small minority. A large majority, for instance, retain at all events some reminder of a trill at the end of the word "star," although in America, if the South be excluded, the "r" may be described as a buzz, rather than a trill.

In Mr. Wilde's vowel system different symbols are given to the "a" in "alms" and the "a" in "at," and quite correctly; the difficulty arises when it is realised that it is indifferent whether the first or second sound of the "a" be used in such words as "castle" or "dance." And this involves the question of a standard pronunciation, about which few people will agree. In the reviewer's opinion (to take the instance given), it is better to retain the one symbol "a" for both sounds, leaving it to individuals to pronounce the "a" as they are accustomed to do. Again, many English speakers make no distinction between the two sounds of "oo" in "boot" and "foot"; here, again, it would appear advisable to let one symbol represent both sounds.

This book is well written, and puts a case for a view of spelling reform which is not usually considered; if it should commend itself to the public to adopt new characters, no decision ought to be taken without attention to what Mr. Wilde has brought forward.

W. R.

THE INDIAN ORIGIN OF THE MAORI.

Who are the Maoris? By Alfred K. Newman. Pp. 303+plates. (Christchurch, Melbourne, and London: Whitcombe and Tombs, Ltd., n.d.) Price 7*s.* 6*d.* net.

THE origin of the Polynesians has long been discussed by more or less qualified persons, and a general agreement has been arrived at. Mr. A. K. Newman takes up the problem where it had been left by Mr. Percy Smith, the author of "Hawaiki," and adduces a great deal of evidence to prove that the cradle-land of the race was northern India—a view, by the by, which has

been held for some time by other students. He says, "By the word 'Maori' I mean the brown-skinned race called Polynesian by European writers. Maori was their own word, should always be used . . . The Maoris were the first people to discover the Pacific islands . . . Some writers talk of other races who inhabited these islands prior to their discovery by Maoris. I assert that there were never any people in these islands except the Maori." The Maori were, he claims, an "Aryan-Naga people"; he agrees they are dominantly Caucasian, but is convinced they have a large infusion of Mongolic blood, which they received, according to him, before their emigration, since he classes the Kolarians and Santals as Mongolic. He says, "centuries before India was invaded by Aryans there was an invasion from the north-west by Mongolic peoples called Scythians, or Turanians. These Mongols conquered the black aborigines and extended their dominion all over northern India. Their principal tribes were called Takkes or Nagas, Kolarians, and Santals." It is a pity that he gives no references in support of these wide statements. "In India the word Maori was variously spelt—Mauri, Maurea, Maori, Maoli, Mauli, Baori, Baoli, Kaori, Waori," for most of which he finds parallels in the Pacific, and he gives a large number of place- and tribal names, mainly in Bengal, which are similarly equated.

The author is evidently unaware of the linguistic researches of Father W. Schmidt, who showed in 1906 ("Die Mon-Khmer-Völker") that the Polynesian, Melanesian, and Indonesian are dialects of the Austronesian group of the Austric linguistic family, of which the Austroasiatic was the other group. The latter group includes the Munda, Khasi, Mon-Khmer and other languages. The Nagas may be "dropped colonies of Maoris," but surely allusion should have been made to the Khasis, who alone in Assam speak an Austric language.

Religion, mythology and various arts and crafts are alike impressed to bear witness to the Indian origin of the Polynesians and their migration through the East Indian Archipelago. There is certainly a great deal to be said in favour of the main thesis, and doubtless many of the facts adduced may support it, but the entire absence of references makes it impossible to gauge their value unless the reader happens to know the authorities. A number of parallels are cited which would equally prove an African or American affinity with the Maori. There is a good deal of repetition in this badly-arranged book, and there is no index.

OUR BOOKSHELF.

Marriage Ceremonies in Morocco. By Prof. E. Westermarck. Pp. xii+422. (London: Macmillan and Co., Ltd., 1914.) Price 12*s.* net.

IT is to be hoped that Dr. Westermarck will one day give us a general work on the origin and development of social ceremonies. Ceremony is a sort of material complement to social ideas, an action-language embodying and expressing, if not imitating and compelling, the social will. Its roots are in the same soil as magic.

This very complete study, by the historian of human marriage, of the marriage ceremonies of the Moroccan peoples, includes a mass of detail, none of which is unimportant. The wealth of ceremonial possessed by Arab and Berber folk-custom is extraordinary. But in most cultures marriage tends to be more ceremonialised than any human happening. Even modern Germany, as Reinsberg-Düringfeld's "Hochzeitbuch" shows, is in this respect nearly the equal of Morocco. Most of these are what anthropologists ten years ago styled customs, but the formal "solemnity" of practically all social and most individual acts in semi-civilised societies has now been well established. It is the main character of the "religious" or "magical" stage of culture.

The betrothal, the negotiations about dowry or bride-price, the preparation of the trousseau, the arrival and reception of the bride, the meeting of bride and bridegroom (as a rule they have never set eyes on one another), these and other scenes are set off by continuous and minute ceremonial. The preservation of so many thousand details by oral tradition is an astounding feat of memory, which deserves the attention of psychologists.

In dealing with the ideas embodied in these ceremonies, the author refers to the magical theory advanced by the present writer in "The Mystic Rose," and to Mr. Van Gennep's theory of *rites de passage*, *rites de séparation*, and *rites d'aggregation*. But he recognises the extreme probability that they may have a mixed origin. Some may be prophylactic or purificatory, others mere expressions of emotion, others again may be positive and intended to promote welfare. The author does not aim at a general philosophy of ceremony; but the many points of view which the material and the comment suggest should lead to important conclusions.

The work is a splendid monograph, worthy of its author. A. E. CRAWLEY.

A Text-book of Geology. By Prof. James Park. Pp. xv+598+lxx plates. (London: Charles Griffin and Co., Ltd., 1914.) Price 15*s.* net.

PROF. PARK'S mining researches have increased rather than lessened his interest in the wide fields of geology, and the present text-book adequately covers the range required for students of mining colleges and secondary schools. It is systematically divided into paragraphs, headed in thick type; facts are concisely stated, and the author's personality is not permitted to intrude.

Already, however, in history for college students—witness Prof. Bury's recent single volume upon Greece—there is a tendency to keep in view the philosophy of the subject as a higher stratum based upon the facts; and something of the kind may be possible in our text-books of science as time goes on. At present one would like to recommend a pupil to read no text-book, but to buy a number of the shilling volumes written by specialists on the lines and subjects that attract themselves. This, however, would not enable the student to meet the requirements of a university degree. Prof. Park is well aware of this, and has kept himself within traditional bounds. At the same time he makes good use of recent work, including even the Piltdown skull (p. 480); and his references to New Zealand and the southern hemisphere introduce a welcome series of examples. The illustrations are numerous and well chosen, though those of ammonites lead to the retention of a somewhat old classification. Formulæ might have been more freely utilised to show the composition of the rock-forming minerals, which are here rather loosely described. The absolutely essential boron would then have appeared as a constituent of tourmaline, and the rhombic pyroxenes would not have been defined merely as "variable silicates." "Titanite" (pp. 197 and 198) is not a synonym for the titanic iron-ores. The explanation of technical terms founded on Greek words is a very useful feature throughout the book. G. A. J. C.

The West India Committee Map of the West Indies. Scale 55 miles = 1 in. Size 3 ft. 9 in. by 2 ft. 10 in. (London: George Philip and Son, Ltd., 1914.) Mounted on cloth and varnished with rollers, 10*s.* 6*d.*; on sheet, unmounted, 7*s.* 6*d.*

THE object of the West India Committee in issuing this map is to stimulate interest in the British West Indies. No attempt has been made to give the land relief and other physiographical features of the individual islands—the relative size of the islands in relation to the parts of the mainland shown making such a course impracticable. Prominence is given to railways, sea routes, cables, and other data of commercial importance. Three inset maps are provided: one shows the routes and distances between Canada and the United States and the West Indies, another a plan of the Panama Canal, and a third a graphic representation of the areas and populations of the islands.

The Origin of the World. A Book for Children. By R. McMillan. Pp. xiii + 136. (London: Watts and Co., 1914.) Price 2*s.* net.

THE object of this little book is to explain, in language simple enough for an intelligent child to understand, the steps in the evolution of our planet, of plant and animal life, and of the human race. The book is written in a pleasant style which should appeal to young readers, arrest their attention, and engender a desire for fuller knowledge.

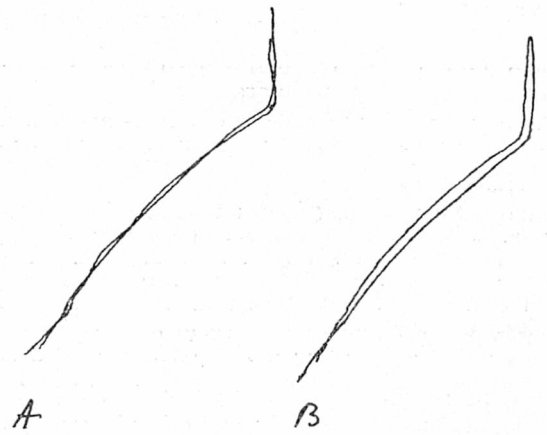
LETTERS TO THE EDITOR.

[*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.*]

Temperature-Difference between the Up and Down Traces of Sounding-Balloon Diagrams.

DR. VAN BEMMELEN'S letter in NATURE of May 14 is of great interest to me, and seems to prove an appreciable amount of lag in the instruments he uses. Every thermometer must as a matter of course have a certain amount of lag, but I have not been able in the records of the English instruments to detect any sign of it, although there is a marked distinction between records obtained at night or when the sun is low, and those obtained when it is high.

In the diagram, A is the ordinary type of a night ascent, B that of a day ascent. The double trace, one made on the ascent, the other on the descent, is apparent in about every record obtained. It is not often apparent to the naked eye, and hence the diagram is an exaggerated one, but under the microscope by means of which the records are read, the traces in type A can be seen to cross each other here



and there, in type B, on the other hand, the traces are distinct throughout, but the distance between them is plainly variable, ranging often from about 1° to about 3° C. It is very seldom that differences so large as 4° C. are found. In three cases out of four type A will occur at night, and type B when the sun's altitude exceeds 10°, but now and then type B occurs at night, and seems then to indicate an actual change of temperature during the ascent.

In the English instruments the thermograph depends on the temperature of a very thin strip of German silver; this is kept stretched by a small invar tube. The expansion of the invar is nil, and therefore its temperature is of no consequence; the German silver is 0·03 mm. thick, and exposed on both sides to the air current. It is therefore very sensitive as a thermometer; certainly much more so than the Bourdon tube or ordinary metal couple.

I have always accepted the Continental records made in the winter as being free from any systematic error, but have long felt that their summer ascents show temperatures that are persistently too high.

The policy of making all ascents at a fixed time, 7 a.m. G.M.T., seems to me a most unfortunate one

Its advantage is that it is the time of the morning weather chart, and hence the results can be plotted on the chart with the knowledge that all the observations shown are simultaneous. But the objections are twofold. In many cases figures obtained at great expense have to be rejected, because they are obviously falsified by solar radiation. This must happen if the balloon does not burst, and the sun is high, whereas if the sun is near to or below the horizon it is of no consequence if the balloon does or does not burst. This gives cause for doubt also about some of the printed figures since it is not too clear in all cases as to what may be accepted and what must be rejected. Secondly, it is impossible to get the annual or the daily variation from observations at a fixed hour. The daily variation is, of course, hopeless, and not knowing the law of the daily variation, it is uncertain whether the same correction for the hour should be applied both summer and winter. The result is that the annual variation above 12 km., as shown by the English ascents, many of which were made at sunset before the international time of 7 a.m. was fixed, differs by 3° C. from the Continental value, but it is very improbable that there is any real difference. A plan has now been adopted by which the string carrying the instrument uncoils after the balloon is started, and since last winter a very much longer string has been employed in the English ascents. This avoids the difficulty of starting with a long string in rough weather, and it will be interesting to see what effect the plan will have on the records. The change of length is from 44 to 132 ft.

W. H. DINES.

May 20.

Transmission of Electric Waves Round the Bend of the Earth.

IN a paper on the transmission of electric waves round the earth's surface, read by Prof. H. M. Macdonald before the Royal Society on February 12, some conclusions are recorded which cast new light on the problem of long-distance wireless telegraphy. Prof. Macdonald's point of view is that of simple diffraction, and the paper is the latest one of a notable series of attempts by a number of eminent mathematicians. In the present paper the author reduces his formulæ to figures, and thus makes comparison with experiment easy. The most extensive quantitative experiments yet made over great ranges are those of L. W. Austin in 1910 (Bulletin Bureau of Standards, vol. vii., No. 3), and those of J. L. Hogan in 1913 (*Electrician*, August 8, 1913). From the former experiments Austin and L. Cohen deduced a formula which has been corroborated by Hogan's results. This formula may be written :—

$$i = c\epsilon^{-a.x/\sqrt{\lambda}}/(\lambda x),$$

where i is the current in amperes in the receiving antenna at the distance x kilometres for the sending station, λ is the wave-length of the radiation in kilometres, a has the value 0·0015, and c, like a, is a quantity which does not depend on λ or x. This formula was deduced from daylight experiments extending over larger ranges of λ and x than those used in the table below.

By aid of this formula Prof. Macdonaid's calculations can be quickly compared with the results of experiment. In the following table the first column contains the number of miles between sender and receiver, and the remaining columns contain the ratios of the effect at various distances to that at 419 miles. R_d is the ratio, calculated on the diffraction theory, between the electric fields, R_m is the ratio found by measurement between the currents in the same receiving antenna when moved to the successive distances in turn.

Miles	λ=320 m.		λ=625 m.		λ=1220 m.		λ=2560 m.		λ=5000 m.	
	R_d	R_m	R_d	R_m	R_d	R_m	R_d	R_m	R_d	R_m
419	1	1	1	1	1	1	1	1	1	1
536	0·504	0·481	0·392	0·554	0·464	0·605	0·537	0·660	0·585	0·693
675			0·128	0·266	0·184	0·349	0·256	0·418	0·315	0·467
814					0·0764	0·218	0·128	0·282	0·178	0·336
1070							0·0392	0·148	0·0637	0·184
1257									0·0321	0·134

From the table it seems fair to draw the conclusion that diffraction accounts for a large proportion of the observed effects up to distances of, perhaps, 2000 miles. The proportion is much larger than has hitherto been demonstrated, and compels the admission of diffraction into the list of phenomena contributing to the practical success ot wireless telegraphy.

But the Austin-Cohen formula expresses a remarkable experimental fact which is not explained, but, rather, is contradicted by the diffraction theory; namely, that for each distance there is a best wave-length. The formula indicates that this optimum wave-length is given by $4\lambda = a^2x^2$, and, consequently, that under the best condition

$$i = 4c(a\epsilon)^{-2}x^{-3} = cx^{-3} \times 2{\cdot}140 \times 10^5,$$

for rather long ranges. These equations are, broadly, borne out by the experience of wireless telegraph engineers. The equation for λ shows that as the wave-length is increased the effect at a given place first increases and then decreases. Here the theory of diffraction appears to fail, for the diffraction effect at any fixed point should increase steadily with increase of wave-length. On the other hand, the hypothesis of the refraction of electric waves in the atmosphere when it is ionised by sunlight seems more promising. For while radiation of very short wave-length is lost into space by the rays suffering too little bending, radiation of great wave-length, by being too strongly refracted, is lost in the ground between the oscillator and the receiver; and thus an optimum wave-length is easily conceivable.

W. ECCLES.

University of London, University College, May 18.

Some Phenomena of Clay Suspensions.

THE interesting letters in NATURE on the cellular structure of emulsions induced me to test the behaviour of clay which I have been accumulating for some time for evaporation experiments. The clay is obtained by the usual sedimentation method, and is that fraction of the soil which does not settle in twenty-four hours in a beaker containing dilute ammonia to a depth of 8·5 cm. The suspension is then evaporated to dryness *in vacuo*.

If some of this dried clay be well shaken up with strong ammonia solution and poured into a Petri dish, the usual network, mentioned by Mr. Wager in NATURE for May 7, gradually develops. Occasionally a different pattern appears, only the angles of the network are formed, and the surface thus has a pitted appearance.

The pattern persists for a few minutes and then gradually becomes blurred. The two cases are shown in Figs. 1 and 2 respectively. In neither case are groups of cells formed. Although the structure is quite sharp to the eye, the lack of contrast makes the photographic difficulties considerable. I am in-

debted to Dr. H. B. Hutchinson and Mr. A. Appleyard for the photographs here reproduced.

A suspension of clay in alcohol gives the opposite effect; in this case the preliminary network does not seem to appear. Isolated groups or single cells form active centres, from which other cells grow until the surface is covered. The cells are nearly hexagonal and sharply rectilinear, and frequently measure half cm. in diameter. There is a light spot in the middle of each, and the particles can be seen flowing up at the middle and down at the sides of the cells. The

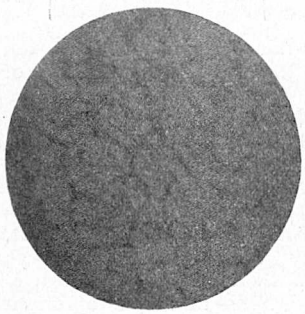


FIG. 1.

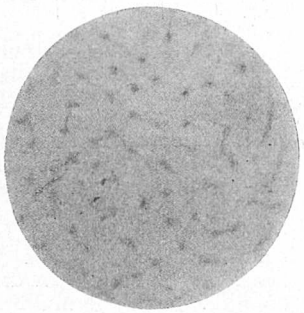


FIG. 2.

pattern persists for a few seconds and then fades away, only to reappear after a short interval. This periodic reappearance is very fascinating to watch. In all probability it is caused by small air currents flowing over the surface of the liquid, disturbing the rate of evaporation.

I have occasionally noticed another very curious phenomenon in the beakers containing the clay suspension in dilute ammonia. Usually, after the lapse of a few hours, the brown coloured mixture increases in opacity from top to bottom of the liquid. In the case mentioned this graduation is broken by one or two colourless horizontal rings, which appear round the side of the beaker. Thus, there is an increase in opacity from the surface to a depth of one or two cm., until the first ring is reached. The layer immediately below seems to be less opaque than the layer immediately above the ring, but this may be purely an optical illusion. The liquid below the ring increases in opacity until the second ring is reached, when the appearance already mentioned is repeated.

This stratification will persist indefinitely. The rings remain unbroken and gradually sink, at a rate below one cm. in twenty-four hours, as the suspension slowly clears. The phenomenon seems to be quite fortuitous, and I have not been able, up to the present, to reproduce it at will.

It is possible that it may be related in some manner to those forces producing the cellular structure, and I should be glad if some reader could supply me with information or references to it.

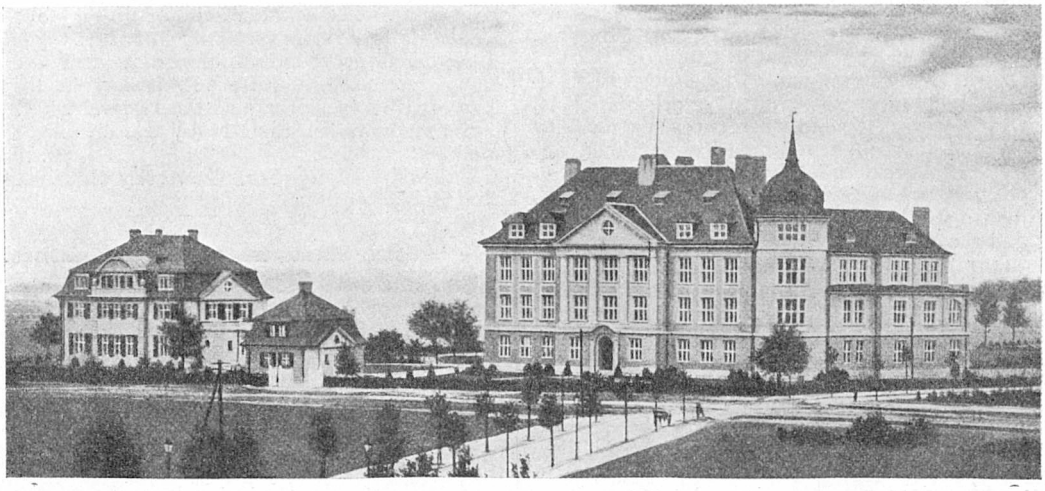
B. A. KEEN.
Rothamsted Experimental Station, Harpenden.

THE KAISER-WILHELM INSTITUTE OF CHEMISTRY.

A DESCRIPTION of the objects of this Institute has already been given in NATURE of Feb. 23, 1911, in the report of a lecture delivered at the inauguration of the Kaiser-Wilhelm Gesellschaft by Prof. Emil Fischer on January 11 of that year.

The institute was formally opened by the Emperor on Oct. 23, 1912. It is divided into sections each of which is under the direction of specialists with a consultative committee of experts. Dr. Beckmann is director of the chemical section and is assisted by Dr. Willstätter, who is head of the organic laboratories, and Dr. O. Hahn, who is engaged upon the study of radioactive substances.

The institute is situated at Dahlem, not far from Berlin, and it forms a three-sided block consisting of three floors and a basement. The top floor is occupied by Dr. Beckmann and has accommodation for about a dozen workers, the first floor is apportioned to Dr. Willstätter, and the ground floor to Dr. Hahn. In the basement are installations for vacuum and pressure machines, electric motors and accumulators, liquid air plant and cold storage rooms. The ventilating exhausts are in a chamber under the roof where distilled water is prepared. The main buildings are shown in the accompanying illustration.



Main building, with director's and porter's houses, of the Kaiser-Wilhelm Institut, Berlin, Dahlem.

The first volume of researches issued by the institute and covering the period from April, 1912,

to October, 1913, has recently been issued, and its chief contents are here summarised.

The first paper is a contribution by Dr. Beckmann on the use of various solvents,

$$(SO_3,\ SO_2(OH)Cl,\ CrO_2Cl_2,\ SO_2Cl_2),$$

for ebullioscopic determinations. He finds that many organic compounds give normal results in sulphonyl chloride; but that for one reason or another the others are unsuitable. In a second paper the same author describes a Bunsen burner of porcelain, its object being to prevent the coloration of the flame by metallic incrustations in analytical examinations, and so masking the presence of small quantities of salts. In a third paper the constant for iodine when used as a solvent in cryoscopic determinations, was estimated, the value found for a large number of metals and metallic iodides, varying between 200 and 211. As an ebullioscopic solvent iodine gave a constant of 102 to 107. Taking 105 as the mean, the formulæ for aluminium and ferric chloride were found to be Al_2I_6 and Fe_2I_6. As in the case of the cryoscopic method, the alkaline iodides gave abnormally high molecular weights.

In a further paper a new sodium lamp is described. It is so constructed that a spray of sodium hydroxide or carbonate is driven into a bunsen burner supplied at the orifice with oxygen. The spraying is produced by nickel electrodes let into the vessel near the bottom of the burner. In another paper which is in reality a continuation of the above, a method is described for spraying salt solutions by dropping the solutions on to a horizontal revolving disc, and has been utilised for obtaining a steady colour intensity in the flame. In collaboration with R. Hauslian, Beckmann has studied the molecular weight of selenium, which had been previously found to correspond to Se_2, as determined by its cryoscopic effect on iodine, whereas in methylene iodide and phosphorus it is Se_{10} and Se_8 respectively. They found that the dissociation of the molecule in iodine is not due to any thermal effect as sulphur has the molecular weight of S_8 under similar conditions, nor is there any union with the iodine.

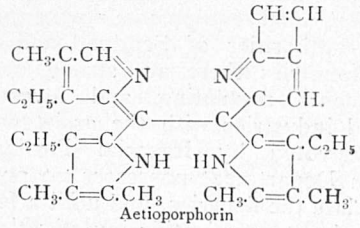
The series of papers published by Dr. R. Willstätter begins with an account of the interesting hydrocarbon *cyclo*octatetrene which he has recently prepared.

It behaves like an ethenoid compound inasmuch as it is rapidly oxidised by permanganate; is readily reduced by hydrogen in presence of colloidal platinum to *cyclo*octane, and combines with a molecule of bromine and hydrogen bromide to form $C_8H_8Br_2$ and C_8H_9Br respectively. Moreover it cannot be nitrated either by nitric acid or benzoyl nitrate. It therefore is very unlike an aromatic compound such as benzene. Like benzene, however, it exhibits no exaltation of molecular refraction nor of dispersion for $H_\beta - H_\alpha$, but, in consequence of a higher dispersion in the violet regions, shows distinct exaltation for $H_\gamma - H_\alpha$. It shows no absorption bands but selective general absorption. The pure substance has a yellow colour, and solidifies at $-27°$ to a pale yellow crystalline mass. In another paper Willstätter and King describe the preparation of dihydronaphthalene and its reduction products with hydrogen and platinum. It behaves like benzene with an unsaturated side-chain such as styrene, $C_6H_5.CH=CH_2$, inasmuch as the partly reduced ring in dihydronaphthalene is much more rapidly reduced than the other. In this respect naphthalene is sharply distinguished from dihydronaphthalene, for in the former case no tetrahydro-derivative is obtained at whatever stage the reduction is interrupted, but the decahydro-compound with larger or smaller quantities of the unaltered hydrocarbon. They still leave the formula of naphthalene an open question.

In conjunction with Wirth, Willstätter has further extended the method of exhaustive methylation which he has successfully used in the preparation of dihydrobenzene, dihydronaphthalene, *cyclo*butene, *cyclo*heptene, and *cyclo*octene, to the formation of vinylacetylene, $CH:C.CH:CH_2$, from the dibromide of butadiene. It is a gas boiling at 2–3°, and forms a greenish-yellow copper salt, and a colourless crystalline silver salt.

The memoir on chlorophyll by Willstätter and Forsén, which follows, has already been published *in extenso* in Liebig's *Annalen*, vol. cccxcvi., and is a continuation of previous work on the same subject. It is concerned with methods for introducing magnesium into the porphyrin molecule by Grignard's reaction and into other chlorophyll derivatives by heating with magnesium oxide and an alcoholic potash solution under pressure.

A memoir of equal importance and closely related to the one on chlorophyll is on the structure of hæmoglobin, the red colouring matter of the blood, by Willstätter and M. Fischer. The subject has already been studied by Küster, Piloty, H. Fischer, and others. Hæmoglobin readily breaks up into hæmatin, which is a coloured body and globin, a colourless protein. From hæmatin by heating with hydrochloric acid, hæmin is obtained in reddish-brown crystals having the formula, $C_{34}H_{33}O_4N_4FeCl$, which loses its atom of iron on treatment with hydrobromic acid giving hæmatoporphorin. If the latter is treated with alcoholic potash it yields hæmoporphorin, which with soda-lime loses carbon dioxide and forms aetioporphorin, a substances identical with the product of disintegration of the chlorophyll molecule. The relation of hæmoporphorin to aetioporphorin is represented by the formulæ, $C_{33}H_{36}O_4N_4$ and $C_{31}H_{36}N_4$. As Fischer stated in his inaugural address, "this fact denotes a species of consanguinity between the animal and vegetable kingdoms. This must, however, be of great antiquity, that is to say, to date from remote times when the animal and vegetable kingdoms were as yet not distinct." As aetioporphorin can be broken down in successive stages to dimethyl ethyl pyrrole, it is possible to devise a structural formula which, according to Willstätter, takes the following form :—



Aetioporphorin

Other papers by Willstätter and Zechmeister describe the hydrolysis of cellulose by strong hydrochloric acid containing 40–42 per cent. of the gas (sp. gr. 1·2). The cellulose rapidly and easily dissolves in the strong acid, and after a time the solution contains only glucose. A method of oxidation of olefinic compounds such as tetrahydrobenzene, limonene, menthene, etc., by the use of osmium in presence of oxygen gas is the subject of a paper by Willstätter and Sonnenfeld.

In the radio-active section of the institute Drs. Hahn and Meitner have studied the question of radio-actinium and its position in the periodic system. As the radio-element evolves both α and β rays, and therefore indicates a mixture, an attempt was made, though unsuccessfully, to discover the second con-

stituent. In order to explain the production of both kinds of rays, the authors suggest that the series may branch at uranium-X into UrX_2 and Act, with the discharge of β rays, and that in one series so produced the β-ray change is followed by the α-ray change, and in the second the reverse takes place. In a second paper they confirm the discovery of UrX_2 by Fajans and Göhring, and describe a simple method for its preparation, which consists in filtering the UrX_1 solution through a layer of moist tantalic acid. The latter retains the UrX_2, whilst the UrX_1 remains in solution with the thorium. This process is based upon the relations of UrX_1 and UrX_2 in the periodic table. J. B. C.

THE REORGANISATION OF THE FISHERY AUTHORITIES.[1]

THIS report presents the results of the latest of a long series of inquiries into the productivity and administration of the British Sea Fisheries. In many ways it is the most important document of its kind presented to Parliament during the last twenty years. Former fishery inquiries usually considered the fishing industry as it is carried on on the high seas, and international questions so greatly complicated any possible action, both with regard to scientific investigation and administration, that might have been taken that little in the way of legislation resulted from them. The Committee now reporting was appointed little more than a year ago; it has considered domestic, rather than international fishery matters; and there is every indication that its utterance represents an official desire for legislative action. Altogether the recommendations are of greater significance than those of any Committee or Commission since 1885.

These recommendations are almost revolutionary. They presuppose a coordinated and reasoned scheme of scientific investigation of the fisheries of the three kingdoms, and at the same time they urge the establishment, in England, of a public Department possessing the status, *personnel*, and equipment now enjoyed by the fishery authorities of Scotland and Ireland. In these countries there are strong central fishery departments regulating and investigating the national industries with the assistance of money directly voted by Imperial Parliament. The English Department possesses no power actually to regulate the fisheries, and until a few years ago it carried out no scientific investigation. Regulation was entrusted, in 1888, to local committees created on the initiative of county and borough councils, and deriving their revenue from local rates levied on the maritime counties. Eleven of these local committees exist at the present time, but, with the exception of the Lancashire body, they have done little to regulate methods of sea-fishing, and nothing at all to investigate and develop the industry. Only by the cordial cooperation of the wealthy inland boroughs, and by amalgamation with neighbouring counties has Lancashire been enabled successfully to regulate and investigate its local fisheries, and even there scientific work has been carried on precariously and with little promise of continuity. Two lines of advance were suggested to the departmental committee, first, the amalgamation of the local authorities on the south-west, south, and east coasts into two or more bodies similar to the Lancashire committee, and secondly the abolition of the local committees and the transfer of their powers of regulation to the Fisheries Branch of the Board of Agriculture and Fisheries.

The latter course is that recommended. The local bodies are to continue to exist as small advisory councils deprived of the power of rating, or of appointing officers. Their staffs are to be transferred to the Board, along with the power of initiating and enforcing restrictions and prohibitions of methods of fishing. Local resident inspectors will be appointed to supervise the work of regulation, and to place the fishermen in touch with the local advisory committees on one hand, and the Board on the other. To all these functions will be added that of the organisation and development of inshore fishing. How this work of development will be carried out is only vaguely suggested in the report, but in the first place a Fisheries Organisation Society, on the lines of the Agricultural Organisation Society, will be founded, and will be financed by public funds. This body will promote the idea of cooperation among fishermen, will assist them in marketing their produce, in securing better means of transport, and in obtaining credit for the provision of boats, motors, and other gear. Its work will be largely propagandist at first. The Central Department itself will undertake the task of improving or constructing fishery harbours and piers, and better channels and breakwaters; of organising the shell-fisheries by means of regulating and several orders, and the provision of plant whereby such molluscs as mussels and cockles can be freed from dangerous pollution; of intervening where the rights of fishermen are threatened; and of the dissemination of intelligence of value in the disposal of the produce of the fisheries.

Scientific investigation will be maintained and amplified where it exists and instituted on those parts of the coasts where it is not yet carried out. This will be controlled and coordinated by the Board, and it is now generally known that a scheme for the adequate investigation of the fisheries of all three countries has been prepared, and only awaits sanction and the provision of very large initial and annual grants of money by the Development Commissioners before it is put in operation. That the importance of research and statistical investigation has been recognised by the Committee is apparent, but that it is all-important *before* beginning the task of repealing and simplifying regulations, or of the further development of the shell-fisheries, or the working-out of an exhaustive system of obtaining fishery statistics, has not been clearly apprehended, we think. Yet experience of the huge mass of futile restrictive legislation built up in the past should have taught them to be

[1] Report of the Departmental Committee on Inshore Fisheries. Vols. i. and ii., Report, Appendices, and Minutes of Evidence. [Cd. 7373 and 7374.] (1914.)

averse to making further radical change, or constructive legislation, before attaining much more knowledge of the natural history of the marine economic animals than we yet possess.

The weakest part of the Report is that dealing with the better education of the fishermen. It does not appear to us that the Committee has received sufficient evidence on this question, or that it made itself acquainted with the educational machinery already in existence, or even that it properly considered the admirable memorandum on this subject by the Board of Education, which is printed in the report. The Committee distinguishes between the instruction that is necessary for the inshore, and that which is necessary for the deep-sea fishermen, a distinction which it will be impossible to maintain in practice, since one class is continually being recruited from the other. The deep-sea man urgently requires instruction in working methods of navigation—much more instruction than is at present recognised except by the Board of Trade, which tends continually to raise the standard of its Fishery Examinations. The inshore man requires a knowledge of his technique, net-making, fish-curing, and the management of small boats at sea, for instance, and how this is to be acquired except by actually practising it under the instruction of older men we do not know. Both kinds of men require above all a much sounder elementary education than they at present possess—without this the further instruction will surely fail in its object. The Committee recommends supplementary courses in the elements of navigation, the natural history of the sea (without biology!), practical ropework, sail-mending, signalling, carpentry and metalwork, all for boys attending sea-board primary schools. It recommends evening continuation school courses in the same subjects, but with the addition of fish-curing for girls, and motor-mechanics for boys, these without restriction of age. It recommends occasional lectures in fishing centres in order that a knowledge of the natural history of fishes might be imparted, that the necessity for restrictions on methods of fishing might be explained, and that the resentment of fishermen to these restrictions on their operations might be obviated.

It is difficult, and there is no space at our disposal, to consider these recommendations seriously. They do not matter since the whole organisation of the elementary and technical education of fishermen, inshore and offshore, is at present being actively developed by the Board of Education and by the local authorities, and will work itself out in a satisfactory manner all the sooner under the stimulus of a reorganisation of the fishery authorities.

Apart from these defects (due obviously to the desire of the Committee to report without delay, and to the fact that its primary concern was with industrial development) the report is a statesmanlike piece of work. We cannot help feeling that now or never is the time for the reorganisation of the fishery authorities on one or other of the alternative lines suggested in the evidence, and for the strengthening and adequate equipment of the Central Department. It is also sincerely to be hoped that investigation in the widest sense, scientific and statistical and industrial, will at all steps accompany this reorganisation in order that the failures of past fishery legislation may be avoided. J. J.

AUSTRALIAN MEETING OF THE BRITISH ASSOCIATION.

AS August draws nearer the organisation of the first Australian meeting of the British Association is gradually approaching completion. The overseas party will number, roughly, 350, and will for the most part leave England at the end of June or the beginning of July. The Blue Funnel liner *Ascanius* is to convey a considerable proportion of the advance party for Western Australia, while the main body of the visitors will leave later in the Aberdeen liner *Euripides* (on her maiden voyage), and the Orient mailboat *Orvieto*. The latter will take on board at Fremantle the advance party, and will arrive at Adelaide on the same day as the *Euripides*, viz., August 8. Other lines and other routes will bring small detachments of members.

A special arrangement has been completed with the Customs Department in Australia for the speedy handling of luggage at ports of entry. Clearance will be effected very rapidly of all baggage certified to contain only personal effects. Members bringing with them anything subject to taxation will be required to make the usual statements and payments.

The matter of overland conveyance in Australia of the overseas party is one of not inconsiderable difficulty. To the lively satisfaction of the Federal Council and the various committees controlling arrangements, it was decided at a conference of the Premiers of the different States, held at the beginning of April, that the hospitality of the several State railways should be offered to all visiting members without distinction. The desire is very strong in Australia that there shall be the least possible amount of distinction made between the various members of the visiting party. Where differential treatment does come in, it is simply because the numbers in the party put equal treatment beyond the ability, though not the wishes, of Australia.

The Federal Handbook, a volume of 600 pages, is now published and about to be distributed to the visiting party by the High Commissioner for the Commonwealth prior to the party's departure. The book is the work of leading authorities of the country, and neither trouble nor money has been spared to make it worthy of the occasion of its issue. It is the intention of the Commonwealth Government to present a copy not only to each visiting member of the Association, but also to each member of its General Committee.

State handbooks, supplementary to the larger and more general work, are practically all com-

pleted, and will shortly be made available in England. Western Australia and Tasmania have decided, at a later stage than the other States, also to issue suitable books, but these will probably not be distributed before the departure of the party.

As the full programme of the meeting is still subject to amendment, it may be withheld for the present. The presidential address will be divided between Melbourne and Sydney, and the sectional presidential addresses will be distributed in the following way :—

Adelaide : Geography and Agriculture (part i.).
Melbourne : Mathematics and Physics, Chemistry, Zoology, Economics and Statistics, Physiology (part i.).
Sydney : Geology, Engineering, Anthropology, Botany, and Education.
Brisbane : Physiology (part ii.) and Agriculture (part ii.).

For ordinary business the sections will meet only in Sydney and Melbourne. Australian papers will occupy one-third of the available time in all sections, except those dealing with geology, zoology, geography, anthropology and botany, in which the proportion will be one-half. Perhaps the most important of all the local contributions will be an account by Dr. Douglas Mawson of the scientific results of the recent Australian expedition to Antarctica. Dr. Mawson is generously postponing his announcement until this meeting : it will add a very distinctively Australian element to the proceedings of several sections, particularly of that concerned with geography.

Citizens' lectures are being undertaken in each centre, either by the Workers' Educational Association, Trades-Hall or University Extension Board, or a joint committee of two or more of these bodies. The following lectures and discourses are to be delivered during the meeting :

Perth, W.A. : July 28, Why we investigate the ocean, Prof. W. A. Herdman; July 31, Stars and their movements, Prof. A. S. Eddington; August 2, The primitive methods of making fire, and their survival for ceremonial purposes, H. Balfour; August 3, The electrical action of the human heart, Dr. A. D. Waller. *Kalgoorlie* : School inspection : a review and retrospect, or Mining education in England, C. A. Buckmaster. *Adelaide* : August 10, The æther of space, Sir Oliver J. Lodge; August 11, Ancient hunters, Prof. W. J. Sollas. *Melbourne* : August 17, Mimicry, Prof. E. B. Poulton; August 18, The Greenwich Observatory, Dr. F. W. Dyson. *Sydney* : August 21, Primitive man, Prof. G. Elliot Smith; August 24, Atoms and electrons, Sir Ernest Rutherford. *Brisbane* : August 28, The materials of life, Prof. H. E. Armstrong; Wireless Telegraphy, Prof. G. W. O. Howe; August 31, The place of physiology in general education, Sir E. A. Schäfer. Public lectures (to which members of the association are not admitted as such) will also be delivered as follows :—*Adelaide* : "Saving and Spending," Prof. E. C. K. Gonner. *Melbourne* : "Brown Earth and Bright Sunshine," Prof. B. Moore; "The Making of a Big Gun," Dr. W. Rosenhain. *Sydney* : "Comets," Prof. H. H. Turner; "Clocks," Sir H. H. Cunynghame. *Brisbane* : "The Decorative Art of Papua," Dr. A. C. Haddon.

Excursions will form an exceedingly important part of the meeting. In Sydney, for example, half the total available time is devoted to them. With the exception of the special trips in Western Australia and Tasmania, and to Broken Hill, members will not be asked before their departure to make any selection. On arrival at each centre, however, they will be requested to fill in a form stating in order their preferences for particular excursions. A definite number of visitors will have been arranged for on each excursion, and allotment will be made on the basis of the preferences submitted. With the possible exception of a few of the more lengthy trips, it may now be taken for granted that no charges will be made upon excursions to members of the overseas party.

The fulfilment of the promise to extend private hospitality to most of the visitors in each centre is already assured. To the committees dealing with this matter, and in fact to all concerned with the organisation of the meeting, the high and increasing interest which is being taken by the general public in Australia is a source of very great satisfaction. An enthusiastic and successful meeting is certain.

NOTES.

WE greatly regret to see the announcement of the death on Saturday, May 23, in his seventy-fifth year, of Dr. P. H. Pye-Smith, F.R.S., lately vice-chancellor of the University of London and consulting physician to Guy's Hospital.

THE death, at the age of seventy-five years, is announced in the issue of *Science* for May 15, of Prof. Newton H. Winchell, formerly State geologist of Minnesota and professor of mineralogy and geology at the University of Minnesota.

INVITATIONS have been issued by the president of the Royal Society, chairman of the General Board of the National Physical Laboratory, to meet the board at the laboratory on Friday, June 19, when the various departments will be open and apparatus will be on view.

THE sixth informal spring foray of the British Mycological Society will be held in the Forest of Dean from Friday, May 29, to Tuesday, June 2. Daily forays will be made, from the Saturday to the Tuesday inclusive, and the various places to be visited will be selected on the previous evening.

THE council of the Institution of Electrical Engineers has appointed Mr. W. Duddell, F.R.S., Mr. F. Bailey, Mr. K. Edgcumbe, Mr. Haydn T. Harrison, and Prof. J. T. Morris as delegates to the British National Committee of the International Illumination Commission, and will contribute equally with the Institution of Gas Engineers towards the expenses of the committee.

AN exhibition of photographs by Mr. A. Radclyffe Dugmore, the African traveller and author of many works on photographing big game in their native haunts, is being held at the house of the Royal Photo-

graphic Society, 35 Russell Square, W.C., from May 27 until June 13 (Whit Monday and Tuesday excepted), between the hours of 11 a.m. and 5 p.m., free to the public on presentation of visiting card.

THE value of the discovery of flint implements of a very primitive type by Mr. Reid Moir at Ipswich has been widely recognised. The work of exploration has hitherto been carried on by the aid of a grant from the Royal Society. An appeal, which we trust will meet with adequate support, for a fund to assist the work has been issued by Sir A. Geikie, Sir Ray Lankester, Sir A. Evans, Sir H. Read, Prof. Marr, and Messrs. W. Whitaker and Henry Balfour. Sir Ray Lankester, whose address is 331 Upper Richmond Road, Putney, S.W., has consented to act as treasurer of the fund.

WE regret to announce the death by drowning in Ceylon of Mr. E. R. Ayrton, the Archæological Commissioner of the island. Mr. Ayrton was a valued officer of the Egyptian Exploration Fund, in which he served with Prof. Petrie at Abydos, with M. Naville and Mr. H. R. Hall at Dêr-el-Bahri, and then with Mr. Thomas Davis at the Tombs of the Kings, contributing largely to his success. He afterwards resumed explorations at Abydos, and elsewhere for the Egyptian Exploration Fund, by the members of which he was held in great respect. After a course of studies in Indian languages, he was appointed on the Archæological Survey of Ceylon, where he cooperated with Mr. H. C. P. Bell in his archæological work. His untimely death will be regretted by all students of Ceylonese antiquities.

ON Tuesday next, June 2, Prof. A. Fowler will begin a course of two lectures at the Royal Institution on celestial spectroscopy; on Thursday, June 4, Prof. Silvanus P. Thompson will deliver the first of two lectures on Faraday and the foundations of electrical engineering; and on Saturday, June 6, Mr. S. Goetze will commence a course of two lectures on studies on expression in art. The Friday evening discourse on June 5 will be delivered by Prof. W. H. Bragg on X-rays and crystalline structure, and on June 12 by his Excellency the Hon. Walter Hines Page (the American Ambassador) on some aspects of the American democracy.

AFTER the erection of the memorial window to Lord Kelvin in Westminster Abbey, there was a balance in hand from the fund collected for this purpose. This is to be disposed of by the establishment of a Kelvin gold medal to be awarded triennially as a mark of distinction achieved in engineering work of the kinds with which Lord Kelvin was especially identified. The award will be made on each occasion by a committee consisting of the presidents of the Institutions of Civil, Mechanical, and Electrical Engineers, the Institution of Naval Architects, the Iron and Steel Institute, and the Institution of Mining and Metallurgy, after the consideration of recommendations to be invited from the principal engineering societies in all parts of the world.

THE first meeting of the International Scientific Radio-Telegraphic Commission was held in Brussels on April 6, Mr. W. Duddell, F.R.S., Dr. W. H. Eccles, and Dr. E. W. Marchant representing Great Britain. The other members of the British National Committee are Prof. G. W. O. Howe, Sir Oliver Lodge, F.R.S., Sir Henry Norman, M.P., and Prof. Silvanus P. Thompson, F.R.S. It will be remembered that this International Scientific Radio-Telegraphic Commission was founded in October last for the purpose of carrying out scientific experiments in wireless telegraphy, and that by the generosity of Mr. Goldschmidt, of Brussels, the use of a large wireless station and the sum of 50,000 francs was placed at the disposal of the commission. Measurements are being made of the strength of the signals sent out from Brussels. The National Committee of each country represented on the commission organises the method of making the measurements, and arranges with experimenters to carry them out.

A CORRESPONDENT writes:—"By the death of Miss Freund (NATURE, May 21, p. 299), for many years lecturer in chemistry at Newnham College, Cambridge, science has lost a devoted follower, chemistry an enthusiastic and original teacher, investigator, and writer, and her friends a wise, warm-hearted, and gentle woman. During most of her life Miss Freund laboured under a great physical disability; but she was always in her laboratory, guiding, encouraging, directing her students; whenever she had a spare hour or two she was pursuing some piece of investigation, and for many years she spent much time in the vacations in writing that remarkable book on 'Chemical Composition,' which made her well known to all chemists. Miss Freund was a genuine student of science; her work is marked by thoroughness, lucidity, sound judgment, suggestiveness, and grasp of the relative importance of different classes of facts. It is known to her friends that she was preparing a book on practical chemistry; should the manuscript be sufficiently advanced for publication to be possible, not a few teachers of chemistry will welcome the book with enthusiasm, not a few will be astonished at the thoroughness and the boldness of it."

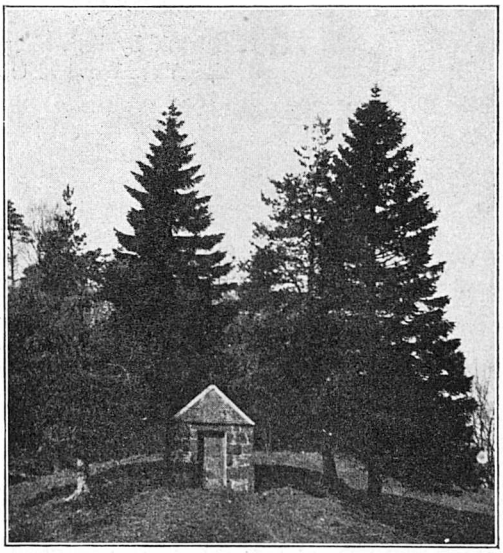
MR. WILLIAM WEST, of Bradford, died on May 14 at his residence in Bradford from heart failure. He was a native of Woodhouse, Leeds, where he was born February 22, 1848, so that he was in his sixty-seventh year. He was brought up as a pharmaceutical chemist, carrying on business in Little Horton Lane, Bradford, in which town he settled about 1872. More than a decade later he gave up that business on becoming lecturer in botany, biology, pharmacology, and kindred subjects at the Bradford Technical College. He was a most successful teacher, and his students kept up their attendance at his classes even after the completion of their necessary courses. It is stated that his success in sending up students to the Royal College of Science was remarkable, and it is largely owing to his influence, example, and teaching that Bradford possesses an unusual number of investigators in natural science. His elder son, William West, jun., a most able botanist, died of cholera in India within a fortnight of landing to take up a biological appointment;

and the younger son, George S. West, is the present professor of botany in the University of Birmingham. Mr. West was a keen and accomplished all-round botanist, with a special preference for the cryptogamia. Of late years, in association with his son George, he concentrated upon the study of Desmidiaceæ from all parts of the world, their papers, severally and jointly, being very numerous. The monograph of British Desmidiaceæ is in course of publication by the Ray Society.

LAST Friday the directors of the Cambridge Scientific Instrument Company entertained a large company at their works, among whom were many of the leading men of science in Cambridge and their lady friends. The occasion marked the completion of a further extension of the works, by which an additional floor area of 6,740 sq. ft. is provided to meet the growing necessities of the business. The works were thrown open to the visitors, who availed themselves of the privilege of passing through the various departments and inspecting the process of manufacture from raw material to finished product. A very interesting and instructive exhibit of instruments was provided, and many were to be seen in operation, and were explained by members of the staff to interested groups. We cannot do more than touch upon a few of the instruments displayed amongst a wide variety which attracted merited attention. An aerodynamic balance, which has been made for the new aeronautical laboratory of the Massachusetts Institute of Technology, possesses the latest refinements for investigating the reactions upon aerofoils, a form of instrument which is sure to play a large part in the study of these problems. The string galvanometer with double vibrator arranged for electro-cardiographic work was seen in operation, the action of the heart being shown on a screen. Another instrument shown was the crack micrometer, for determining the movement taking place in cracked masonry. Two steel pins are cemented into the masonry, one on each side of the crack, and the micrometers are applied to ascertain the relative displacement in three dimensions. This instrument is used in St. Paul's Cathedral. A very comprehensive series of pyrometers was shown, including the Féry radiation and absorption pyrometers, and the Whipple-Féry closed tube pyrometer, also an automatic temperature regulator for maintaining the temperature in a gas-heated molten metal bath. Among other instruments of precision were the Darwin extensometer, Boys's radio-micrometer, and galvanometers and electroscopes of various types, besides many other instruments in great variety.

THE issue of the *National Geographic Magazine* for April is chiefly devoted to a singularly interesting account by Mr. J. C. White of the little-known State of Bhutan in the lower Himalaya. A fine series of photographs adds to the value of this contribution. The writer gained the confidence of the present ruler, Maharaja Sir Ugyen Wang Chuh, who provided ample facilities for exploration. Mr. White gives an enthusiastic account of the people and their country, with its varied scenery and flora, the latter including rare varieties of orchids. He shows ample reason for rejecting the views of a high Indian official, who, so late as 1890, wrote:—"No one wishes to explore that tangle of jungle-clad and fever-stricken hills, infested with leeches and the pipsa-fly, and offering no compensating advantages to the most enterprising pioneer. Adventure looks beyond Bhutan. Science passes it by as a region not sufficiently characteristic to merit special exploration."

MR. C. CARUS-WILSON described in NATURE of September 28, 1911 (vol. lxxxvii., p. 415) the "Earthquake House" erected at Comrie in 1872 through the combined efforts of the British Association and Mr. Drummond. He has now sent us a photograph of the house, and it is reproduced in the accompanying illustration. It may interest seismologists to know that Mr. Carus-Wilson is exhibiting a model of the early form of seismometer used in the "Earthquake House" in the Science Section of the Anglo-American Exhibition at Shepherd's Bush, where the details may be studied.



The "Earthquake House" at Comrie.

IN the May number of the *Irish Naturalist* Dr. H. Stokes records the result of digging for remains of the "Irish elk" in bogs at Howth and Ballybetagh, County Dublin. In the latter locality no fewer than twenty-two more or less imperfect skulls, together with a number of broken bones, were discovered; but at Howth, which had been previously worked, only three skulls and three skeletons were obtained. In Mulligan's Bay, County Wicklow, two skeletons, six skulls, and five shed antlers were dug up.

THE *Malta Chronicle* of May 1 announces the discovery on "Il Gebla tal General," otherwise known as "Fungus Rock," in the island of Gozo, of a new local form of the wall-lizard, which has been named (where not stated) by Dr. G. Giulia *Lacerta muralis*, var. *generalensis*. It is stated to have the back black with yellowish-green spots, the flanks bluish, the under-parts brick-red, the legs black, and the tail maroon, with a black tip. Specimens of the Gozo

wall-lizard are, we understand, *desiderata* in the Natural History Museum.

IN the *Field* of May 23 is reproduced a lithograph, drawn by G. Scharf, and printed by Hullmandel in 1836, representing the four Nubian giraffes brought to London in May of that year by Mr. Thibaut, the agent of the Zoological Society, and his party of Arab attendants, all of whom are included in the picture. In the heading to the accompanying letterpress it is stated that these were the first living giraffes received in England; but the writer has evidently forgotten George IV.'s giraffe, received at Windsor in 1827, of which an account is given by Mr. Lydekker in the Zoological Society's Proceedings for 1904 (vol ii., p. 339).

As reported in the *Times* of May 21, an international conference was held last week at the Foreign Office, with Lord Chelmsford as president, for the purpose of devising more efficient measures for the protection of elephants and rhinoceroses in Africa The conference, which included representatives of all European States possessing territory in Africa, was summoned at the instigation of Mr. Woosnam, the game-warden of British East Africa. Existing regulations for the protection of elephants and rhinoceroses are, it appears, not observed equally throughout African territories; and without such equality it is obvious that their efficiency must be greatly impaired. One of the points in which revision of existing legislation is imperative relates to the size of elephants' tusks for export. According to the *Times* of May 26, the conference is understood to have finished its labours and to have arrived at an agreement, which, when ratified by the Governments concerned, will prove a distinct step in advance. The recommendations to the respective Governments are believed to include the formation and maintenance of sanctuaries for elephants and rhinoceroses in suitable localities. The shooting of these animals is to be permitted only on licences, the conditions of which are to be made as nearly as possible identical in the different territories. In the case of rhinoceroses, absolute protection is recommended for a number of years, and, as regards ivory, the standard weight for export is to be raised to 10 kilos, or more than 22 lb.

THE Board of Trade and the Natural History Branch of the British Museum are to be congratulated on the results of their joint efforts to obtain a census of the number of cetaceans stranded annually on the British coasts. The scheme was initiated in 1912 by the issue of a circular to Receivers of Wrecks, instructing them to report by telegraph to the museum all cases of stranded whales, porpoises, and dolphins that came under their notice. This was followed by the issue in 1913 to coastguard officers of a leaflet intended to aid in the identification of species, and to indicate the essential points of distinction between a porpoise and a shark—animals which, strange to say, are frequently confounded with one another by non-scientific persons. The results of the census are summarised by Dr. S. F. Harmer in a "Report on Cetacea Stranded on the British Coasts during 1913," just issued by the British Museum (price 1*s.* 6*d.*) The total number of stranded cetaceans reported during that year was seventy-six, a few of which were, however, sharks. The identification of species, as might have been expected, was not very satisfactory, but the inquiry, as shown in maps accompanying the report, has brought out very clearly the fact that the great bulk of the strandings occurs on the east coast, especially in Norfolk and Lincolnshire, during the late summer and autumn. To what extent this is dependent on the migrations of herrings is a question which cannot at present receive a decisive answer. Incidentally, the census has been the means of securing a certain number of specimens of the rare species for the museum.

DURING the five years it has been in existence, the International Institute of Agriculture has performed a useful function by publishing monthly a bulletin of agricultural intelligence and plant diseases. In addition to a very large number of abstracts of scientific papers with an agricultural bias, the current number (vol. v., No. 3) contains original articles by recognised authorities on agricultural education in the Argentine, moor cultivation in Germany, entomological work in Hungary, and the cattle industry in Britain. The latter paper, by Prof. Robert Wallace and Mr. J. A. S. Watson, raises several interesting points on the rise and fall in the number of the different classes of live stock during the period for which trustworthy data are available. Since 1878 the number of cattle in the United Kingdom has shown a steady increase from $9\frac{3}{4}$ millions to almost 12 millions, while the number of sheep in the same period has shown somewhat rapid fluctuation without any marked tendency either in one direction or the other. There is a large export trade in pedigree cattle from Great Britain, and during the five years 1906–10, this averaged almost 5000 head, of which rather more than 3000 were breeding animals of an average value of about 60*l.* On the other hand, a very large importation of young store animals and others ready for fattening is carried on, the extent of which may to some extent be judged from the fact that Ireland supplies about half a million stores annually. The increased attention which is being devoted to the improvement of dairy stock is reflected in the very rapid development of milk record societies and also in the greatly increased prices that are now being paid for pedigree dairy stock.

THE Geological Society of Glasgow has always been noted for the original researches published in its Transactions, and it is fortunate in the cooperation of professional workers and keen local amateurs. The discussions are reported, and this is usually a stimulus to debate. In part i. of vol. xv., published in 1914, Alexander Scott reviews the pitchstones of Arran, and shows that the order of crystallisation of the constituents and the occurrence of tridymite raise questions of interest in view of modern researches on silica and the silicates. A. Stevens takes us as far as Stornoway, and suggests that the coarse conglomerate, so well seen east of the town, and generally regarded as a relic of Torridonian strata, may be in reality of Triassic age. G. W. Tyrrell, dealing with

the Carrick Hills near Ayr, furnishes one of his careful studies in petrography. J. W. Gregory, attracted towards geographical subjects, uses the Campsie Fells as a text for an essay upon cirques. Matthès's observations on "nivation," which leads to the sinking of a snow-patch into a hollow worked out by frost and thaw upon its margins, might well be added to those quoted in favour of the "meteoric theory" of the origin of cirques. The edges of certain plateaus in Spitsbergen, as Prof. Gregory knows better than most geologists, afford excellent evidence of the potency of "nivation." This paper will lead to the further consideration of one of the commonest and most puzzling surface-forms of our British highlands.

A VERY elaborate gravimetric survey of Italy has been undertaken by Prof. V. Reina and Dr. G. Cassinis, the observations being published in the *Memorie della R. Accademia dei Lincei*, vol. ix., p. 5. The apparatus used consisted in a modification of Sterneck's pendulum, the apparatus being connected with a wall table with a bipendular support. The stations chosen were Rome, Leghorn, Arcetri, Genoa, Vienna, and Potsdam, the two latter serving as bases of comparison. The uncorrected values observed for g at these stations exceeded 980 by 0·367, 0·534, 0·491, 0·557, 0·860, and 1·275 cm./sec.^{2}, and the corrected values reduced to sea-level by the use of various formulæ are in every case, except one in excess of the values, calculated for the corresponding latitude from the Potsdam formula, the excesses being in every case less than 0·1 cm./sec.^{2}.

THE present year marks the tenth anniversary of the Aerodynamic Institute of Koutchino, which was founded on the initiative of its director, Dr. D. P. Riabouchinsky, for the purpose of researches on fluid pressures and other problems connected with aerial navigation. The main laboratory is equipped with wind tunnels, whirling tables, apparatus for testing propellers, and, in short, all the necessary appliances for experimental work, while attached to the institute there is a hydrodynamic laboratory where use is made of a small river called the Pékhorka. The staff consists of Dr. Riabouchinsky, three assistants, six mechanics, and several workmen. The published work alone includes investigations on propellers, rotation of plates and oscillation of pendulums in a current, and effects of the size of tubes on air currents passing through them, as well as papers of a more mathematical character. A descriptive pamphlet has been published in connection with the present occasion. It is printed by J. N. Kouchnereff, of Pimenoskaïa, but is probably obtainable from the director. It might, however, have been safer if Dr. Riabouchinsky had left the question of locomotion through interplanetary space to M. Jules Verne and Mr. H. G. Wells.

THREE communications from the physical laboratory of the University of Leyden which have reached us are of exceptional interest. The first is a reprint of the address which Prof. Onnes delivered before the Swedish Academy on the receipt of the Nobel Prize for 1913. It describes the apparatus and the methods adopted for the production of extremely low temperatures at Leyden, and is well illustrated. The second is a report by Prof. Onnes to the third international congress on refrigeration held at Washington and Chicago last year. It deals with the work done in the professor's laboratory since the last meeting of the congress in Vienna. The chief results relate to radio-activity, magnetic susceptibility and electrical resistance at temperatures down to 2° or 3° absolute. Radio-activity remains unchanged, the susceptibility of paramagnetic substances decreases below the values given by Curie's law of variation inversely as the absolute temperature, and in some cases reaches a maximum and decreases for temperatures lower still. The resistivities of metals decrease and almost disappear at temperatures 10° or 20° above the absolute zero. The third paper is a report to the same congress on low-temperature thermometry by Prof. Onnes. He advocates the substitution of the helium for the hydrogen thermometer as the standard scale for low temperatures. If the nitrogen thermometer has to be substituted for the hydrogen thermometer at high temperatures, he would suggest that the helium scale should extend up to 100° C., and the nitrogen scale begin at that point. As auxiliary thermometers for low temperatures he recommends platinum or gold resistance thermometers, but in both cases it is necessary to calibrate the resistance thermometer by comparison with a helium thermometer at a considerable number of points on account of the strong curvature of the resistance-temperature curve at very low temperatures.

As a supplementary note to the article on the "Total Eclipse of 1914 in Turkey and Persia," which appeared in last week's NATURE, attention should be directed to the Map of Armenia by the late H. F. B. Lynch, on the scale of 1 : 1,000,000, published by Mr. Edward Stanford, Ltd. The map is in a very useful and portable form, and covers the whole country from Trebizond to Tabriz. It can be obtained apart from Mr. Lynch's book.

OUR ASTRONOMICAL COLUMN.

COMET 1914*b* (ZLATINSKY).—A Kiel circular dated May 20, and an appendix to *Astronomische Nachrichten*, No. 4736, give the following elements and ephemeris, calculated by Prof. H. Kobold, of Zlatinsky's comet (1914*b*), based on observations on May 16, 17, and 18 :—

Elements.

T = 1914 May 8·3618 Berlin M.T.
ω = 116° 17·85′
Ω = 32 43·22 } 1914·0
i = 112 56·31
log q = 9·73478

Ephemeris 12h. Berlin M.T.

	R.A. h. m. s.	Dec. ° ′	Mag.
May 27	7 12 42	+31 30·6	5·8
28	7 25 55	28 37·9	
29	7 37 41	25 49·5	6·1
30	7 48 8	23 7·4	6·2
31	7 57 30	20 33·2	
June 1	8 5 51	18 7·6	
2	8 13 19	15 51·1	
3	8 20 2	13 43·7	6·7
4	8 26 5	+11 45·0	

At the time of discovery this comet was observed to be of the fourth magnitude, so it is rapidly diminishing in brightness. It is situated in the constellation of Gemini, not far from Castor and Pollux. Owing to an error in the original telegram from the discoverer, his name was wrongly recorded.

NOVA NO. 2, PERSEI.—Some very interesting observations relating to the changes of magnitude of Nova No. 2, Persei, have recently been communicated to the Monthly Notices of the R.A.S. (vol. lxxiv., No. 6, April) by Mr. C. R. D'Esterre. This observer uses comparatively small instruments, his largest aperture being 15 in. (reflector), yet with two hours' exposure and most careful following he can photograph stars down to magnitude 19·3. From observations extending from September 1911, to April of the present year, he has been able to establish an interesting degree of variability in the light of the above nova, duplicate exposures with other instruments corroborating his statements. While the mean magnitude of this object during the above period is given as 12·3 mag., there has been a range of variation between 11·7 mag. and 13·2 mag. The fluctuations are described as irregular and rapid, but these have now decreased, and the nova is staying at almost a constant but fainter magnitude. The decline in magnitude has not been accompanied by any marked change of colour. Mr. D'Esterre publishes the individual observations in the paper so that they form a valuable series to link up with those of other observers.

OBSERVATIONS AT THE LOWELL OBSERVATORY.—Lowell Observatory Bulletin No. 59 summarises in thirty-one brief paragraphs the visual and photographic work that has been carried on during the period April, 1913, to April 14, 1914. The list is too long to refer to in detail, but the following notes may be given. Confirmation and completion of the detection of spoke-like markings on Venus, making them a distinguishing feature of the topography of the surface. Determination of the rotation period of Mars giving 24h. 37m. 22·57s. Observations of the canals and oases as fine geometrical lines and dots with the full aperture of the 40-in. reflector. Variability in brightness of the third or fourth satellites of Saturn and measures of the planet's ball, ring, and satellites. Numerous deductions are next given from the photographs taken with slit and slitless spectrograms of the nebulæ in the Pleiades, Cygnus, gaseous nebulæ, nebulæ, and globular clusters, etc. Velocity of approach to the sun of the nebula of Andromeda is given as 300 km. a sec. Spiral nebulæ as a class have a much higher order of velocity than have the stars.

THE SPECTRA OF δ CEPHEI AND ζ GEMINORUM.—A study of the relative changes of intensity in the lines (dark) in the spectra of δ Cephei and ζ Geminorum is described by Inna Lehmann in the *Bulletin de l'Académie Impériale des Sciences de St. Pétersbourg* (No. 6, 1914, p. 423). The spectra of the two stars discussed were taken at the Pulkowa Observatory, and there were available thirty-three plates of δ Cephei and thirteen of ζ Geminorum. The method of procedure was to select one plate as a specimen, and then to compare each of the others with it by means of a spectro-comparator, and thus determine the relative intensity of selected lines. For both stars details are given as to the lines chosen, their wave-lengths, the resulting comparisons, etc. Forming the normal values of the intensities estimated, and comparing them with the light phases, it is found that in the case of δ Cephei when the lines are best visible the star is at a minimum brightness and *vice versâ*. On the other hand, the curve representing the relative intensity-change of the lines in the spectrum of ζ Geminorum are not parallel with the light fluctuation of the star. Four days after the minimum, when the light curve is at a maximum, there is an undoubted diminution in the intensity of the lines.

THE BRITISH SCIENCE GUILD.

THE eighth annual meeting of the British Science Guild was held at the Mansion House on Friday, May 22, the Lord Mayor presiding over a distinguished and representative gathering. The report of the year's work was presented by Sir Boverton Redwood, who directed attention to matters of special importance dealt with by the committees of the guild.

Amongst other matters the medical committee had prepared a well-considered report on the subject of venereal diseases which had been presented to the Royal Commission now considering the matter. Also a warning had been issued to the general public against the danger of fraud in connection with the sale of substances or waters as curative agents, in which radium is said to exist, and the danger of being harmfully treated by persons with no medical qualifications.

The report of the Canadian Committee attracted special interest. Amongst other matters attention was directed to the serious effect of the wholesale slaughter of native insect-eating birds in view of the destruction of agricultural and forest products by insect and other pests. Insects disseminate malaria, yellow fever, typhoid, and other pernicious diseases. Nevertheless, millions of people engage in destroying the birds that eat destructive and disease-spreading insects. In this connection it is satisfactory to note that, in this country, the Bill to prohibit the importation of the plumage of wild birds has just passed the Committee stage of the House of Commons.

Mr. Charles Bathurst, M.P., the chairman of the Select Committee on the Ventilation of the House of Commons, expressed his indebtedness to the guild for its valuable help in connection with the scientific investigation of the matter.

A feature of the meeting was an address by Sir Ronald Ross on the encouragement of discovery, in which he sought to show that of all the labours which man can undertake those which issue in discovery have conferred the greatest benefits upon mankind. He maintained that in the encouragement of science the public omits the main consideration, namely, the purchase of genius. Our universities are largely paid for by private individuals, and the money spent by them is spent more upon teaching than upon discovery. Sir Ronald Ross deprecated the inadequacy of the steps taken to persuade the individuals capable of making discovery to devote themselves to this great task. This could only be done by making it worth their while. If the nation wishes to stimulate discovery, which includes science, to the utmost, it should not only provide universities, institutes, and research laboratories, but should endeavour also to attract by adequate material recognition the most capable men to a field of work which yields the most valuable results to humanity.

The annual dinner of the guild was held in the evening at the Trocadero Restaurant, with Sir William Mather in the chair. The chairman, in proposing the toast of "Science and Industry," commended a spirit of optimism, and said that the twentieth century might probably reveal still greater wonders than the nineteenth. Sir Alfred Keogh, who responded, said that the public administration of this country owed a great deal to science and particularly to Sir Ronald

Ross in regard to his discoveries in connection with deadly tropical diseases. Science was everything to industry, and man found that money profits could be made by taking advantage of the advances of science. He was an optimist about industry, but he could not be an optimist when he looked round and saw members of his profession who had laboured for nothing, scarcely even the thanks of the public, certainly without those rewards for which those engaged in industry rightly and properly looked. He referred also to the fact that the headmasters of the public schools generally were clergymen, and deprecated the lack of provision made in those schools for scientific instruction.

Sir William Byrne (Home Office), in proposing the toast of "The British Science Guild," said that he agreed with the statement in the annual report of the guild, that Government Departments used the services of scientific men without remuneration. The charge was irrefutable. Virtue might be its own reward, but science rarely was. He sympathised with them, and promised that so far as he was concerned he would do his best to alter this state of things.

FLUIDS WITH VISIBLE MOLECULES.

PROF. JEAN PERRIN (of the University of Paris) in his recent course of lectures at King's College, London, dealt with aggregates of suspended particles regarded as fluids consisting of visible microscopic molecules. The Brownian movement of such particles appears to be due to molecular agitation, suggesting that particles in suspension function as enormous molecules. If this is so, the laws of gases extended by Van't Hoff to solutions apply also to dilute emulsions consisting of uniform grains, and from a knowledge of the osmotic pressure of this "gas of visible molecules," one can calculate, using Avogadro's law, the ratio of the masses of the grains to those of the molecule of any gas, an indefinite vertical column of emulsion in equilibrium having the properties of a miniature atmosphere.

Suitable emulsions are prepared by isolating uniform particles of precipitated resin by fractional centrifugalisation. Such emulsions obey the laws of gases and give the correct value for Avogadro's number N, whatever the size of the particles.

Since dilute emulsions obey the laws of gases concentrated emulsions should behave analogously to compressed fluids, and the equation $(P+a/V^2)(V-b)=RT$, be applicable, where V represents the volume of the emulsion, b is four times the volume of the grains present, and a a constant which in Van der Waals's equation corresponds to cohesion. Experiment, while verifying the prediction, shows the interesting peculiarity that in the case of emulsions the cohesion constant is negative, the grains repelling one another appreciably. This result allows the experimental determination of the thickness of the double layer of electrification by contact, and throws light on the properties of colloidal solutions.

The Brownian activity of a grain is defined as E^2/t, where E^2 is the mean square of the displacement in the time t. An emulsion should diffuse as a solution of visible molecules with a speed proportional to the speed of the molecules which compose it. It can be shown that the speed of diffusion D is $1/6\,E^2/t$, and since in the steady state as many molecules pass upward through any level by diffusion as pass downward through the level by gravitation, Einstein's equation holds, viz. :—

$$\frac{F^2}{t}=6D=\frac{RT}{N}\frac{1}{\pi r z},$$

where r is the radius of the grains and z the viscosity of the intergranular fluid. Thus both by measuring the rate of diffusion and by measuring the displacement Avogadro's constant has been determined.

Emulsions were prepared of such a nature that those grains touching one side of the retaining vessel became attached and the emulsion progressively weaker by diffusion, the variation with time in the number of grains captured giving a measure of the rate of diffusion.

By selecting relatively large spheruies it was found possible to measure their rate of rotation, and thus verify Einstein's formula for the Brownian movement of rotation.

These theories also apply to grains suspended in a gas except that Stokes's law is no longer applicable, but by applying an electric field to the charged particles Townsend's equation for the diffusion of ions relates the charge on the granule with Avogadro's number and the activity of its Brownian movement.

$$Ne=\frac{RT}{D}\frac{u}{H}=6RT\frac{t}{E^2}\frac{u}{H}.$$

The values of N, the number of molecules in a cubic centimetre of a gas under standard conditions, deduced by these various methods, exhibit a remarkable concordance. Prof. Perrin concluded his lectures with a critical comparison of the results of his measurements of N with the values which have been deduced from determinations of the charge of an electron, from counting alpha particles, and from the theory of radiation.

CONTRIBUTIONS TO VERTEBRATE PALÆONTOLOGY.

THE skull of a remarkable new generic type of horned dinosaur (*Styracosaurus albertensis*), from the Cretaceous of the Red Deer River, Alberta, is described and figured by Mr. L. M. Lambe in the *Ottawa Naturalist* for December, 1913 (vol. xxvii., pp. 109–16, plates x.–xii.). It was found by the well-known collector Mr. C. H. Sternberg, last summer. The skull is long, depressed, and wedge-shaped, with a single nasal horn of somewhat unusual shape; but its chief peculiarities are the large size of the supratemporal fossæ, and the production of the hind border of the great occipital flange into four pairs of spines, of which the three innermost on each side are very long. Although the Alberta horned dinosaur may be generically identical with an imperfectly known species from the Cretaceous of Montana, referred by Cope to the genus Monoclonius, under the name of *M. sphenocerus*, it is considered that the two are specifically distinct.

According to an article by Mr. C. Schuchert on the dinosaurs of German East Africa, published in the *American Journal of Science* for 1913 (vol. xxxv., pp. 33–8), the largest representative of the genus first described as Gigantosaurus, but now known, on account of the preoccupation of the original name, as Tornieria, is believed to have been about twice the length of Diplodocus, or at least 150 ft. The neck appears to have exceeded that of the American species by a length of about 15 ft. It is hoped to set up a skeleton of this gigantic reptile in the Berlin Museum.

At the conclusion of a note on the relationship between the Permian reptiles of South Africa and those of Russia, published in the *Journal of Geology* for November and December, 1913 (vol. xxi., pp. 728–30), Dr. R. Broom expresses the opinion that the dicynodonts of the Durna valley represent the Ciste-

cephalus zone in Africa, which contains dicynodonts of very similar type. If this be so, the Cistecephalus zone will be topmost Permian, and the underlying Pariasaurus zone Middle Permian.

In an article in the February number of the *American Naturalist* Prof. E. C. Case shows that the "sail-backed" reptile, *Edaphosaurus crucifer*, of which a restoration is given, is perfectly distinct from the genus Dimetrodon, with which it had been incorrectly identified. So far from the two being identical, Dimetrodon was carnivorous, whereas Edaphosaurus probably subsisted on molluscs or insects, with perhaps an occasional vegetable meal. Unlike most of its reptilian contemporaries, its head was small in proportion to the body; the dentition consisted of a marginal series of sharp conical teeth, and of crushing teeth on the palate, the latter opposed by a corresponding series on the inner side of the lower jaw.

We have received a corrected copy of a reprint from Dr. L. Reinhardt's "Vom Nebelfleck zum Menschen" (second edition), issued as an appendix to Dr. H. Hallier's "Der Stambaum des Pflanzenreiches" (Munich), which is being completed by Dr. Reinhardt himself. This appendix, in addition to a table exhibiting the geological succession of the leading groups of plants and animals, as exemplified in central Europe, contains a number of phylogenetic "trees" illustrating the evolution of animals and of plants, as well as of many of their classes and orders. Many criticisms of these "trees" might be made, but it must suffice to mention that the author regards the toothed whales as descended from early carnivorous, and the whalebone whales from primitive herbivorous mammals. Mammals themselves he derives from Permian "Urreptilien," which in turn gave rise to "Sauromammalien," a group from which the carnivorous theriodonts are expressly excluded.

In an article published in the *Bull. Amer. Mus. Nat. Hist.* for 1913 (vol. xxxii., pp. 261–274) Prof. H. F. Osborn shows that a skull from the Eocene of Wyoming described by Cope in 1884, and referred to the genus Triplopus, under the name *T. amarorum*, really belongs to the Chalicotheriidæ, or perissodactyles with edentate claws, of which it is the earliest known representative. It is consequently made the type of a new genus, Eomoropus, which is believed to be a specialised offshoot from the stock which gave rise to the titanotheres, on one hand, and to the forerunners of the horse group on the other.

Three publications dealing with the horse family and its extinct forerunners have been issued recently in America. The first, entitled the "Evolution of the Horse," takes the form of a fully illustrated guide to the members of the group exhibited in the American Museum of Natural History. In the first part, Dr. W. D. Matthew discusses the evolution of the horse group in nature, while in the second Mr. S. H. Chubb deals with the origin of the domesticated breeds of the horse, and the structure, growth, and succession of the teeth, this latter section forming a really valuable contribution to science. In a memoir published by the Irving Press, New York, under the title of "The Horse, Past and Present," Prof. H. F. Osborn treats of the same collection, and also of the members of the horse family now living in the New York Zoological Park. In the third publication, which is in the form of a guide-book to the remains of extinct perissodactyles allied to the existing horse group preserved in Yale University, Dr. R. S. Lull records the various expeditions—starting from 1870—which have contributed to the collection, and concludes with a brief summary of the equine pedigree.

THE ROYAL SOCIETY OF TASMANIA.[1]

TO commemorate the seventieth anniversary of the foundation of the Royal Society of Tasmania, the secretary, Mr. E. L. Piesse, has prepared a valuable sketch of its history. The society dates from October 24, 1843, and therefore from a quarrelsome epoch of Tasmanian history. Its founder, Sir John Eardley Wilmot, had landed as Governor before arrival of the news of Sir John Franklin's recall; and an uncomfortable situation was relieved by Wilmot's undertaking a tour in the northern part of the island until Sir John Franklin had time to vacate Government House. Sir John Franklin in 1838 had established a Society for the Promotion of Natural History in Tasmania, and after a nameless existence it adopted in 1842 the title of "The Tasmanian Society." With characteristic generosity Lady Franklin established a Franklin Museum about three miles from Hobart, and endowed it with 410 acres of land, A museum building in a classic style of architecture was erected, but in consequence of uncertainty as to the ownership, owing to vagueness in the deed of gift, Lady Franklin's ideas have not been carried into effect. Shortly after his arrival, Eardley Wilmot determined to reconstitute the Tasmanian Society; but its members were mostly Franklinites, and all but five of them withdrew from the meeting, owing to disputes over unimportant details.

The Governor and those who remained then established a new society under the name of the Botanical and Horticultural Society of Van Diemen's Land. Its main objects, according to the charter, were "to develop the physical character of the island and illustrate its natural history and productions." Next year Queen Victoria became the patron of the society. It accordingly became the Royal Society of Van Diemen's Land, a title which was necessarily changed in 1855, when the name of the colony was altered to Tasmania. The older Tasmanian Society was merged in the Royal Society in 1848, and in the same year the society established the Tasmanian Museum, and in the next year commenced the publication of its Papers and Proceedings. In 1860 the site of the present museum in Hobart was given to the society by the Government, and the new museum was finished in 1862, and extended in 1886 and 1901. The society has done excellent work by the formation of valuable Tasmanian collections and by the publication of its papers and Proceedings, which are one of the main storehouses of information on the natural science of Tasmania.

Mr. Piesse's paper is published in the volume for 1913, which also includes a series of valuable contributions to knowledge of Tasmania. Mr. Rodway, the Government botanist, contributes a monograph on the Tasmanian mosses, including short summaries of all the species known in the island. These belong to 114 genera.

Mr. Beattie reprints with explanatory notes a list of words used by the Oyster Bay tribe; the list was compiled in 1824, and has only recently been discovered. Dr. Noetling describes a section near Hobart, and insists that all the fossiliferous beds of southern Australia, which have long been generally assigned to the Eocene, are at the earliest Miocene. This conclusion is further supported by the description of a fossil whale from Wynyard on the northern coast of Tasmania, by H. H. Scott. Mr. Piesse contributes two papers on proportional representation, which is adopted in Tasmania. J. W. G.

[1] Papers and Proceedings of the Royal Society of Tasmania for the Year 1913. 337 pp., 1 text-fig. 22 plates, 1 map. (Hobart, 1914). Price 15s.

UPPER AIR RESEARCH.[1]

THERE are several ways of obtaining a knowledge of the free air: the observer himself may go up in a balloon and take readings of his instruments; or he may send up recording instruments in a kite, a captive balloon, or a free balloon; in the latter case, he must take the chance of the balloon and the instruments being found after they come to earth.

The first actually to use a kite for scientific purposes was Dr. Alexander Wilson, of Glasgow, who, in 1749, raised thermometers by this means; he used several kites distributed along the line, and he says that on one occasion the top kite "reached an amazing height, disappearing at times in the white summer clouds." Three years later, Benjamin Franklin made his famous experiment with a kite.

Kites with thermometers attached were used in Arctic voyages in 1821, and again in 1836; and in 1847 a kite was flown at Kew Observatory with which it was hoped to measure temperature and wind velocity. But these were isolated attempts, and it was not until the last quarter of the nineteenth century that the method was systematically adopted. The modern exploration may be said to begin with the late Mr. Douglas Archibald, who saw all the possibilities of the method, though his own work was confined to observations on wind velocity. He was the first to use steel piano wire for kite-flying, and he was able thus to get far greater heights than was possible with a line. In 1885, and the years immediately following, observations on electric potential were made by means of kites in Germany and in America. About 1890 Mr. Eddy, in America, devised a tailless kite, and raised thermometers by its means; but the great advance came when the box-kite, invented by Hargrave, of Sydney, was used instead of the older pattern. Since 1895 the Hargrave kite, or some modification of it, has been almost exclusively used in scientific kite-flying. One of the pioneers of upper air research was Prof. Lawrence Rotch, of Blue Hill Observatory; he adopted the Hargrave kite, and used steel piano wire in 1895, and in the following year he raised instruments to a height of 8000 ft. The United States Weather Bureau was so impressed with the success of the Blue Hill kite flights that they organised seventeen stations, and hoped to make daily flights for the construction of synoptic charts at a height of a mile. The experiment failed owing to the light winds in summer, but a large number of observations were taken extending over several months.

FIG. 1.—Kite-flying, Pyrton Hill.

From this time onward the work spread rapidly; it was taken up by M. Teisserenc de Bort at his observatory at Trappes, near Paris; by Dr. Assmann in Germany; and subsequently by many others; it has now become part of the ordinary routine work of any observatory that deals with the upper air.

In this country, however, we lagged behind. It was not until 1901 that a joint committee of the British Association and of this society took up the work. Prof. Rotch had shown that it was feasible to fly kites from a steamship, and in the summer of 1902 Mr. Dines, at the request of the joint committee, flew kites from a steamship on the west coast of Scotland,

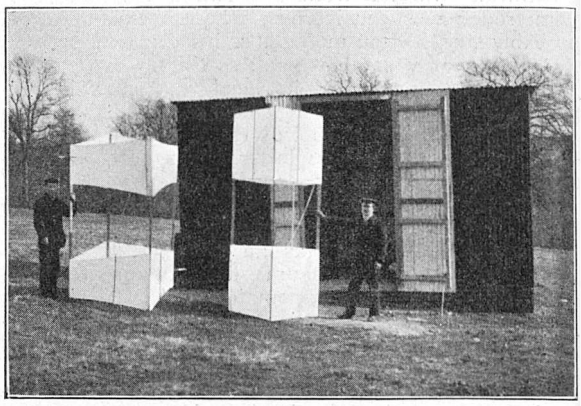


FIG. 2.—Kites (Dines pattern) ready for use.

using a kite of his own, a modification of the Hargrave pattern.

In point of time kites for meteorological purposes preceded balloons, but serious work began soon after the invention of the balloon in 1783. In 1784 Dr. Jeffries made an ascent and took with him a barometer, a thermometer, and a hygrometer, besides bottles filled with water, which were to be emptied at various heights, and corked up again to obtain samples of air. In 1804 both the St. Petersburg Academy and the French Academy of Sciences arranged balloon ascents for scientific purposes. Very remarkable were the experiments of Thomas Forster in 1809. He filled a number of small balloons with "inflammable gas," and watched their movements; we must certainly look on him as the pioneer of pilot balloon observers, and it is strange that his method of observation was neglected for three-quarters of a century.

FIG. 3.—Kite folded for carrying.

In the middle of the last century there was a considerable increase in the interest taken in the upper air. John Welsh, of the Kew Observatory, made several ascents in 1852, and used the aspirated thermometer for the first time. Then came Glaisher's famous ascents, twenty-eight in all, some in a balloon made by Coxwell, a famous aeronaut, some in public balloons, in which Glaisher went as an ordinary passenger. Only seven ascents were specially high, and one on September 5, 1862, was the highest ever made

[1] From a presidential address delivered before the Royal Meteorological Society on January 21 by Charles J. P. Cave.

until recent years. The estimated height was 37000 ft., but Glaisher lost consciousness for thirteen minutes, and his estimate is therefore uncertain; the highest point may not have been much more than 30,000 ft.

In 1875 the French Academy of Sciences arranged for an ascent, and M. Gaston Tissandier and two companions ascended to a great height; in spite of oxygen inhalations, however, his two companions lost their lives, and Tissandier himself barely escaped asphyxiation when the balloon reached a height of 28,000 ft. This disaster prevented any very high ascents for some years, but in 1894 Dr. Berson made the first of his series of ascents that have eclipsed all previous records. In July, 1901, Berson actually took a reading of the barometer corresponding to a height of 34,500 ft. or 10½ km., and in spite of oxygen inhalation, he, too, became unconscious This may be taken as the highest ascent yet made by man.

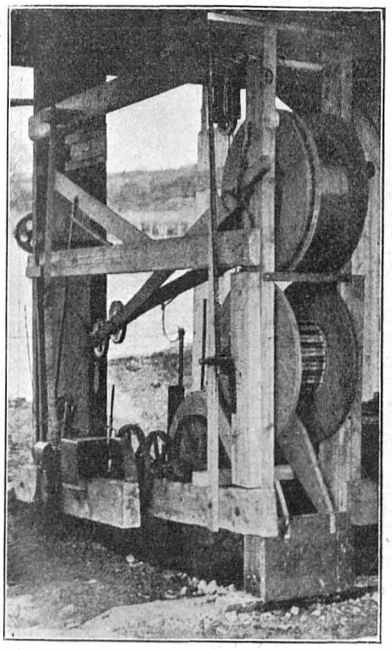


FIG. 4.—Dines winding-gear for kites.

The danger to life at great elevations led to another method of research. In 1891 M. Bonvallet sent up a number of paper balloons carrying post-cards asking the finder to post them, with a note of the time and place of finding. The experiment was repeated by MM. Hermite and Besançon with larger balloons and simple recording instruments. One of these balloons having reached a height of 30,000 ft., they made a still larger one, provided with a better recording instrument. This was the earliest registering balloon, and it made its first ascent on March 21, 1893, reaching a height of 15 km., or nearly 9½ miles. In Germany these experiments were soon repeated. Under the auspices of the German Society for the Promotion of Aerial Navigation, Dr. Assmann sent up a balloon which rose to a height of about 22 km., or 13½ miles. These were sensational experiments, but they seem to have attracted little attention in this country.

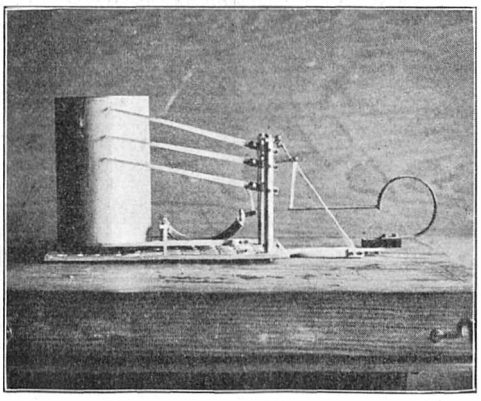


FIG. 5.—Balloon meteorograph with Bourdon tube barometer and bimetallic thermometer.

In the very early days of kite-flying ordinary minimum thermometers used to be sent up; but when the study began seriously, special instruments had to be designed. In the ordinary pattern, pens, actuated by some form of barometer, thermometer, and hygrometer, trace a record on a revolving cylinder. For the barometer an ordinary aneroid box was used at first, but this has given place in most of the instruments used on the Continent to a tube which acts in the same way as the Bourdon tube pressure gauge. The same system was used for the thermometer, the tube being filled with spirit, the expansion or contraction of which changed the shape of the tube. But a bimetallic thermometer has also been much used; this consists of a coil of metal made of two pieces which expand or contract at different rates with rise or fall of temperature. In both thermometers the resulting motion is communicated to the pen by levers.

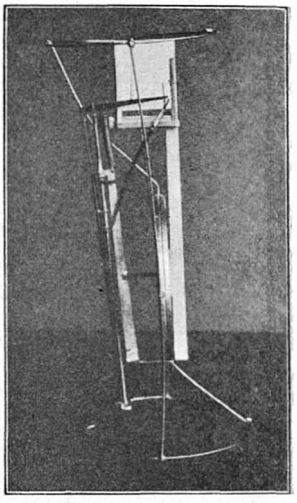


FIG. 6.—Dines light meteorograph.

In this country we are badly situated for balloon work; many of our free balloons are lost in the sea, and we cannot count on Government support in the research as can some of our more fortunate neighbours. I think I am not overstating the case if I say that but for the ingenuity of Mr. Dines we should have had practically no upper air research in this country. In his light balloon meteorograph he has made one of the most striking meteorological instruments. It costs in shillings what the other instruments cost in pounds; and, weighing as it does under two ounces with its case, it can be sent up with quite small balloons. An aneroid box, as it expands with decrease of pressure, carries two pens across a copper plate; the thermometer pen is moved by the relative contraction of a strip of German silver compared with an invar steel bar. Two lines are thus scratched on the copper plate; the length of the lines from the origin represents the pressure, and their distance apart the temperature. The trace is very minute, the whole plate being about the size of a postage stamp, and it has to be read under a microscope; but the expansion and contraction of the thermometers used in the Continental meteorographs have to be magnified mechanically, and, as Mr. Dines has pointed out, the optical magnification is perhaps less liable to error. The instrument is so small that some who had used the other instruments looked on it as a toy rather than as a serious instrument. But it was soon found to give as good results as the other forms; and when at Manchester University twenty-four balloons carrying these instruments were sent up in the space of twenty-four hours, one each hour, it made a considerable

impression. Such an achievement with the larger instruments would have cost more than 500*l.* in instruments alone.

When sending up one of the Continental instruments it is usual to have two balloons made of rubber fabric, one being given rather more lift than the other; the instrument, placed on a bag of nickel paper, open

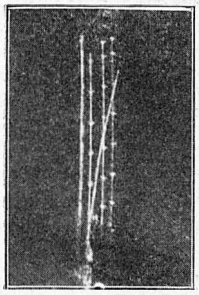


FIG. 7.—Trace and calibration marks, Dines meteorograph.

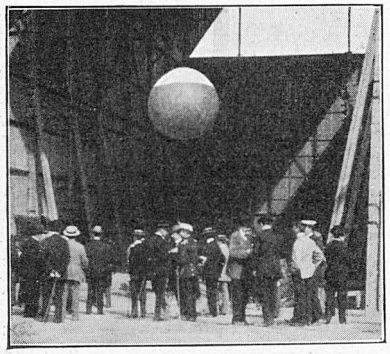


FIG. 8.—Sounding balloon with parachute.

at both ends, to protect it from the direct rays of the sun, is slung below the balloon. The balloons ascend until one of them bursts; the remaining balloon cannot support the instruments, but it has sufficient lift to allow them to descend gently and without injury to the earth's surface. In the case of ascents made at sea a float is attached below the instruments, and the unburst balloon, which has not been given enough lift to support the float and the instruments, has sufficient lift to keep the instrument clear of the water. The unburst balloon, whether on land or at sea, is a signal to show where the instrument has descended. Sometimes only one balloon is used, but in this case it is necessary to have a parachute so arranged that when the balloon bursts the parachute will come into action and bring the instruments down in safety. Mr. Dines's meteorograph is so light that the fabric of the burst balloon is sufficient to check

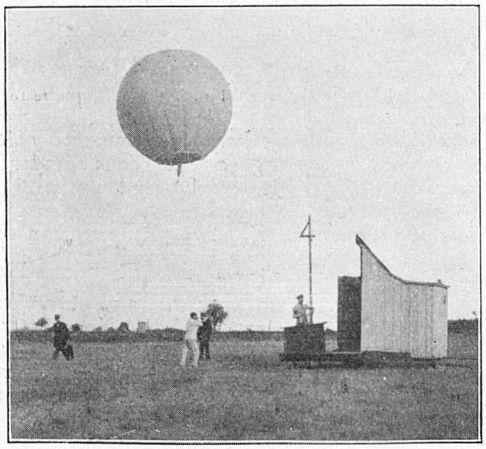


FIG. 9.—Captive balloon at M. Teisserenc de Bort's observatory at Trappes.

the velocity of descent; and these instruments have over and over again fallen from heights of ten miles or more with no ill result whatever.

M. Teisserenc de Bort used paper balloons; and that they might ascend at a regular pace they carried a sandbag with a hole in it, so that the balloon was always dropping ballast. In order that the balloon might not float at the greatest height attained, there was an arrangement actuated by clockwork whereby after a certain time a hook tore a rent in the lower part of the balloon, while the upper part became a parachute which allowed the instruments to fall slowly.

Small captive balloons have been used with success for lifting instruments in calm weather, when it is desired to explore the air up to heights of a kilometre or so; but they cannot attain any very great height, as they have to lift the wire that holds them; they

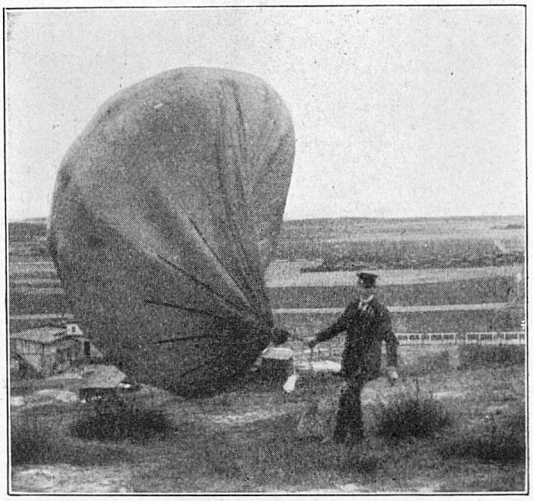


FIG. 10.—Landing the captive balloon.

are apt to become very unmanageable if even a slight wind gets up while the flight is in progress. In Germany and Austria the balloon-kite has been used with success; it is a captive balloon of a form so designed that the wind lifts it instead of depressing it, as it does an ordinary captive balloon.

A balloon in its ascent gives us more information than merely the temperature and pressure of the air through which it rises. If we watch it we see it moving in varying directions as it passes through different currents of air in its ascent. We have only to watch the balloon through the telescopes of theodolites to obtain its real path through the atmosphere, from which may be deduced the wind velocities and directions in the various layers. For this purpose we may use balloons scarcely larger than a child's air-ball, and, given a clear sky, we may follow such balloons up to heights of 5 or 6 km. The larger balloons used for carrying instruments can be followed with the theodolite for much greater distances; and I have myself seen a balloon burst at a height of ten miles above the surface of the earth and at a horizontal distance of forty miles.

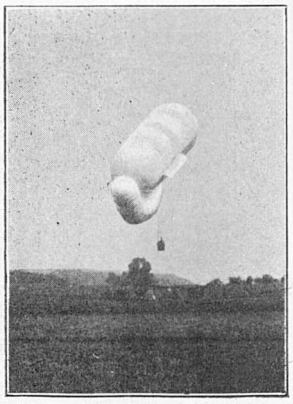


FIG. 11.—Austrian military balloon kite.

For observing balloons in this way a special theodolite is advisable, for the ordinary pattern, when used for high angular altitudes, necessitates extremely uncomfortable attitudes on the part of the observer.

Various ingenious pieces of apparatus have been

designed in connection with upper air research. I should like to mention two of them. M. Teisserenc de Bort made an apparatus for collecting air at great altitudes. In this instrument (Fig. 13) a small weight is released electrically, when a lever connected with a barometer makes contact with a metal stud; the guillotine drops on to the finely drawn out end of a glass tube, which has been exhausted and sealed up; thus air is admitted to the tube. As the balloon

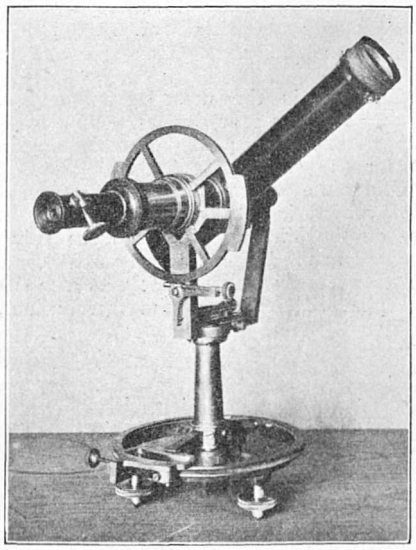


FIG. 12.—Duquervain theodolite for observing pilot balloons.

ascends higher the barometer moves the lever still further until it makes contact with another stud which allows an electric current to flow through a platinum wire coiled round the remaining part of the fine end of the tube, thereby melting the glass and sealing up the tube. M. Teisserenc de Bort collected samples of air in this way.

The second piece of apparatus which I will describe was designed by Dr. Assmann (Fig. 14). It is meant to measure the temperature of the air over the sea, desert countries, or in Arctic or Antarctic regions, when there is little chance of recovering the balloon. The balloon is watched through theodolites, and its height from minute to minute is calculated in the ordinary way. An arm attached to a thermometer completes an electric circuit at a predetermined temperature, say at freezing point; the electric current explodes a firework hung below the balloon, and the observer sees a puff of smoke as soon as the balloon has entered a layer of air in which the temperature is at the freezing point. Other fireworks can be exploded in turn at predetermined temperatures, and it can be arranged that the fireworks connected with the various temperatures should show

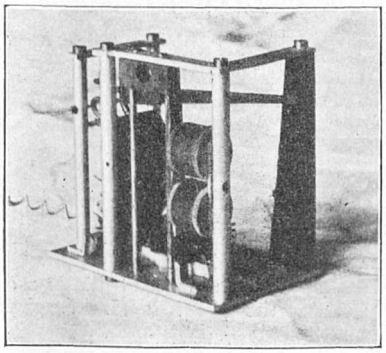


FIG. 13.—Teisserenc de Bort's apparatus for collecting air at great altitudes.

smoke of various colours, so that in the event of any particular firework accidentally failing to explode the colour of the next puff of smoke will show the temperature.

In the first part of this address I gave a short history of upper air research up to the year 1896. Before that time the research had been tentative and spasmodic; susequently it has been regular and organised. In 1896 the International Meteorological Committee constituted an auxiliary committee under the name of the International Commission for Scientific Aeronautics, with Prof. Hergesell, of Strassburg, as its president. It was agreed that simultaneous observations should be made with kites, registering balloons, and manned balloons. The first of these international ascents was made on November 14, 1896, and on that day three registering balloons and five manned balloons ascended in France, Germany, and Russia. Since that time the work has gradually extended; and at the present time international ascents are made on the first Thursday in each month, on three successive days three times a year, and once a year balloons are sent up on each day for a week.

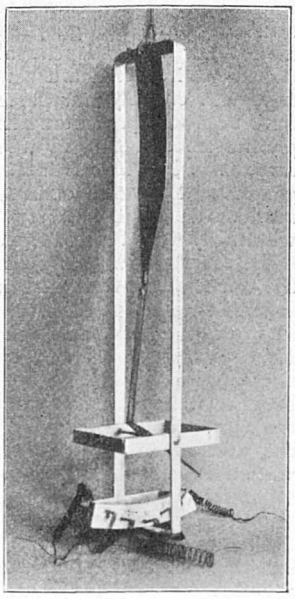


FIG. 14.—Assmann's apparatus for measuring temperature at great heights over the sea.

Meanwhile congresses have been held at Strassburg in 1898; at Paris in 1900; at Berlin in 1902; at St. Petersburg in 1904; at Milan in 1906, at Monaco in 1909; and at Vienna in 1912. The next conference is to be held in England in 1915, and it is to be hoped that in this country we shall do as much for our meteorological guests as they have done for us when we have visited them.

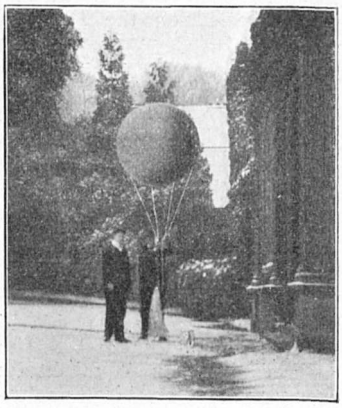


FIG. 15.—Sounding balloon at Ditcham, January 25, 1907.

Meanwhile the work of exploring the upper air has been progressing steadily, and other countries joined the three which began the research. In this country, however, we were again behind. In 1903, the year after Mr. Dines had commenced flying kites, Mr. P. Y. Alexander obtained the apparatus for registering balloon ascents, and about half a dozen balloons were sent up from Bath under the superintendence of Dr. Mansergh Varley. Nothing more was done in this country until 1907, when Mr. Dines had made the instrument that I have described. The first record to come back was from a balloon which Mr. Dines

himself sent up on June 5 of the same year. By the end of July the first international week took place, during which special efforts were made to get observations in the upper air, not only at the regular observatories, but by special expeditions to suitable localities. The number of foreign Government expeditions sent out to take observations in the international weeks in 1907 and 1908 is remarkable; it is also remarkable that England, the geographical position of which makes her more dependent on weather than many Continental States, and which has a larger navy than any, was entirely unrepresented officially, and would have been unrepresented altogether had it not been for private effort. But by the time of the first international week Mr. Dines had perfected his meteorograph and several observers had made themselves familiar with balloon work, therefore this country was fairly well represented.

There are now many observatories in all parts of the world which take part in the organisation. Among others that have recently been established may be mentioned Simla, under Dr. Walker; Helwan, in Egypt; Teneriffe; and a station in Uruguay. Particularly to be noted, also, is the station in Spitsbergen, where German observers remain not only in the summer, but through the winter also, to study the atmosphere in the Arctic regions; and also the station at Batavia, in Java, where Dr. van Bemmelen is doing such excellent work on the winds in the upper air over the equatorial regions.

The most complete observatory for upper air research is that at Lindenberg. This observatory was founded under the direct personal interest of the Kaiser, and under the direction of Dr. Assmann has carried out an immense amount of work with kites, captive balloons, and registering balloons. Ascents of one sort or another are made on every day in the year, and on the international days a large number of ascents are made on each day. You will realise the immense amount of work done when I mention that in 1912 there were twenty-six ascents of registering balloons, 262 of captive balloons, and 516 of kites. The Kaiser has also shown his interest in the subject by giving to the International Commission a transportable observatory that, in the first instance, has been erected on the Peak of Teneriffe, where the Spanish Government now proposes to build a permanent observatory.

The Blue Hill Observatory, near Boston, which belonged to Prof. Rotch, has since his death been carried on by Mrs. Rotch; the observatory is now to be carried on for five years under the direction of Prof. McAdie, who is to take up the post of professor of dynamical meteorology at Harvard. It is to be hoped that some permanent arrangement will be come to whereby the observatory at Blue Hill may continue; for it was here that so much pioneer work was done by Lawrence Rotch, whose untimely death was such a loss to science and to his friends.

Another pioneer and a charming personality has also died, when it might have seemed that many years were before him to carry on his favourite study; I mean Léon Teisserenc de Bort, who only a few years ago received the Symons gold medal from this society. His death leaves his observatory at Trappes without a director. I believe, however, that arrangements have now been made by which it will be taken over by the French Government in connection with aviation.

But it is not only in the permanent observatories that work is being done. No expedition for scientific exploration would be complete to-day without some means of studying the upper air. Dr. Simpson worked with balloons in the Antarctic in Captain Scott's expedition; and both Captain Amundsen and the Danish Expedition to Greenland propose to study the upper air.

Many expeditions have been dispatched for the sole purpose of aerological research. M. Teisserenc de Bort and Prof. Rotch chartered a steamer, which, in the years 1905, 1906, and 1907, traversed various parts of the eastern Atlantic, between the temperate zone and the equator, and obtained most interesting results from their observations. The Prince of Monaco made several cruises in his yacht, the *Princess Alice*, in company with Prof. Hergesell, notably to the neighbourhood of the Canaries and to Spitsbergen.

As Lindenberg is the most complete aerological observatory, so it has sent out what was perhaps the best equipped expedition; this was organised by Dr. Assmann for the study of the upper air in tropical Africa. Under the charge of Dr. Berson twenty-three ascents of registering balloons were made from a steamboat on the Victoria Nyanza from July to September, 1908; great heights were reached, and valuable results obtained: much work was also done with kites and pilot balloons. In the international week

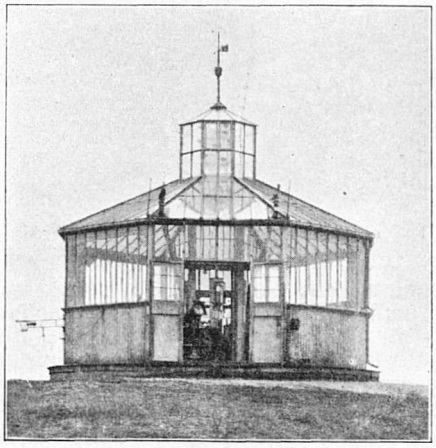


FIG. 16.—The Windlass House at Lindenberg.[1]

in July of the same year Prof. Palazzo made some ascents with registering balloons from an Italian cruiser in the neighbourhood of Zanzibar.

The most recent aerological expedition is one organised by Mr. P. Y. Alexander to study the upper air over the valley of the Amazons; this, too, has been put under the charge of Dr. Berson.

The *Scotia*, which was sent out to the parts of the North Atlantic where ice is frequent, also carried balloons and kites, and Mr. G. I. Taylor was able to carry out observations in a part of the globe where upper air work had not been tried before.

I have attempted to give you a short history of upper air research up to the point it has reached to-day; I have refrained from giving you the results that have been gathered from the research.

From this brief and necessarily incomplete account you will realise that upper air research is a cooperative study. The single observer out of touch with others can do little; more perhaps than in most sciences, it is the trained and united army that succeeds. And this is not the least of the charms of the science. I can personally testify how English and American, French and German, Russian and Scandinavian are all ready to help each other. There is no jealousy in the upper air. International barriers are broken down.[1]

[1] The author is indebted to Prof. Assmann, Director of the Lindenberg Observatory, for the photographs reproduced in Figs. 10 and 16.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

LONDON.—The Higher Education Subcommittee have presented to the London County Council Education Committee an important report on the recommendations of the Royal Commission on University Education in London, generally approving the proposals of the Commission with reference to the government of the University. The subcommittee considers that the Senate should have full and effective control, both educational and financial, over the proposed constituent colleges, without reference to the provisions of existing Acts and Charters. Upon this understanding, it is regarded as essential that the Imperial College of Science and Technology should become a constituent college of the University. The appointment of a small Senate, non-representative in character, is also approved, but exception is taken to the proposed constitution of the Committee of Technology, particularly in regard to the representation of constituent colleges on such committee. Recommendations are also made as to widening the representation of teachers in the membership of the re-organised faculties.

At the meeting of the Senate on May 20, Prof. E. G. Coker was appointed to the chair of civil and mechanical engineering, tenable at University College, in place of Prof. Jeffcott recently appointed to the chair. Dr. Coker is at present professor at the Finsbury Technical College, and formerly held an appointment at the Gill University.

Dr. Frank Horton has been appointed to the chair of physics tenable at Royal Holloway College.

The D.Sc. degree in botany has been granted to E. J. Schwartz, an external student.

The result of the poll for the election of a member of the Senate by graduates in science shows that Dr. M. O. Forster, who was elected, obtained 796 votes, against 293 cast for his opponent, Dr. Forster Morley.

MANCHESTER.—It is proposed to confer the following honorary degrees:—*Litt.D.*: Prof. E. K. Gonner, University of Liverpool; Prof. A. Feuillerat, University of Rennes. *D.Sc.*: Prof. W. H. Bragg, University of Leeds; Prof. W. J. Pope, University of Cambridge; and Dr. J. E. Stead, Middlesbrough.

THE honorary degree of Doctor of Engineering has been conferred upon Commerzienrat Carl Paul Goerz, the head of the well-known Goerz Optical Works, by the Technical High School in Charlottenburg, in recognition of his efforts in the development of the German optical industry in the advancement of photographic optics, and in the construction and technical improvement of optical and measuring instruments.

WE learn from the issue of *Science* for May 15 that the gifts to Oberlin College for various purposes during recent months amount to nearly 38,000*l.*, apportioned as follows:—For campus improvement, 5000*l.*; for a new art building, 25,000*l.*; for a new organ in Finney Memorial Chapel, 5000*l.*; subscriptions toward the new athletic field, 2860*l.* A large number of gifts, mostly anonymous, go to make up the 25,000*l.* for the new art building.

IT was announced in several daily papers last week that the University College of Wales, Aberystwyth, had received a gift of 75,000*l.* for the establishment of a school of music. We are informed that the report was unauthorised and inaccurate, and that the facts are that a donor who does not wish his name to be made public has agreed to guarantee the sum of 3000*l.* per annum for a period of five years in order to enable the college to found a school of instrumental music. The school will be opened next October.

THE council of the University of Birmingham invites applications for the chair of physics, vacant by the death of Prof. J. H. Poynting. The stipend offered is 750*l.* a year. The regulations state that it will be the duty of the professor appointed to contribute so far as in him lies to the advancement and diffusion of knowledge, especially by the prosecution and promotion of original research; to give instruction in accordance with the curriculum prescribed by his faculty and the Senate in his subject; to undertake necessary examining work; and to take part in the organisation of the work of the University. Applications should be sent to the secretary of the University on or before October 15 next.

PROF. JOHN PERRY, F.R.S., has recently retired from the staff of the Imperial College of Science and Technology, and a fund is being raised for the purpose of giving expression to the appreciation of his services to the teaching of mathematics and to engineering education. An appeal for subscriptions has been issued to his former students and colleagues at the Imperial College and at Finsbury Technical College, but there are doubtless many others who have benefited by his published works and will desire to subscribe to the testimonial fund. It is to be hoped that there will be a ready response, so that the committee will be able to commemorate his work in a fitting manner. Past and present students of the Imperial College should also notice that another fund is being raised for a testimonial to Prof. J. Harrison. Subscriptions should be sent to the hon. treasurer, Mr. P. T. Wrigley, Royal College of Science, South Kensington.

MUNIFICENT gifts to the University College of South Wales and Monmouthshire were announced a few weeks ago, and were referred to in NATURE of May 14 (p. 287). We understand that the facts connected with the recent donations to the college are as follows:—Last year Sir William James Thomas, of Ynyshir, undertook to build and present to the college on a site contiguous to the old buildings in Newport Road a complete physiological department, so constructed as to form a part of a scheme for a complete medical school on the same site. This year a donor, who wishes at present to remain anonymous, has offered to build the whole of the buildings necessary not only for a medical school, but also a school of preventive medicine, at an estimated cost of 60,000*l.* One of the conditions attached to the latter gift, however, is that the funds supplied by the Treasury should be sufficient for the upkeep of the complete school; and it remains to be ascertained whether this condition can be fulfilled.

THE movement inaugurated a few months ago to develop as completely as possible the educational side of the kinematograph made definite headway on Wednesday, May 20, when the Educational Kinematograph Association was formed at a meeting in London. Among those who have joined the council of this body are Sir H. A. Miers, Rt. Hon. Sir Horace Plunkett, Dr. C. W. Kimmins, Prof. R. A. Gregory, Prof. J. W. Gregory, Mr. C. Bathurst, M.P., Dr. Lyttelton, Mr. A. P. Graves, Prof. Darroch, Sir Edward Anwyl, Sir Harry R. Reichel, Sir Bertram Windle, Sir Albert Rollit, and Gen. Sir R. Baden Powell. At the meeting a report was presented by the secretary, Mr. Morley Dainow, on behalf of the provisional committee, suggesting that the work of the association should be to encourage the best types of kinematograph production and develop a completely educational plan for their use. The report was adopted, subject to revision by a sub-committee. The

following officers were elected vice-presidents:—Sir Wm. Chance, Dr. Kimmins, Col. Sir J. R. D. Smith, Sir Albert Rollit. An executive committee representative of educational and social welfare associations, was also appointed, and Mr. Morley Dainow was elected secretary; communications should be addressed to him at 22–24 Great Portland Street, London, W.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, May 21.—Sir William Crookes, president, in the chair.—Prof. W. M. **Hicks**: The effect of the magneton in the scattering of α rays. The presence of a magneton in an atom must exert some effect in scattering α or β particles passing through the atom. In order to test the order of magnitude of the effect, the orbits of charged particles moving in the equatorial plane of a magneton are discussed, and it is seen that the scattering produced is very considerable. The nearest approach of an α particle to the centre of the atom is of the same order as in Rutherford's theory. The electrostatic repulsion of an α particle combined with the magnetic field of the atom will therefore be more effective, as the diminished velocity will render the particle much more susceptible to the magnetic forces.—Hon. R. J. **Strutt**: Luminous vapours distilled from the arc, with applications to the study of spectrum series and their origin.—I. (1) It is known that mercury vapour distilled away from the arc *in vacuo* remains luminous for some distance away from the region of discharge. It is now shown how to observe brilliant effects of the same kind from a large number of other metals. (2) As the luminous vapour moves away from the region of discharge, the rate at which different constituents in the spectrum die out is not always the same. Both the subordinate series of lines in the sodium spectrum die out at the same rate, but the principal series dies out more slowly. The lines belonging to any given series always die out at the same rate, but another series may or may not die out at the same rate as the first. (3) In some cases the glowing vapour distilled from the arc shows a band spectrum. The alkali metals show a continuous band beyond the limit of the subordinate series like that seen in absorption in the hydrogen stars.—W. T. **Pawlow**: The ionisation of gases by collision and the ionising potential for positive ions and negative corpuscles.—C. E. **Stromeyer**: The determination of elastic limits under alternating stress conditions. The present paper deals exclusively with the question of endurance or fatigue qualities of metals. The apparently incongruous results obtained by previous experimenters, including those by Wöhler, made it appear probable that samples taken from different parts of a bar or plate might differ so much in quality that the law of fatigue would be masked by local variation of quality. The test pieces of the present first series (*bending*) were therefore shaped in such a manner that consecutive pieces were separated from each other in the original plate by only one inch. The test results were found to be very consistent and could be expressed by the formula $S_n = Fl + C(10^6 : N)^{\frac{1}{4}}$, where S_n is the nominal alternating stress which will cause fracture after N repetitions, Fl is the fatigue limit found by extrapolation from a series of tests resulting in fracture, and C is a constant. A comparison was made of previous tests with the help of this formula, and it was found to agree well with those of Wöhler, Baker, and Eden, Rose and Cunningham. The torsion fatigue tests were made with the same materials as used in the above tests, and the results also agreed very closely with the above formula, except that new values for Fl and C were found. The inquiry was extended to the measuring of the heat generated during fatigue tests. G. W. C. **Kaye** and W. F. **Higgins**. The emission of electricity from various substances at high temperatures. Experiments have been conducted at temperatures from 2000° to 2500° C. within a carbon-tube furnace at atmospheric pressure. Under these conditions the electrical emissions, in the absence of any applied potential, have been measured for a number of substances (including the alkaline earths and the metals tin, aluminium, iron, and copper) on their introduction into the furnace. During their rapid volatilisation the substances gave out large amounts of electricity which, with one exception, were negative in sign. For example, barium oxide and alumina generated negative currents of the order of 4 amperes per sq. cm., boiling tin about 2 amperes per sq. cm., and boiling iron about 1 ampere per sq. cm. Boiling brass, on the contrary, produced a positive current of about 0·5 ampere per sq. cm. The results have interest in connection with the problems of solar magnetism.

Linnean Society, May 7.—Prof. E. B. Poulton, president, in the chair.—H. N. **Ridley**: The botany of the Utakwa Expedition, Dutch New Guinea. The extensive collection of plants made by Mr. C. B. Kloss during Mr. Wollaston's expedition to Mt. Carstensz, Dutch New Guinea, in 1912–13, is the most important collection of New Guinea plants brought to this country. In spite of the large collections made by Dutch and German collectors, there are upwards of five hundred new species and eight new genera in the collection, many of great interest. The plants were collected at various heights from sea-level to an altitude of about 13,000 ft., where vegetation ceased. The areas explored may be divided into four botanical regions:—(1) The coastal region, where the flora was largely of Malayan affinity. (2) The foot-hills, ranging from 500 to 3000 ft. elevation, an area of dense forest, the flora still typically Malayan but containing a distinct Australian element. (3) The frontal mountain belt from 3000 to 8000 ft. elevation, the begonia and balsam region. Here cultivation ceased. Palms disappear, and the first of the Palæarctic forms are met with, such as Viola, Ranunculus, Hypericum, and Galium. (4) The main mountain range. Here the big forest trees disappear, and herbaceous plants show a marked increase.—G. W. **Smith**: The genus Lernæodiscus, F. Müller, 1862.—Dr. J. C. **Willis**: A new natural order of flowering plants: Tristichaceæ, separated from Podostemaceæ.—Prof. C. **Chilton**: Some terrestrial Isopoda from New Zealand and Tasmania; with the description of a new genus, Notoniscus.—G. C. **Champion**: Curculionidæ from the Indian Ocean.

Geological Society, May 13.—Dr. A. Smith Woodward, president in the chair.—C. T. **Trechmann**: The Scandinavian drift of the Durham coast, and the general glaciology of South-East Durham. Evidence relating to the pre-Glacial levels and contours of the land in the Permian and Triassic areas has been collected and examined, and supports the conclusion that, immediately prior to the oncoming of glacial conditions, the land stood at not less than 100 feet above its present level. The fissures and depressions of the Middle and Upper Magnesian Limestones have been instrumental in preserving relics of the material brought by the earliest ice-sheet. This material proves to be devoid of the ordinary glacial erratics of the North of England and Scotland. The Scandinavian drift proper occurs about midway between Hartlepool and Seaham Harbour. It is represented by a transported shelly clay containing a fauna of Arctic affinities, which recalls that of some of the basement

clays of Flamborough and Holderness. All the stones (between 300 and 400) found in this clay were collected and examined. The greater part are well-glaciated crystalline rocks, many of which (the typical Christiania eruptives) certainly are of South Norwegian origin. The apparent absence of any East Scandinavian rocks in Durham is noticed, and an explanation offered. Later than the fissure-filling material are certain water-deposited gravels and sands, which occupy shallow depressions underlying the main drift seen on the coast. The main drifts of S.E. Durham are described, and also the conspicuous kaimes developed about the village of Sheraton and others, associated with the Cheviot drift.—F. W. **Penny**: the Relationship of the Vredefort Granite to the Witwatersrand System. The Vredefort Granite has always been considered as a member of that "old granite" group, which everywhere in the Transvaal and in the Orange Free State is found emerging from beneath the Witwatersrand Series. Evidence is bought forward to prove the intrusive character of the Vredefort Granite, both into the Witwatersrand Beds and into the basic intrusion associated with them. Along its margin the granite has removed varying amounts of the sediments from point to point; it reacted with the basic intrusions in the sedimentary beds, with the consequent production of hybrid rocks. In one place, a subsidiary intrusion of granite occurs in the middle of the diabase. The granite, where it comes into contact with the slate members of the Witwatersrand Series, has induced definite metamorphism in them, producing a magnetite-actinolite-staurolite rock, which is of an entirely distinct type from that induced by the basic intrusion associated with the Witwatersrand Beds, a micaceous phyllitic rock. It is suggested that the Vredefort Granite, instead of being "Archæan," is of a post-Pretoria-pre-Karoo age, if not contemporaneous with, at least connected with, the same epoch of igneous activity as the "Red Granite" of the Northern Transvaal.

Royal Meteorological Society, May 20.—Mr. C. J. P. Cave, president, in the chair.—E. **Gold**: The reduction of barometer readings in absolute units, and a new form of barometer card. The Meteorological Office having now employed the c.g.s. units in its publications, this has necessitated the preparation of new tables for the reduction of the barometer readings and for the adjustment of the effect of difference between the standards of temperature 62° F. and 273° A.—A. Hampton **Brown**: A Cuban rain record and its application. The author dealt with the rainfall records of the Belen College Observatory, Havana, for the period 1859 to 1912, and gave particulars of the monthly, yearly, and seasonal rainfall. The average yearly rainfall for the fifty years 1861–1910 is just under 50 in., but during the past fifteen years there has been a marked tendency to diminished amounts. The rainfall year can be divided into two seasons: a wet from May to October, and a dry from November to April. During the former, 35·36 in., or 71 per cent. of the rain falls, the remaining 14·60 in., or 29 per cent., being recorded in the dry months. The author has endeavoured to trace the connection between the wet season at Havana during May to October, and the precipitation in England, south-west, and South Wales, during the three months, January to March following, and he has found that from 1878 onwards, when the first reports for this country are available, that an excess rainfall in Havana during May to October was generally followed by a deficient rainfall in England, south-west, at the beginning of the next year, and *vice versâ*. For the eight years 1888–95, when the rainfall at Havana was continuously in excess, in England, south-west, the figures with one exception were the reverse. During the next five years, 1896–1900, there was a deficiency at the Cuban station, and, excepting 1897, an excess in this country. There were many years where the application failed, but the general continuance of the see-saw movement was so persistent that it could scarcely be regarded as merely coincidental.

CAMBRIDGE.

Philosophical Society, May 4.—Dr. Shipley, president, in the chair.—W. L. **Balls**: (1) (*a*) A note on leaf-fall as a factor in soil-deterioration. Described two cases where soil was rendered infertile through the shedding of leaves from tree-cottons over several years, and by very heavy shedding from rank growth of ordinary cotton. (*b*) Specific salinity in the cell-sap of pure strains. Followed from investigating the salt relations of the previous note. Egyptian cotton was shown to be a facultative halophyte, and different pure strains of the same were found to differ in salt content when growing with interlacing root. (2) Predetermination of fluctuation. Environmental factors which act at, or near, the time when a character is manifest in an organism, are rarely of much importance in determining the development of that character. Such factors merely exercise a subsidiary deforming influence upon a predetermined scaffolding, which was constructed at a much earlier stage in the life of the organism. A conception of discontinuity is thus introduced into the study of fluctuation. Simple illustration is provided by the development of the cotton fibre. A most complex example is the flowering of the cotton plant.—J. T. **Saunders**: The ammonia content of the waters of small ponds. The free ammonia that exists in small ponds is very considerably reduced in amount after heavy rains, a reduction that is out of all proportion to the amount of rain that has entered the pond. This reduction in the ammonia content adversely affects the nannoplankton, which decreases after heavy rains.—F. A. **Potts**: (1) Thompsonia, a little-known Crustacean parasite. Thompsonia is a Rhizocephalan cirripede, characteristic of the Indo-Pacific area, parasitic on various Decapods. (2) The gall-forming crab, Hapalocarcinus. Hapalocarcinus causes the curious bodies known as "galls" on branching corals like Pocillopora and Seriatopora. The female alone is responsible for the gall building; growth of a coral branch is modified by her respiratory current. The male is less than one-sixth the size of the adult female, and apparently wanders from gall to gall.

BOOKS RECEIVED.

Zur Lehre von den Zuständen der Materie. By Prof. P. P. von Weimarn. Band i. Text. Pp. x+190. Band ii. Atlas. Tafel lii. (Dresden and Leipzig: T. Steinkopff.) 7 marks.

Annual Report of the Zoological Society of Scotland for the Year Ending March 31, 1914. Pp. 79. (Murrayfield, Midlothian.)

Department of the Interior. Weather Bureau. Annual Report of the Weather Bureau for the Year 1911. Pp. 166. (Manila.)

A Critical Revision of the Genus Eucalyptus. By J. H. Maiden. Vol. ii., part 10. Pp. ii+291–312+plates 85–88. Vol. iii., part i. Pp. 11+1–22+plates 89–92. (Sydney: W. P. Gullick.) 2*s*. 6*d*. each.

Mémoires de la Société de Physique et d'Histoire Naturelle de Genève. Vol. xxxviii. Fasc. 1. Rapport du Président de la Société pour 1914. Les Cothurnidés Muscicoles. By E. Penard. Pp. 66+5 plates. (Genève: Georg et Cie.) 7 francs.

My Garden in Summer. By E. A. Bowles. Pp. viii+316+plates. (London and Edinburgh: T. C. and E. C. Jack.) 5*s*. net.

Notes on Elementary Inorganic Chemistry. By F. H. Jeffery. Pp. 55. (Cambridge University Press.) 2s. 6d. net.

Plants and Their Uses. By F. L. Sargent. Pp. x+610. (London: Constable and Co., Ltd.) 5s. net.

The Wonders of Wireless Telegraphy. By Prof. J. A. Fleming. Second edition, revised. Pp. xi+280. (London: S.P.C.K.) 3s. 6d. net.

Molecular Physics. By J. A. Crowther. Pp. viii+167. (London: J. and A. Churchill.) 3s. 6d. net.

Makers of Modern Agriculture. By Dr. W. Macdonald. Pp. ix+82. (London: Macmillan and Co., Ltd.) 2s. 6d. net.

Coast Sand Dunes, Sand Spits and Sand Wastes. By G. O. Case. Pp. 162. (London: St. Bride's Press, Ltd.) 5s. net.

Handwörterbuch der Naturwissenschaften. Edited by E. Korschelt and others. Lief. 76 and 77, 78. (Jena: G. Fischer.) Each 2.50 marks.

Lunar Nomenclature Committee of the International Association of Academies. Collated List of Lunar Formations Named or Lettered on the Maps of Neison, Schmidt, and Mädler. Compiled and Annotated for the Committee by M. A. Blagg, under the direction of the late S. A. Saunder. Pp. viii+182. (Edinburgh: Neill and Co., Ltd.)

A Manual of Practical Physical Chemistry. By Dr. F. W. Gray. Pp. xvi+211. (London: Macmillan and Co., Ltd.) 4s. 6d.

The Naturalist at the Sea-Shore. By R. Elmhirst. Pp. viii+86+plates. (London: A. and C. Black.) 1s. 6d. net.

Das Herzflimmern seine Enstehung und Beziehung zu den Herznerven. By D. L. Haberlandt. Pp. 13. (Jena: G. Fischer.) 50 pfennigs.

Die Erregungsleitung im Wirbeltierherzen. By Prof. E. Mangold. Pp. 36. (Jena: G. Fischer.) 1.20 marks.

Board of Education. Special Reports on Educational Subjects. Vol. xxviii. School and Employment in the United States. Pp. iv+225. (London: H.M.S.O.; Wyman and Sons, Ltd.) 1s. 6d.

The British Revolution. By Dr. R. A. P. Hill. Pp. xii+116. (Cambridge University Press.) 2s. net.

Elementary Logic. By A. Sidgwick. Pp. x+250. (Cambridge University Press.) 3s. 6d. net.

John Napier and the Invention of Logarithms, 1614. By Prof. E. W. Hobson. Pp. 48. (Cambridge University Press.) 1s. 6d. net.

Cambridge Tracts in Mathematics and Mathematical Physics. No. 15. Complex Integration and Cauchy's Theorem. By G. N. Watson. Pp. 79. (Cambridge University Press.) 3s. net.

Ancient and Medieval Art. By M. H. Bulley. Pp. xxx+328+plates xxvi. (London: Methuen and Co., Ltd.) 5s. net.

A Manual of X-Ray Technic. By Capt. A. C. Christie. Pp. viii+104. (Philadelphia and London: J. B. Lippincott Co.) 8s. 6d. net.

DIARY OF SOCIETIES.

THURSDAY, MAY 28.

ROYAL SOCIETY, at 4.30.—Anomalous Trichromatic Colour Vision: Prof. W. Watson.—Formaldehyde Perhydrol: Dr. H. J. H. Fenton.—Studies of the Processes Operative in Solutions. XXIX.: The Disturbance of the Equilibrium in Solutions by "Strong" and "Weak" Interfering Agents: Prof. H. E. Armstrong and E. E. Walker.—A Type reading Optophone: Dr. F. E. Fournier d'Albe.—An Application of Electrolytically-produced Luminosity, forming a Step towards Telectroscopy: L. H. Walter.—The Axial Chromatic Aberration of the Human Eye: P. G. Nutting.—The Convection of Heat from Small Cylinders in a Stream of Fluid and the Determination of the Convection Constants of Small Platinum Wires, with Applications to Hot-wire Anemometry: L. V. King.

ROYAL INSTITUTION, at 3. Identity of Laws: in General: and Biological Chemistry: Prof. Svante Arrhenius.

CONCRETE INSTITUTE at 4.30.—Annual General Meeting.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.15.—The Tribes of Togoland: Major H. Schomburgk.

FRIDAY, MAY 29.

ROYAL INSTITUTION, at 3.—Plant Autographs and their Revelations: Prof. J. C. Bose.

SATURDAY, MAY 30.

ROYAL INSTITUTION, at 3. Fiords and their Origin. II.: Fiords and Earth Movements: Prof. J. W. Gregory.

TUESDAY, JUNE 2.

ROYAL INSTITUTION, at 3.—Celestial Spectroscopy: Prof. A. Fowler.

WEDNESDAY JUNE 3.

SOCIETY OF PUBLIC ANALYSTS, at 8.—The Insoluble Bromide value of Oils and its Determination: A. Gemmell.—The Determination of Iridium in Platinum-Iridium Alloys: C. O. Bannister.—(1) The Symbolical Representation of Analytical Operations; (2) The Properties of some Chlorhydrocarbons and their Uses in Chemical Analysis. II.: L. Gowing-Scopes.—The Changes in the Character of Fats during the Process of Cooking: Helen Masters and H. Ll. Smith.—The Chief Source of the Loss of Sulphuric Anhydride and of Chlorine by Ashing Substances containing these Constituents: J. O'Sullivan.

ENTOMOLOGICAL SOCIETY, at 8.

THURSDAY, JUNE 4.

ROYAL INSTITUTION, at 3.—Faraday and the Foundations of Electrical Engineering: Prof. S. P. Thompson.

FRIDAY, JUNE 5.

ROYAL INSTITUTION, at 9.—X-rays and Crystalline Structure: Prof. W. H. Bragg.

GEOLOGISTS' ASSOCIATION, at 8.—Prehistoric Problems in Geology: R. A. Smith.

SATURDAY, JUNE 6.

ROYAL INSTITUTION, at 3.—Studies on Expression in Art. I.: Origin and Development: Sigismund Goetze.

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Editorial and Publishing Offices:
MACMILLAN & CO., LTD.,
ST. MARTIN'S STREET, LONDON, W.C.

Advertisements and business letters to be addressed to the Publishers.

Editorial Communications to the Editor.
Telegraphic Address: PHUSIS, LONDON.
Telephone Number: GERRARD 8830.