THURSDAY, MAY 14, 1896.

FLIGHT.

The Aeronautical Annual, 1896. Edited by James Means. Medium 8vo, pp. 158. (Boston: W. B. Clarke and Co. London: Wm. Wesley and Sons, 1896.)

Zur Mechanik des Vogelfluges. Von Dr. Fr. Ahlborn. Demy 4to, pp. 134. (Hamburg: L. Friedrichsen and Co., 1896.)

TILL quite recently, artificial flight was regarded in much the same light as perpetual motion, the philosopher's stone, and other insoluble problems. But, now that Maxim, Langley, and others have demonstrated the possibility of overcoming the purely mechanical difficulties of flight, a wide field has been thrown open for scientific research in investigating the laws underlying the flight of birds and their practical application to the flight of man. The present record of investigations performed and theories propounded during the past year, will prove of great value to all who are interested in the subject by indicating what work has been done and what still remains undone.

The "Annual" opens with a long account by Lilienthal of recent experiments performed with his new apparatus, in which two superposed wing surfaces are employed instead of one. A description of these experiments was given in NATURE for January 30; but it may be interesting to call attention to the diagram of the undulating path of Lilienthal's machine when raised by a sudden head-wind and again allowed to descend. The motion bears a striking resemblance to that of a model glider allowed to descend in still air, although in the latter case the undulatory course is not due to any wind beyond what the glider makes for itself in its descent.

After a short editorial note on the analogy between the development of the flying machine and that of the modern bicycle, we have a well-written article by Maxim on "Natural and Artificial Flight." Our interest naturally centres round the sections dealing with the author's experiments on the relative advantages and disadvantages of narrow and wide planes. These experiments fully confirm the theory that narrow superposed planes possess greater lifting power per square foot than a single wide plane, a principle which Maxim proposes to utilise most ingeniously in his next machine by constructing his condenser of aeroplanes capable of lifting their own weight + 1000 lb. additional. Maxim, however, doubts whether in an actual machine it may be safe to dispense with wide planes altogether, on account of the risk arising in case of a sudden breakdown. Possibly a suitable compromise may result from adopting the "cellular" principle, which has been introduced with such success in the Hargrave kite. A number of important experiments with this and other kites, notably the "Malay" kite, are described in subsequent articles of the "Annual."

That aerial navigation is regarded as a subject of national importance on the other side of the Atlantic, is evidenced by the Bill introduced into the Senate of Washington on December 4, 1895, to provide for the award of money prizes of 100,000 dols. and 25,000 dols., the first for the successful achievement of mechanical flight, and the second for improvements in soaring machines. The editor of the "Annual" evidently inclines to the view that the final solution of the problem will result from a successful combination of the ingenuity of Lilienthal and Maxim.

Passing now to the flight of birds, we find in the first part of Dr. Ahlborn's memoir a detailed account of the form and structure of birds' wings, and their action in active or "rowing" flight. Marey's observations, in particular, are discussed at some length and freely criticised. The second part deals with the so-called soaring of birds—that is, their power of sustaining themselves continuously in the air without flapping their wings; the term "sailing flight," lately adopted by American writers as a literal translation of the French "vol à voile," is a better name for this action. Unfortunately Dr. Ahlborn's suggested explanation will not bear close examination from a theoretical standpoint. We may take it as an axiomatic consequence of general dynamical principles that when a current of air is blowing uniformly, the relative motion of a bird flying freely is the same as if the current were reduced to rest by applying an equal and opposite velocity both to the air and bird. Starting from this fact, Lord Rayleigh, Prof. Langley, and other investigators have long realised the impossibility of a bird supporting itself without the expenditure of muscular action in a *uniform* horizontal wind, and they have therefore had to seek other sources of energy, either in the variability of the wind velocity, or in local upward convection or other air currents, of which birds have been supposed to take advantage. Dr. Ahlborn, however, seems to hold the opinion that these variations are rather a hindrance than a help to the sailing bird, and that the kinetic energy of the wind is the sole source from which the bird derives its energy. To support this view, the author considers the action of a side wind on a bird sailing round and round in a circle, and he derives his supposed gain of energy by arguments which, though ingenious, are not at all convincing.

The theory of sailing flight is examined from a somewhat more plausible standpoint in the "Annual." Maxim inclines to the view that upward currents of air are the chief cause of the phenomena. Prof. Pickering contributes an article first published in 1889, in which he advocates the theory that the action depends on pulsations or gusts of wind, thus agreeing substantially with the views enunciated subsequently by Prof. Langley in his paper on "The Internal Work of the Wind."[1] Mr. Octave Chanute contributes the first portion of a paper on the subject, but as yet he deals exclusively with observations on sailing birds, and gives no theoretical explanation of their action. We regret that this writer has had to defer till next year's "Annual" his mathematical calculations connected with this singular phenomenon.

With such literature as the "Annual" at hand, the aeronaut should have little difficulty in deciding what experiments will be the most likely to lead to the realisation of artificial flight. G. H. B.

[1] Proceedings of the Aeronautical Congress at Chicago, 1893.

ASTRONOMY AND MILTON.

The Astronomy of Milton's "Paradise Lost." By Thomas N. Orchard, M.D. 8vo, pp. 388. (London: Longmans, Green, and Co., 1896.)

THIS work amounts in fact to a sketch of the history of astronomical discovery under the heads of the different departments of that science to which allusions are made in the great epic of the sublimest of our poets. The author justly remarks that the choicest passages in "Paradise Lost" are associated with these allusions; his main object has been their exposition and illustration, and his enthusiasm has led him to include a wealth of matter in carrying this out, which his readers will not regret. Milton lived in a critical period of astronomical progress. The discoveries of Galileo and Kepler had shown the great probability of the truth of the Copernican system; but Newton had not yet placed that system upon an irrefragable basis. Hence, "in describing the natural phenomena witnessed by our first parents, he adheres to the doctrine of the Ptolemaic system," whilst it is evident from many passages, particularly from the discourse between Adam and the angel in the eighth book, that he saw and appreciated the simplicity and beauty of the Copernican theory, on which he had doubtless conversed with Galileo, the "Tuscan artist," when on his travels in his younger days. All will remember how he represents Raphael as speaking with scarcely-veiled sarcasm of the sphere being supposed to be girded with "Centric and Eccentric scribbled o'er, Cycle and Epicycle, orb in orb," and Adam's difficulty at conceiving "how nature, wise and frugal, could commit such disproportions." Mr. Masson has, we need hardly say, written well on the cosmogony of "Paradise Lost" in the introduction to his edition of Milton; but Dr. Orchard has treated the subject with an abundance of illustration which fully justifies his hope that his contribution to Miltonic literature is both interesting and instructive. A chapter is devoted to the poet's visit to Galileo, and the allusions thereto; it is somewhat remarkable that Milton nowhere mentions the fact that the astronomer was then blind, an affliction which afterwards befell himself. Satan's shield is compared to the glass with which the moon was viewed from the top of Fesolé, a suburb of Florence, or in Valdarno, meaning the valley of the Arno in which that city was situated. Less pertinent to his subject is the sketch of the discoveries of Herschel and others in the sidereal heavens or the region of the fixed stars, of which scarcely anything was known until long after the time of Milton, the date of W. Herschel's birth being exactly a century after the poet's visit to Florence. Dr. Orchard does not seem to have disabused himself of the so-called island theory of the nebulæ, which, it is now clear, have some relation to our own galactic system; but, on the whole, his survey of the history of sidereal astronomy is accurate. There are many allusions in "Paradise Lost" to the starry host "spangling the hemisphere"; and one fine passage speaks of their motions "regular then most when most irregular they seem," which, however, may refer chiefly to the planets, and only by analogy to other systems conceived as probably existing, but not then known. Three constellations (besides the cluster of the Pleiades) are mentioned by name: Taurus, Ophiuchus, and Andromeda, the "fleecy star" near the last being generally supposed to be Aries or its principal star, though this is not certain. Much more frequent allusion is made in the poem to the sun than to any of the other orbs of the firmament, and that body is described "in a manner worthy of his unrivalled splendour and of his supreme importance in the system which he upholds and governs." Probably few passages in any poem are more familiar to all than Satan's address to the great luminary, whose beams the spirit of evil is appropriately represented as hating. Venus is alluded to under the name Hesperus, and as the evening star; and the Galaxy or Milky Way is described as "a broad and ample road, whose dust is gold and pavement stars." As to comets, they are twice introduced, oddly enough in one place as a simile to Satan, and in another to "the brandished sword of God." In the former of these places Milton makes a remarkable mistake by speaking of a comet "that fires the length of Ophiuchus huge in th' arctic sky." No part of Ophiuchus is thus situated; does he mean Draco? Dr. Orchard himself makes a mistake in p. 297, calling 1456 "the year in which the Turks obtained possession of Constantinople." The last chapter, on Milton's imaginative and descriptive astronomy, is, as might be expected, more full of passages from the great poem than any other, and appropriately closes a work which deserves, and will probably attain, a wide circulation.

W. T. LYNN.

OUR BOOK SHELF.

Cholera in Indian Cantonments, and how to deal with it. By E. H. Hankin, M.A. Pp. iv + 103. (Allahabad: *Pioneer* Press. Cambridge: Deighton, Bell, and Co., 1895.)

THE knowledge of the cholera microbe, gained during the past few years, is applied in this little volume in formulating directions for the prevention of the disease. The author has had exceptional opportunities of studying cholera outbreaks in India; and his experience in investigating sources of infection, renders the practical precautions he describes as necessary to prevent the spread of the disease in Cantonments, of great value to Cantonment magistrates, medical officers, and others interested in the question. Before dealing with the practical hints for the prevention of cholera, Mr. Hankin gives a brief account of the properties of the cholera microbe, which may be summarised as follows: (1) The cholera microbe when outside the human body, so far as is known, only lives and reproduces in water; (2) it is so small that it cannot be removed by filtration through ordinary domestic filters; (3) it is easily and rapidly destroyed by boiling; (4) it is rapidly destroyed by drying; (5) it is readily killed by acids; (6) it varies in virulence; (7) laboratory experiments show that its growth is favoured by the presence of traces of common salt and of nitrates in its culture fluids.

In a chapter on cholera epidemics, irregular and otherwise, it is shown that infection is caused by swallowing the microbe either in food or water; hence the precautions laid down are mainly concerned with the means for preventing the access of the microbe to the food and water supply, and with easy methods of disinfection. The instructions given are such as can readily be carried out, and though they are not so elaborate as the regula-

tions published by the German Government in the year 1893, an abridged translation of which forms an appendix to Mr. Hankin's book, they are sufficient for the purpose, and are better adapted to Indian Cantonments.

Chemical Experiments, General and Analytical. By R. P. Williams. Pp. 110. (Boston, U.S.A., and London: Ginn and Co., 1895.)

THIS is a practical, and, in some respects, an admirable, manual for chemical laboratories. The experiments described in the first half of the book instruct in metric measurements, glass manipulation, physical changes, chemical changes, and the preparation, properties and tests for the non-metallic elements and of the most important gaseous compounds. This part of the volume furnishes a good introductory course of practical chemistry. In the second part, the general and analytical reactions for metals are tabulated, the method adopted being to take each metal of a group separately and give the analytical reactions for it, and afterwards to treat the group in the same way. As a whole, the book should prove of service to students of analytical chemistry. Two features possessed by it offend the eye: one is the reformed chemical orthography, such as sulfuric for sulphuric, oxids for oxides, iodin for iodine, and so on; the other is the use of nearly sixty abbreviations, as, for instance, in the following sentences.

"Put into a t.t. or e.d. a thin piece of Cu, say $1^{qem.}$ add 10 or 20 drops HNO_3" (p. 19).

"Put into a gen. (rec. or t.t.) 5^{g} FeS, $10^{cc.}$ H_2O, and $5^{cc.}$ HCl (or H_2SO_4)" (p. 42).

"Arrange the app. with inverted recs. as for the hydrogen exp." (p. 35).

Something may perhaps be said for the free use of abbreviations of this character by trained chemists, but their introduction in a book for young students is apt to lead to slovenly habits.

Traité de mécanique générale. Par H. Resal. Deuxième édition, entièrement refondue. Tome premier et deuxième. Pp. 166 and 300. (Paris: Gauthier-Villars, 1895.)

IN editing the first two volumes of the seven volumes which form M. Resal's "Traité de mécanique," the author has seized the opportunity of completing certain subjects in the seventh volume, to which he directs attention in his preface. The scope of this treatise is so very great, covering all the ground of modern Theoretical and Applied Mechanics, that the author is debarred from entering into much detail. Thus, for instance, such a large subject as Hydrodynamics, including Hydraulics and Sound, is polished off in about sixty pages.

The work is obviously intended to serve as a text-book n Government technical schools, in which the amount of various knowledge required from a student is so great that he does not allow himself to become interested in details. G.

Modern Stone-Cutting and Masonry. By John S. Siebert, C.E., and F. C. Biggin, B.S. Pp. v + 47. (New York: John Wiley and Sons. London: Chapman and Hall, Limited, 1896.)

THE arts of stone-cutting and masonry, and their applications in engineering and architectural practice in the United States, are briefly treated in this book, with special reference to the making of working drawings. The information given is of a thoroughly practical nature, and the fourteen plates, containing drawings of various forms of buttresses and arches, furnish useful examples of actual masonry work. The book will be found serviceable and instructive to students of the section of engineering and architecture described in it.

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.*]

Two Brilliant Meteors.

ON April 8 and 12, fine meteors were observed at various places in England.

The first of these appeared at about 8h. 21m. (April 8), and descriptions of its apparent path have reached me from Croydon, Kenley and Sutton in Surrey, also from Bridgwater, Reading and Crowthorne.

At Croydon the meteor was described by Mr. Salmon as a beautiful one, passing from Arcturus to near α Cassiopeiæ. Duration, ten seconds. The nucleus divided into two fragments. At Kenley Mr. Evershed noticed the meteor travelling from Arcturus to β Cassiopeiæ. It finally broke into fragments after a duration of five or six seconds. At first it was not brighter than a second magnitude star, but increased rapidly, so that at the end of its flight it was many times brighter than Venus. Mr. Bawtree, of Sutton, describes the path as from near β Draconis to β Cassiopeiæ, and estimated the duration as six to ten seconds. Mr. Corder, at Bridgwater, saw the meteor through trees, and at a low altitude, so that it did not appear to him brighter than Vega. Towards the end the nucleus divided into three. Its path was from 225° + 15° to 260° + 40°, and duration six seconds. Mr. Saunder, at Crowthorne, Berks, says the meteor was several times as bright as Jupiter, and that before its disappearance the head was in several distinct pieces. Its path was from δ Boötis to near β Cephei. Mr. Davis, at Reading, describes the meteor as being equal to Venus, and passing in twelve seconds from near Arcturus to the point 340° + 57°. It broke up into fragments at the end.

The second meteor appeared on April 12 at 8h. 6m., and I have accounts of it from Greenwich, Wellingborough, Bridgwater, Stokesay, Nottingham, West Malvern, Southport, Slough, Dunstable, Lochwinnoch, Renfrewshire, and several other places. At Greenwich, Mr. Dyson estimated the meteor as four times as bright as Jupiter, and describes the end part of its flight as being about 15° below the pole from W. to E. Mr. Tatman, of Wellingborough, says the meteor passed from N.E. to S.E., and occupied 12 seconds in its transit, ultimately disappearing behind a dark cloud. At Bridgwater the meteor moved from about 30° altitude in N. to 15° in N.E., and appeared to be about the size of the moon in one of her quarters. Mr. C. E. Clough, at Southport, says the meteor fell vertically about 15° to the right of Arcturus. In brightness it was estimated to equal two full moons. When first seen it was about 60° high, and it disappeared at an altitude of about 10° or 15°. At Nottingham, Mr. J. T. Wood says the meteor crossed the zenith, and was last seen near δ Virginis. It was ten times as bright as Jupiter. At Oxford, Mr. Robinson gives the time as 8h. 6m., and describes its course as from 7½° + 60° to 257½° + 37°. Its duration was six seconds, and the meteor equalled and probably excelled Jupiter in brilliancy. At Lochwinnoch, Renfrewshire, Mr. P. Dewar noticed the meteor at 8h. 4½m., and says its motion appeared slow, lasting for four or five seconds. Its direction was from S.E. to E., and it disappeared near the horizon. At Coalbrookdale, Shropshire, the object was seen to come from the west, travel to N.E. and be lost towards E. The observations at Stokesay and West Malvern appear in NATURE of April 23, p. 581. I have a few other descriptions, and they are in satisfactory agreement.

The real paths of the two meteors appear to have been as follows:—

	April 8, 8h. 21m.	April 12, 8h. 6m.
Height at appearance	65 miles	118 miles
Position over	Straits of Dover	Formby, Lancashire
Height at disappearance ...	38 miles	34 miles
Position over	S. border Leicestershire	Doddington, Camb.
Length of observed path ..	161 miles	177 miles
Velocity per second	20 miles	19 miles
Earth point	Irish Sea	Woodbridge, Suffolk.
Radiant point	204° − 9°	50° + 42°
Inclination of meteor's descent	9°	31°

The meteor of April 8 was directed from a radiant in the eastern limits of Virgo, and not far from Spica. A fireball was seen on March 16 last, which was probably from the same radiant, as the paths converge on the point 205° – 18°. This region is the centre from which many fireballs and ordinary shooting stars are directed in April and other months, as the following table will prove :—

Radiant point	Date.	Description	Observer or authority
210 – 6	January 5–11, 1870	Meteor shower	Tupman
205 – 8	January 20–22, 1877	,, ,,	Denning
200 – 5	January 20—Feb. 3, 1896	,, ,,	Herschel
204 – 10	January 21—Feb. 23, 1869	,, ,,	Denning from Tupman's obs.
202 – 9	February 13, 1869	,, ,,	Tupman
210 – 13	February 15–21, 1877	,, ,,	Denning
200 – 10	March 2–3, 1870	,, ,,	Tupman
205 – 18	March 16, 1896	Fireball	Denning
204 – 10	March 23, 1895	Meteor shower	Denning
204 – 8	March 31—April 12, 1872	,, ,,	Denning from Italian obs.
210 – 10	April 7–16, 1877	,, ,,	Denning
216 – 10	April 11, 1871	Fireball	Niessl
206 – 8	April 12–26, 1879	Meteor shower	Sawyer
210 – 7	April 1877	,, ,,	Corder
209 – 3	April 1874	,, ,,	Denning
209 – 9	April 1896	,, ,,	Herschel
198 – 8	April 18 ,1841	,, ,,	Forshey
214 – 13	April 21, 1887	Fireball	Niessl
218 – 5	April 21, 1889	Bright meteor	Denning
210 – 9	April 19–23	Radiant 10 fireballs	,,
207 – 7	April 22, 1876	Meteor shower	,,
206 – 9	April 27, 1851	Fireball	Niessl
209 – 8	May 3–15, 1872	Meteor shower	Denning from Italian obs.
214 – 7	May 12, 1878	Fireball	Herschel
214 – 7	May 29, 1889	,,	Denning
217 – 6	July 7, 1895	,,	,,

The mean of the twenty-six positions is 209° – 9°.

The fireball of April 12, 1896, came from a radiant in the N.W. sky at 50° + 42°. The large meteor of April 22, 1894, had a similar radiant (*Observatory*, June, 1894), and the same may be said of the fireball of March 9, 1875.

Bristol, April 27. W. F. DENNING.

Becquerel and Lippmann's Colour Photographs.

I WISH to raise a point in connection with the optics of photochromy, which was not touched upon at the recent discussion at the Royal Society. The photochromatic spectra produced by the earlier workers, and especially by E. Becquerel about 1850, have long been known and have always appeared to be very mysterious to those who have repeated the experiments. When Prof. Lippmann's success with the interferential method was made known some five or six years ago, and his first results exhibited in this country, many of those who were acquainted with the previous methods of producing coloured spectra by direct impression came to the conclusion that all the earlier workers had unconsciously been producing the Lippmann effect. This supposition was not unreasonable. In Becquerel's method, for instance, which gave the most brilliant effects, the sensitive film of violet chloride is produced on a surface of metallic silver, and is thus backed by the necessary reflecting surface. Even when the colour sensitive chloride is on paper, as in the still earlier experiments of Robert Hunt and Sir John Herschel, it is not unreasonable to suppose that the bounding surface of the paper and silver haloid reflects sufficiently well to produce the necessary interference. At the discussion following Prof. Lippmann's paper, Lord Rayleigh raised the question whether the earlier and later results were not due to the same cause, but there seemed to be an impression that the Becquerel and Lippmann effects were produced by different causes. For my own part, I am bound to confess that the reasons assigned for arriving at this decision still appear to be inconclusive. The main points which have been allowed to prevail are that the Becquerel photographs cannot be fixed, that they appear of the same colour at whatever angle they are viewed, and that they appear of the same colour by transmitted and by reflected light. The fact that these photographs cannot be fixed is easily explained if we bear in mind that the silver salt, is not embedded in a vehicle, as in Lippmann's process, and that there is consequently nothing to hold the laminæ apart at the correct intervals when the fixing solution has done its work. The other points are less easy to explain; but it may be suggested that the difference is here due to the earlier experimenters having used coarse-grained films, in which the silver haloid particles are sufficiently large to *scatter* the colours produced in the film by the laminated structure of the alternating planes of decomposition and no decomposition. The question is a purely physical one, and may be put into the following form :—If the Lippmann effect is produced in a coarse-grained instead of in a transparent film, would not the Becquerel results be obtained? If physicists can answer this in the affirmative, the difficulty of supposing that similar results can be obtained by totally different causes would disappear.

R. MELDOLA.

Aquatic Hymenoptera.

UNDER the title "On Two Aquatic Hymenoptera, one of which uses its Wings in Swimming," Sir John Lubbock, Bart., read a paper before the Linnean Society, May 7, 1863, therein describing two most extraordinary insects, which he named *Polynema natans* and *Prestwichia aquatica*.

Last year I had the good fortune to obtain a large number of both sexes of the first named, which, after most critical microscopic examination, I identified as belonging to Haliday's *Caraphractus cinctus*, the unique characteristic of the "*keeled* metathorax" placing the matter beyond a doubt. The late Prof. Riley, to whom I had the pleasure of showing specimens, fully confirmed my opinion, as also did Mr. Charles Waterhouse.

The life-history of any of these minute Hymenoptera is not worked out in one season—very far from it; and since last year I have steadily followed up the chain of facts, my efforts being again rewarded by finding this most exquisite Hymenopteron this season within twenty miles of London.

Encouraged by my success, I continued my search for some hours at a small pond, and at last captured two female specimens of the long-lost-sight-of *Prestwichia aquatica* (Lubbock), which has not been recorded since its first capture by Sir John Lubbock in 1862—thirty-four years ago!

The two specimens (and *I*) have scarcely taken any rest since their capture yesterday morning, May 4; but they have been constantly running or paddling *under* water, never once having been to the surface. When I first put them into the tank, they had the *greatest* difficulty in forcing their way through the film; but as soon as that was accomplished, they moved about with their legs, as propellers, far more rapidly than did *Caraphractus cinctus* with its wings.

I am looking forward to capturing the *male Prestwichia aquatica*, which has not yet been recorded by any entomologist.

21 Manor Gardens, Holloway, N. FRED. ENOCK.

Dalton's Atomic Theory.

IN the review of "A New View of the Origin of Dalton's Atomic Theory," published in your issue of April 16, your reviewer, in summing up the evidence as to the origin of the atomic theory, makes an omission of such importance that it cannot be allowed to pass unchallenged. He attaches great weight to Thomson's statement that in 1804 Dalton himself informed him "that the atomic theory first occurred to him during his investigations of olefiant gas and carburetted hydrogen gas." Now these researches, as pointed out by your reviewer, were begun in the summer of 1804, a date which is assigned to them by Dalton himself, and is confirmed by the entries in his laboratory note-books of the time; so that Thomson's statement amounts to saying that the atomic theory first occurred to Dalton in the *summer of 1804*. This conclusion appears to us to be entirely discredited by the fact that several detailed tables of atomic weights and lists of atomic symbols, which are dated *September 1803*, occur in Dalton's laboratory note-books, one of these tables being reproduced in facsimile at p. 28 of the work under review, but not referred to by your reviewer.

It must be remembered that Thomson's account of the origin of Dalton's theory was first published in his "History of Chemistry" (vol. ii. p. 291) in 1831, no less than twenty-seven years after his visit to Dalton had been paid. Moreover, in 1850, after the lapse of another nineteen years, he gave a second and totally different account of the origin of the same theory, saying it was founded on the analysis of protoxide and dentoxide of nitrogen (Henry, "Life of Dalton," p. 80).

THE AUTHORS.

THE question is whether Dalton was led to apply the Newtonian doctrine of atoms to the explanation of chemical

phenomena (1) by a consideration of the composition and properties of atmospheric air; or (2) in consequence of remarking the results of the analysis of certain pairs or series of chemical compounds, the composition of which illustrates the law of multiples.

The authors contend for the former view, and adduce the contents of the lecture note-book dated 1810; but these notes of lecture 17 contain evidence of confusion in the statements made by Dalton himself. In these notes he says (p. 14 of the book), "In order to reconcile or rather adapt this chemical theory of the atmosphere to the Newtonian doctrine of repulsive atoms or particulars, I set to work to combine my atoms upon paper," &c. (P. 15), "In 1801, I hit upon an hypothesis." This hypothesis relates to the mutual repulsion of gaseous particles. (P. 16), "Upon reconsidering this subject it occurred to me that I had never contemplated the effect of difference of size. . . . This idea occurred to me in 1805." (P. 17), The different sizes of the particles being once established, "a train of investigation was laid for determining the *number* and *weight* of all chemical and elementary principles which enter into any sort of combination one with another."

So that the atomic theory as applied to chemical combination took shape in Dalton's mind according to this version of the story in 1805. Yet according to another of the note-books, quoted p. 26, he was using symbols to express the atoms of elementary bodies in 1803. The authors notice this conflict of statement, but get rid of it by assuming 1805 to be a clerical error for 1803.

Thomson was probably wrong in attributing the origin of the atomic theory to the study of marsh gas and olefiant gas. But in his exposition of the Daltonian doctrine, prepared only a short time after his interview with Dalton, he illustrates the use of the atomic doctrine by reference to the oxides of nitrogen. This was in his third edition, published 1807. In his sixth edition he introduces the oxides of carbon as well as the oxides of nitrogen. Thomson, therefore, from the time of his interview with Dalton retained the impression that the genesis of the theory was intimately connected with the facts known to Dalton as to chemical combination in multiple proportions, though he was evidently not clear as to the particular case first considered. That it was the oxides of nitrogen which first attracted Dalton's attention is, however, probable from the fact that he refers to them in the following noteworthy passage which occurs in his paper on the atmosphere read at Manchester, November 12, 1802: "These facts clearly point out the theory of the process: the elements of oxygen may combine with a certain portion of nitrous gas, or with twice that portion, but with no intermediate quantity." The authors have succeeded in discrediting the story about marsh gas, but it still remains doubtful whether Dalton's recollections in 1810 of what occurred six or seven years before are more trustworthy than the impressions of Thomson received much earlier, when it is a question as to the order in which various considerations came before his mind in the long course of meditation which led to the adoption of his theory.

YOUR REVIEWER.

An Advance in Röntgen Photography.

SINCE my last communication I have been pursuing the study of the photography of the soft tissues in the living adult subject, and making attempts to see shadows of them on the fluorescent screen. In a previous communication I was able to state that I had accomplished these in the region of the neck, the tongue, hyoid bone, larynx, &c. Proceeding downwards, I have now photographed and seen shadows of the cardiac area. In the photograph the diaphragm is clearly indicated below; the pyriform shape of the cardiac area is well made out, the base downwards, apex upwards, and the right and left borders show the relationship to the spine and ribs. JOHN MACINTYRE.

179 Bath Street, Glasgow, May 9.

PROJECTS FOR ANTARCTIC EXPLORATION.

ON January 28, 1841, Captain James Clark Ross and his comrades on her Majesty's ships *Erebus* and *Terror*, saw for the first time the giant volcanoes, rising in latitude 78° 30′ S., which bear the names of the only vessels that ever sighted them.

Fifty-five years later we remain in possession of no more information regarding these regions than was brought home by the discoverer. This is a circumstance absolutely unique in the modern history of geography. During these fifty-five years the map of Africa has developed from a *carte blanche* into a well-ordered delineation of mountains, lakes and rivers, even towns and villages the names of which are household words. In the far North the limits of the unknown have been and are still being strenuously pushed back. It is only in the far South that the explorer's march has been stayed, and during the last ten or fifteen years the importance of securing a farther advance in this direction has been given expression to, with increasing frequency and emphasis, by the scientific men of all countries. The latest and most weighty statement on the subject was the resolution of the Sixth International Geographical Congress, drafted in London by the leading geographers of Europe, to this effect:

"That the Congress record its opinion that the exploration of the Antarctic regions is the greatest piece of geographical exploration still to be undertaken. That, in view of the additions to knowledge in almost every branch of science which would result from such a scientific exploration, the Congress recommends that the scientific societies throughout the world should urge, in whatever way seems to them most effective, that this work should be undertaken before the close of the century."

It is clear to all scientific men that, although the recent experimental trips of Scottish and Norwegian whalers to the Antarctic regions have led to some distinct advances in our knowledge, and have rightly occupied a good deal of attention, they leave the question of serious exploration untouched. In the absence of a real expedition, we must continue to eagerly utilise every scrap of information which may be obtained by any means; but such trifles are only of provisional value. The drowning man may, for want of other floats, catch at straws, but the least critical spectator of this proverbial tendency would not argue that a life-belt was therefore unnecessary.

Antarctic exploration, if newspaper reports are to be trusted, has been commenced by the American Dr. Cook, who accompanied Lieutenant Peary on one of his journeys in Greenland, and has now got together a small scientific party on board two little sailing vessels of only 100 tons, with which he hopes to penetrate to the coast of Graham's Land and winter there. Weddell, in 1823, succeeded in reaching 74° 15′ S., in that neighbourhood, one of his vessels being only 65 tons, so that small size does not necessarily mean failure. If Dr. Cook has experienced ice-navigators with him, he will probably be able to effect a landing and collect some useful information. His equipment, however, is, we fear, inadequate to the task he has undertaken, and much must not be expected from it.

A more serious effort is announced as almost ready. It is to be commenced in September this year, under a flag which we believe has not hitherto appeared in polar regions, that of Belgium. The proposed expedition is being arranged by Lieut. A. de Gerlache, of the Berlin Navy, under the auspices of the Royal Belgian Geographical Society, and the expenses, which are estimated at £10,000, are to be met by public subscription. It is said that a large proportion of the money has been promised, the Brussels municipality have voted a grant; but until the whole of the cost is guaranteed, it would be rash to look upon this or any other expedition as a settled affair. A strong scientific staff is intended to accompany the vessel, which will probably try to get south along the east coast of Graham's Land.

In Germany the enthusiasm for Antarctic exploration has been gradually rising, and a strong Committee was appointed at the Eleventh German Geographical Congress, held last year at Bremen, to organise an expedition.

Dr. Neumayer, of the German Marine Observatory at Hamburg, and Herr G. Albrecht, of Bremen, are the Presidents, and the Secretary is Dr. Lindeman, who for many years has, through his editorship of the *Geographische Blätter*, kept the German public fully informed concerning all polar matters. This Committee has recently issued a detailed plan and estimates of a great German expedition to be sent out, not by the Government, but by the nation.

The objects of the expedition are defined as being the study of the meteorological and magnetic conditions of the South Polar area, geodetic observations, zoological, botanical and geological collections, the study of Antarctic ice, and the exploration of the still untouched polar region. For these purposes a station, in which observers can winter, would be fitted up either on the Antarctic continent or on one of the neighbouring islands, and one ship would remain in the nearest safe harbour which could be found, while the second vessel should spend the winter in cruising round the Southern Ocean making oceanographical researches.

The point at which an effort should be made to break new ground within the Antarctic circle was carefully considered, and the region between 70° and 85° E., *i.e.* south of Kerguelen, was selected, for the excellent reason that no previous serious effort has been made south of the Indian Ocean. Special value is placed upon magnetic and meteorological observations at Kerguelen or McDonald Island, because these lie nearly equidistant between the great observatories of Cape Town and Melbourne to west and east, and at a corresponding distance from the observatory of Mauritius to the north.

The recent publication by Dr. Murray, in the *Transactions* of the Royal Society of Edinburgh, of a detailed account of the work of the *Challenger* in the neighbourhood of Kerguelen, with lists of all the species obtained by the collectors on board, will be of service in guiding the biological work of the expedition, while at the same time it furnishes a compact summary of all that is at present known of the marine life and deposits on the edge of the Antarctic.

The German expedition is intended to include two vessels of about 400 tons, no doubt of the type of steam whalers, each carrying four officers, a scientific staff of four, and a crew of twenty-two. The ships would be absent for about three years, and would spend two winters in the Antarctic regions. The total cost is estimated at 950,000 marks, or £47,500, and the German nation is appealed to to find this money, the report of the Committee as published in the *Verhandlungen* of the Berlin Geographical Society concluding:

"The leading Powers of the civilised world appear to be preparing to attempt the solution of the great problem of the geographical conditions of the Antarctic regions. The German nation, always a leader in the solution of geographical problems, cannot possibly lag behind in this contest, the less so because a great and successful voyage of discovery would largely increase the reputation of Germany on the seas, and bring the greatest honour to the German name."

Beside this patriotic sentiment, the practical outcome of which the scientific world and not Germany alone looks for with hope and confidence, we may place a remark from another continental scientific paper, which from the reported refusal of the British Government to consider a proposal for a national expedition, drew the not illogical conclusion that the whole strength of the British Navy had to be brought under requisition for the purpose of making a warlike display before the great Powers. The President of the Royal Geographical Society at a recent meeting observed that "never was there a more favourable opportunity than the present for our Government to demonstrate its confidence in its own naval resources, by detaching a small expedition for special service in Antarctic research." The country is always ready to applaud and support a movement for the honour of the flag and the popularisation of the navy. If a contest between the great Powers is called for by the unthinking of several nations, what contest could be better than friendly rivalry in the advancement of science by maritime exploration? Around the South pole there is room for many simultaneous expeditions. Ross from Britain, Wilkes from the United States, and Dumont D'Urville from France were together in Antarctic waters fifty-six years ago, and the scientific world would gladly hail the early repetition of such history.

The Antarctic Committee of the Royal Geographical Society having been warned that an appeal to Government is not likely to be favourably entertained, has not as yet come to a decision as to its future action. The agitation for a complete scientific expedition will certainly not be allowed to rest. The only want is money; and surely some means can be found to supply this. The necessary amount would never have been missed from the surplus recently at the command of the Chancellor of the Exchequer. If the 600,000 professional men of the British Islands were to subscribe half-a-crown each, the resulting £75,000 would suffice for a very valuable expedition. If a few of the largest daily papers were to start a popular shilling subscription, they might without expense to their proprietors confer a priceless boon on science, and stimulate a healthy excitement in the public. There surely remain in this country some men—at least one man—able to do for the South Polar region what Mr. Harmsworth is so generously doing for the North; and to induce such potential benefactors to make their names great in history should not be an insurmountable task. The last and greatest feat of exploration on our planet may still be done, and allow the nineteenth century to close on a *Terra Cognita;* and the doing of it may still be secured for our country. If the opportunity is not taken now, it may not occur again for us, and the inevitable enrichment of science will redound to the glory of some more far-sighted, more patriotic, and less selfish people. It is an error surprisingly common, and every day becoming more ludicrously erroneous, that only Englishmen are capable of great deeds of daring and perseverance. If we are to retain our pre-eminence in polar exploration, we shall have to fight for it, not with armoured ships costing a million pounds apiece, but with a few old wooden whalers that may be purchased, manned, and equipped for a three years' cruise for less than a tenth part of that sum. Nothing less than a well-equipped scientific expedition can be looked upon as sufficient for the purpose in view.

Mr. T. Gilbert Bowick, of 2 Savile Row, is, as mentioned in a recent number of NATURE, at present completing arrangements for securing a passage for a party of scientific men on a whaling expedition, which is expected to set out in the autumn of this year, and will endeavour to land the passengers near Cape Adare (lat. 71° 45′ S.) in November 1896, returning for them in December 1897. Mr. C. E. Borchgrevink, whose Antarctic voyage is described in NATURE (vol. lii. p. 375), is proposed as the leader of the scientific party, which is intended to include twelve members. The plan of work involves the exploration of the coast of South Victoria Land and shallow-water dredging from a small steamer, which will be left at the winter quarters. Most of the work will naturally consist of meteorological, biological and geological observations near the station at Cape Adare, but a *ski*-journey is projected over the ice-cap in the direction of the magnetic pole. This expedition will, we hope, be undertaken, and if a landing can be made and a station established, the results will be of great value; but such an expedition, useful as it must be, is not sufficient. The alternative seems to be to allow the German and Belgian expeditions the full glory of renewing

serious work in the Antarctic, or to equip an adequate British expedition to co-operate with them by conducting simultaneous observations on the other side of the unknown area. An expedition a few years hence would be much less serviceable, because the value of consecutive work is at most additive, while that of simultaneous work is as the square, or some higher power, of the numbers engaged.

For the first time a south-polar map on a good scale is now available, thanks to the enterprise of Herr von Haardt of Vienna, and his publisher Hölzel. It is on a polar projection, and the scale of 1 : 10000000, approximately 160 miles to one inch. A special feature is made of ice-conditions and ocean currents, and the tracks of all the important southern voyages are laid down. But the most impressive feature is the vast central blank wherein lie hitherto untouched gold-fields of scientific data. HUGH ROBERT MILL.

THE HEIGHT OF LUMINOUS CLOUDS.

IN the *Astronomischen Nachrichten* (No. 3347), Dr. O. Jesse gives a short condensed account of some of the main results that have been obtained from a discussion of all the observations made during the years 1889-91. The full discussion, entitled "Die leuchtenden Nachlwolken," will, however, soon appear in the Publications of the Konig. Sternewarte in Berlin.

Perhaps the most interesting part of this work is that which is based, for the most part, on a series of photographs taken simultaneously at Steglitz, at the Urania Observatory, at Nanen, and at Rathenow, which brings out prominently the fact that the height of these clouds since the beginning of the phenomenon in 1885 has remained for the most part constant. The first table given by Dr. Jesse shows to a remarkable degree this almost constant value obtained for the mean height of the clouds, the actual total mean value being 82·08 kilometres ± 0·009. The apparent constancy in the value thus obtained for the height of these luminous masses is even more surprising when it is remembered that the observations were not made exactly simultaneously, a task by no means easy, so that the fast movements of the clouds were liable to influence the results to some marked extent.

An examination of the facts, however, seems to indicate that if the observations had been made strictly simultaneously, then the zone in which these nocturnal masses move might be considered narrower than the observations have as yet indicated.

As the observations used in this discussion were made for the most part after midnight, the computed value of the height to which they extend can only be said to hold for those clouds observed at this time. As a matter of fact, however, the few observations made before midnight indicate also roughly the same elevation as above obtained, but the paucity of the observations renders impossible any degree of certainty being attached to the result obtained.

Another part of the investigation related to the question as to whether the apparent height of the clouds had always been the same as that deduced from the observations extending over the years 1889-91. To answer this, an examination of all the observations since 1885 was made to see whether the zenith distances for the same depression of the sun below the horizon had always been the same ; which would necessarily be the case if the distance of the clouds from the earth's surface be assumed to be nearly always constant.

The observations employed were those made by Backhouse, of Sunderland, in Kissingen, and by Dr. Jesse himself in Steglitz. A condensed form of the table given by the latter is as follows :—

Number of observations.	Depression of sun below horizon.	Zenith distance of the clouds.	Probable error of observation.
	°	°	°
6 ...	9·9 ...	69·9 ...	2·5
9 ...	11·2 ...	77·8 ...	1·4
8 ...	11·8 ...	80·3 ...	0·8
5 ...	12·5 ...	81·7 ...	0·6
7 ...	13·8 ...	85·0 ...	0·5

In the year 1889 the phenomenon of luminous clouds occurred on July 2, and was, fortunately, unusually bright, rendering it possible to make numerous accurate measures ; these Dr. Jesse gives in the following table, and compares the results with those given above. The numbers are as follows :—

The Difference of the Zenith Differences on July 2, 1889, *from those found in earlier Years.*

Depression of sun below horizon.	Zenith distance of the highest point of the clouds. 1889, July 2.	From table.	Difference.	Variation in height for 1° error in measured Z.D.
°	°	°	°	km.
11·4 ..	77·5 ...	78·6 ...	+1·1 ...	6·4
11·7 ...	79·1 ...	79·9 ...	+0·8 ...	7·0
12·6 ...	82·7 ...	82·0 ...	−0·7 ...	8·2
12·9 ...	83·1 ...	82·7 ...	−0·4 ...	8·7

After allowing for the numerous sources of error which might account for some part of the large differences in the fourth column, Dr. Jesse adds that the magnitudes of these are such as to lead him to assume another source of explanation, namely, in the arrangement of the particles composing the clouds themselves. It is probable that the clouds vary very considerably in thickness vertically, which would also affect the differences to some extent ; thus with decreasing zenith distances a largely increased impression on the measured zenith distance of the clouds would result.

Setting aside, however, the question of the origin of these small differences, the important main result of the investigations still remains intact, namely, that from the years 1885-91 the luminous clouds have always had nearly the same mean height, namely 82 kilometres, or about 51 miles. W. J. S. L.

THE BISHOP OF RIPON ON HUXLEY AND SCIENCE.

AT a meeting convened by the Leeds Philosophica and Literary Society, held a few days ago, a resolution was unanimously adopted appointing a Committee, consisting of the Mayor, the members of the Council of the Philosophical and Literary Society, and all others who volunteered to join, for the purpose of raising subscriptions in aid of the Huxley Memorial Fund. We rejoice at the formation of the Leeds Committee, but another cause of gladness is the address delivered by the Bishop of Ripon in support of the object for which the meeting was held. In no uncertain voice, Dr. Boyd Carpenter declared himself a supporter of the principles which guided Huxley's noble life, and proclaimed the righteousness of scientific truth. It is not often that dignitaries of the Church speak so boldly for science as Dr. Carpenter did at the Leeds meeting ; and on this account, and also because many of our readers will be glad to see this public recognition of Huxley's integrity of thought and purpose, we gladly print a report, though an abridged one, of the address.

It would not be surprising to discover there are many in this meeting who would be prepared to point out one or two special and specific objections or difficulties they have felt in regard to Prof. Huxley's teaching. I think, however, you will agree with me that if we demand complete harmony of opinion, that stupid unanimity which betrays either ignorance or thoughtlessness, before we dare to speak in honour of any one whose

name has become great, we shall be in the position of those who have nobody to honour and no names to commemorate. I feel, therefore, though all may differ in some points from Prof. Huxley, there is not one of you who cannot with the most simple honesty of purpose take part in this meeting. I am here to do honour, as an English citizen, to the name of a great Englishman. We who belong to the English race are, I suppose, sometimes slightly jealous for its greatness in certain departments. We feel we are outstripped by our Teutonic neighbours in the pathways of investigation. We feel we are outstripped sometimes by our American neighbours in the process of invention. So that whenever we have a great man we might as well cherish him, and make the most of him. Nations are great from a variety of causes. Their geographical position contributes to their greatness; their fertility and wealth of soil, and their racial qualities play a large part in the conspicuous or obscure place they are able to fill on the platform of the world. But the element which constitutes the happiest source of national greatness is the possession of great men. Great men are in the nation what the highest peaks are in the geography of the land—they mark the high level to which the people are capable of attaining; they are fertilising water-sheds pouring out their rich stores on the great plains below them. A nation ought, therefore, to reverence its great men, for they are not merely the expression of national greatness, but high ideals producing a reaction, an enthusiasm, an ambition in the hearts of those who come after them. I think you will agree with me that Huxley was entitled to the epithet "great." He was a strong man among strong men. But it was not simply that he attained immense eminence in the walk of life to which he dedicated his powers, he possessed also an unique power of being able to look with a sympathetic and appreciative eye on other walks and realms of science than those which were peculiarly his own. And, therefore, he was able to take a larger outlook than many a man who, shut up in his laboratory, or working in the fields, or observing through his telescope, remained limited to one particular sphere of scientific work. And because Huxley possessed that power, he became what he himself humorously described, "a maid of all work, a gladiator-general for science." That position was a worthy and a useful one. He also possessed a marvellous gift of lucid exposition. He was able to make clear to the minds of those who were not scientific, thoughts and ideas which were eminently scientific. For these reasons we have a right to claim him as great—great in English life, great by virtue of his devotion to science, great by virtue of that wide appreciativeness he brought to bear upon it, and great in the power of being able to expound to others. I am here as a friend of knowledge, to do honour to one who enlarged its borders. I know there are many—though they are a diminishing quantity—who are disposed to look somewhat askance at the progress of science. In the history of the world it has been only too obvious that men through timidity have been afraid of the advance of knowledge, and it is not surprising to find that in the nineteenth century, with all its vaunted enlightenment, that spirit of timidity should have found expression. What men own and feel to be dear to them they cherish, and God forbid they should be hindered from cherishing it. Many a man looks on science very much in the same way as a woman who hugs her infant to her breast looks on the doctor who draws near, and in regard to whom she entertains some very unreal but still natural suspicion. When men hug to their bosom the faith which is dear to them, and which they feel to be bound up with their dearest hopes, one can quite understand their clinging more closely and looking apprehensively at the progress and advance of science. But men are beginning to understand that it cannot be in the nature of things that facts and truths will contradict those things which are nearest and dearest and most essential to men. And because we are men we claim it to be our privilege and our responsibility—I may almost say we claim it to be part and parcel of our probation in this world—to follow truth wherever it leads us. It is not, therefore, our duty to encourage a timidity which, if it were encouraged, can only lead to a fatal obscurantism. The progress of knowledge can only deepen and intensify our attachment to the things which are true, and things which are true cannot be out of harmony with the things round about us. The child, cherished and reluctantly parted with, is restored to us by his doctor healed and saved. Religious truth, in one sense, must always wait on scientific truth, and religious truth must often change its form at the bidding and on the information given it by scientific truth. I am not aware that in the history of scientific progress religion has ever lost; the precious jewels have always been restored to her in richer and nobler settings. Because I believe that the advancement of knowledge must be for the benefit of mankind, and could not in the long run be hostile to any of the things most precious to us, I stand here to-day to do honour to one who laboured in the cause of the advancement of knowledge, and did so much to make it the heritage of all people. And, lastly, I am here to do honour to one, for whose truthfulness of character I have the profoundest admiration. Prof. Huxley had what might almost be called an exaggerated tenacity for the thing which he believed to be true, and a reluctance to surrender the truthfulness of his spirit at the bidding of any man or any authority. "But," some may say, "he was antagonistic." This is not the place nor the occasion to speak of Prof. Huxley's attitude towards Christianity, or even towards faith; but it should be remembered that the antagonism of his spirit was far more called out by the unfortunate attitude adopted by some who professed and called themselves Christians than by anything in its (Christianity) own nature. The moral and lesson of it is perfectly clear. A man may show himself the antagonist of other men's errors and of other men's methods without in the least degree being hostile to those precious things on which the hearts of men were wont to repose. Prof. Huxley was not one to knock from under any cripple's arm the crutch that enabled him to walk. While he spoke the language which seemed to him to be justified against those whose methods he could not approve, his language at other times was of that childlike simplicity, that entire modesty, and that natural humility which belonged to all thinking, educated, and reasonable men. Because he seemed to be setting before the world, even when we did not agree with him, an example of simplicity and truthfulness of disposition, I am here to say I honour him. We all desire to honour one who, great in his powers, sought to extend the borders of knowledge, and thus to add to the comforts, the joys, and the assurances of life, and who showed a character so simple, steadfast and truthful.

NOTES.

PROF. VICTOR MEYER has been elected a corresponding member of the class of mathematics and physics of the Berlin Academy of Sciences.

MAJOR P. A. MACMAHON has been appointed to represent the London Mathematical Society at Lord Kelvin's jubilee commemoration in Glasgow.

THE Bavarian Academy of Sciences at Munich has awarded the Liebig Gold Medal to Prof. F. Stohmann, Professor of Agricultural Chemistry in Leipzig University, and silver medals to Prof. B. Tollens, Professor of Agricultural Chemistry in Göttingen University, and Prof. P. Sorauer, of Berlin.

MR. FREDERIC DUCANE GODMAN, F.R.S., has been elected a Trustee of the British Museum.

THE annual visitation of the Royal Observatory, Greenwich, will take place on Saturday, June 6.

MR. G. GRIFFITH left Liverpool for Toronto on Saturday, to make arrangements for the meeting of the British Association in 1897.

THE exhibition galleries of the British Museum, Bloomsbury and of the British Museum (Natural History), Cromwell Road will be opened to the public on Sunday next from 2.30 to 7 p.m.; and will be opened on subsequent Sunday afternoons until further notice.

A SPECIAL general meeting of the Geological Society will be held on Wednesday, May 20, in order to submit to the decision of the Fellows certain resolutions of the Council regarding a proposed transference of a portion of the Society's collections to the Trustees of the British Museum.

THE *Journal of Botany* states that Herr V. F. Brotherus, of Helsingfors, has just started on a botanical journey to Central Asia; he is going by way of Samarcand and Tashkend to Thian Shan, with the special purpose of investigating the mosses of the highlands of Issikkoul. The district is a new and promising one.

THE *Bulletin de la Société Botanique de France* records the death, on December 31, 1895, of M. R. P. Delavay, Roman Catholic missionary at Yunnan, at the age of sixty-two. Since his arrival in China in 1867, he had been a most industrious explorer of the flora of that country, having sent home to the Museum of Natural History in Paris more than 4000 species, nearly half of them new. According to the *Bulletin*, he described for the first time about fifty species of *Rhododendron* and *Pedicularis*, and about forty of *Primula* and *Gentiana*.

IN connection with next year's country meeting, to be held at Manchester, under the presidency of the Duke of York, the Royal Agricultural Society will offer two prizes of £100 and two prizes of £50 for self-moving vehicles for light and heavy loads. In both classes the self-moving vehicles are to be propelled exclusively by mechanical means. The points to which the special attention of the judges will be called are: due regard to the convenience of the public; ease of handling, with special reference to stopping, starting, and steering; economy in working, price, simplicity, strength of design, and weight of vehicle.

OUR American correspondent writes, under date May 1:—"Columbia College will send a band of naturalists, under the leadership of Prof. Bashford Dean, to explore Puget Sound this summer, leaving New York June 10. Three zoologists and one botanist will accompany the party. The deep-sea work will be done with the aid of the United States Fishery Commissioners' vessel *Albatross*. The region is almost unexplored, and important results are expected.—A delegation of prominent scientific men appeared before the Finance Committee of the United States Senate a few days ago, to urge legislation favouring the metric system, but were informed by Senator Sherman that it was probably too late to accomplish anything at this session of Congress."

THE provisional programme of the International Congress of Psychology, to be held in Munich on August 4 to 7, under the presidency of Prof. Dr. Stumpf, shows that there is likely to be a plethora of papers on all branches of the science of mind. Eminent psychologists from many parts of the world have sent papers, among those who have done so being M. E. Bértillon (Paris), Prof. Bernheim (Nancy), Dr. Alfred Binet (Paris), Prof. Delboeuf (Liège), Prof. H. Ebbinghaus (Breslau), Prof. Sigmund Exner (Vienna), Prof. Stanley Hall (Worcester, Mass.), Dr. E. Hering (Prague), Prof. P. Janet (Paris), Prof. Th. Lipps (Munich), Prof. W. Preyer (Wiesbaden), Prof. Th. Ribot (Paris), Prof. C. Richet (Paris), Prof. H. Sidgwick (Cambridge), Mr. G. H. Stout (Cambridge), Dr. Carl Stumpf (Berlin), and Dr. W. Wundt (Leipzig). Details as to the arrangements of the Congress, which promises to be truly international in membership, and broad in scope, may be obtained from the General Secretary, Dr. Frhr. von Schrenck-Notzing, Max Josephstr. 2/1, Munich.

WE learn from *Die Natur* of April 26, that the Imperial Russian Geographical Society has sent to the northern boundaries of Russia a large number of notices relating to the possible descent of Herr Andrée's polar balloon in Russian territory. The inhabitants are exhorted not to be frightened at the balloon, to treat the occupants, in case of need, with all respect, and to conduct them to the nearest Government authorities; the notice also states that any expenses incurred will be repaid. It is further requested that if the balloon be sighted, information should be given of the direction in which it was going. The document contains representations of the balloon, both in flying and falling conditions.

PROF. UGOLINO MOSSO (*Atti della R. Accad. dei Lincei*) describes a series of observations on human respiration at high altitudes, performed with the object of testing whether the quantity of carbonic acid exhaled in breathing is in any way affected by the rarefaction of the air. For this purpose a number of soldiers were tested in the course of an expedition on the slopes of Monte Rosa, and further experiments were made by the author on himself in an experimental chamber at the Physiological Institution of Turin. These observations prove that the quantity of CO_2 expired by a man at an altitude of 6400 metres, differs but slightly from that expired at 276 metres above the sea-level. Prof. Mosso subjected himself to pressures as low as 34 cm. of mercury without feeling any ill-effects, the oxygen present being still sufficient for purposes of respiration; but when the pressure was reduced to 30 cm., the author began to find his faculties impaired, and in one case felt a great want of breath. After about eleven or twelve minutes, he became incapable of making accurate observations, and the experiments had to be discontinued.

THE Kew Observatory Committee of the Royal Society have recently issued their Report for the year 1895. The Chairman of the Committee is Mr. F. Galton, and the Superintendent of the Observatory is Dr. C. Chree. At the suggestion of the Council of the Royal Society, the title of the Committee has been changed during the year; the change consists in the insertion of the word "observatory" and the omission of the word "incorporated." The magnetographs have been kept in constant operation throughout the year, but no very exceptional disturbances were registered during that period. An analysis of the declination and horizontal force results for selected "quiet days" during 1890-94 has been published in the Report of the British Association for last year. The self-recording meteorological instruments have also been in regular action during the year, and the observations have been transmitted, as usual, to the Meteorological Office. Sketches of sun-spots were made on 159 days, and the groups numbered according to Schwabe's method. Various experimental investigations have been carried on, in addition to the regular routine work, relating to fog, atmospheric electricity, platinum thermometry, &c. A sum of £100 was obtained from the Government Grant Committee for the purpose of making experiments on the behaviour of platinum thermometers; these are found to possess advantages even in dealing with some ordinary temperatures which require to be read at a distance from the spot where they are recorded. The total number of instruments verified, and of watches and chronometers rated, shows a considerable increase.

IT was not to be supposed that the astonishing announcement made by Jörgensen and Juhler as to the development of yeast cells from the *Aspergillus oryzæ* would go unchallenged; but it must, at any rate, be a satisfaction to these investigators that the inquiry has fallen into such skilled hands as those of Messrs. Klöcker and Schiönning, both assistants in the famous Carlsberg Laboratory. These gentlemen have repeated in every conceivable manner the experiments of Jörgensen and Juhler, and have even greatly extended the scope of their original observations; but in no single instance have they obtained any evidence of the development of yeast cells from moulds. It would appear that too much weight has been given to mere microscopical evidence, and not sufficient attention bestowed upon the acquisition of pure cultures. Perhaps the most interesting efforts to decide this knotty question were those investigations made with various fruits growing in a natural condition on trees,

investigations suggested by some early work of Pasteur, and also Chamberland, published in 1879. As is well known, moulds and yeasts are present side by side in large numbers on various fruits, such as plums, cherries, grapes, &c. ; and Messrs. Klöcker and Schiönning determined to prove, if possible, that their simultaneous presence is a mere coincidence, and not evidence of the development of yeast cells from moulds. Comparative examinations were therefore instituted of numerous fruits, some of which were simply gathered from the tree, whilst in other cases they were only examined after having been carefully excluded from the outside air for some time by enclosing a small fruit-bearing branch in a specially constructed glass case. Thus, for example, on none of the plums protected from the surrounding air could any yeast cells be discovered, although moulds were present in abundance, whilst on as many as 50 per cent. of those exposed to the air, yeast cells were found along with the moulds. Messrs. Klöcker and Schiönning contend that they offered the moulds the most natural and favourable opportunities for the production of yeast cells in these glass cases, which could be devised, but they failed in every case to make their appearance. Dr. Jörgensen himself, it is only fair to add, appears to be somewhat baffled by the nature of his observations, and in his most recent communication on the subject, frankly confesses that this elaboration of yeast cells from moulds must at present be regarded as a process in which chance appears to play an important part, and the circumstances attending which we are yet quite unable to master !

M. MOISSON is reported (*Centr. Zeit. für Opt. u. Mech.*, xvii. 6) to have discovered a substance harder than the diamond in the form of a compound of carbon and boron, produced by heating boracic acid and carbon in an electric furnace at a temperature of 5000°. This compound is black and not unlike graphite in appearance, and it appears likely to supersede diamonds for boring rocks, cutting glass, and other industrial purposes. It will even cut diamonds without difficulty, and it can be produced in pieces of any required size.

ACCORDING to Prof. J. C. Arthur, the popular idea that of the two seeds in the spikelet of wild oat, one germinates at once, and the other only after a year, has no foundation in fact. But this is true of the two seeds in the fruit of the "cockle-bur," *Xanthium canadense* and *strumarium*. The cause of the difference in the action of the two seeds appears to be constitutional and hereditary.

ONLY three species of Bears have hitherto been generally recognised by naturalists as occurring in North America, namely the Polar Bear, Black Bear of the Atlantic States, and Grizzly Bear of the Western States, though others have been proposed. In his recently issued "Preliminary Synopsis of the American Bears," Dr. C. Hart Merriam takes a very different view. Dr. Merriam raised the number of American Bears to no less than eleven, dividing those of the "grizzly" type (*Ursus*) into six species, and those of the "black" type (*Euarctos*) into four. Dr. Merriam's synopsis is illustrated by figures of the skulls of the different species.

M. E. A. MARTEL, President of the Speleological Society (Paris), has visited and surveyed the Mitchelstown Cavern in Ireland, and reports on it in the *Irish Naturalist* for April. Although discovered over sixty years ago, and well known to tourists, this cavern had never before been properly explored. Its chief peculiarity consists in its extensive ramifications, which in one part follow the jointing of the limestone so regularly that the plan looks like that of the streets of a town. The total length of the cave exceeds a mile and a quarter, so that it is probably the longest in the British Isles. Mr. Lyster Jameson furnishes a report on the living animals found in this and other Irish caves, which mostly fall into three categories—those inhabiting the entrance to the cave as a hiding-place, those that have accidentally been brought in, and those that form its normal fauna. The last consist of a spider and two *Collembola*, and are interesting as constituting the first true cave-fauna recorded in the British Isles. A description of these forms appeared in previous numbers of the *Irish Naturalist* and of *Spelunca*.

WE have received from the Geological Survey of Norway a set of their Reports for the years 1893, 1894, and 1895, published by H. Aschehoug and Co., Christiania, at prices which bring them within the reach of every one who may be interested in the subjects of which they treat. The Reports are highly creditable to such a sparsely-peopled country as Norway, and to the Director of its Geological Survey, Dr. Hans Reusch, who seems to thoroughly appreciate the wants of his practical countrymen. As the country apparently possesses few organised public departments, the publications of its Geological Survey are comprehensive in their scope, covering questions of agriculture, forestry, climate, irrigation, soil, and orography, as well as of mining and geology. The economic aspects of the building-stone and mining industries are well considered and presented to the people for their deliberation and guidance, as well as the purely geological questions of stratigraphy and petrography. Palæontology, however, is conspicuous by its absence. One of the largest of the Reports deals with roofing-slates, flagstones, and with steatite as a building-stone. It is a pity that the vocabulary of the language is not rich enough to have different words for slate and schist (*Skifer* represents both); but our own language is equally faulty, or rather misapplied, when the word slate is used in referring to Stonesfield slate, as well as to that of Ballachulish or Llanberis.

IN one of the Reports (No. 14) referred to in the foregoing note, there is an interesting communication by A. Helland, on the depths of the lakes in Jotunheim and Thelemark, as ascertained from soundings by himself and others ; but unfortunately all of them have been made in the line of the length of the lakes, none of them transversely, thereby missing a most important clue to the explanation of their origin. He gives longitudinal sections of four of the principal lakes in Jotunheim, but the irregularities in the bottoms are not favourable to the glacial erosion theory which he supports ; transverse sections would probably prove more instructive. Of the forty-two lakes mentioned, no less than twenty-three of them have their bottoms below sea-level. The following series of figures represents the number of feet below sea-level of the first twelve, viz. 1417, 1085, 715, 712, 593, 568, 528, 456, 456, 456, 361 and 190. The first is the Hornindals Vand, the surface of which is only 177 feet above sea-level, but the bottom is 1417 feet below it ; the second is the Mjösen Vand, the surface of which is 397 feet above, and bottom 1085 below, sea-level. The great depth below sea-level seems to militate against the theory that they were eroded by ice.

IN the *Bulletin* of the Academy of Sciences of Cracow, Dr. L. Natanson contributes a long and elaborate communication on "The Laws of Irreversible Phenomena," and L. Birkenmayer describes a series of observations on the length of the seconds' pendulum in the neighbourhood of Cracow.

PROF. J. M. COULTER publishes, in the "Contributions from the United States National Herbarium," a revision of the North American species of *Echinocactus*, *Cereus*, and *Opuntia*. Fifty-two species are enumerated of the first genus, eighty-two of the second, and 101 of the third ; a good many of these are now described for the first time.

MR. JAMES HORNELL, Director of the Jersey Biological Station, is issuing a series of Microscopical Botanical Sections,

similar to those in Zoology already published. The series will consist of twenty original photo-micrographs, accompanied by descriptive letter-press and illustrations. The subjects included in the part we have received comprise longitudinal and transverse sections through the underground bud of *Equisetum*, transverse sections through leaf-buds of the Elm and the Ash, cuticle of *Araucaria*, longitudinal section through node of Sycamore, longitudinal section through flower-bud of Peony, transverse section through fruit of Date-palm, transverse sections through flower-buds of *Iris* and *Lilium*.

MESSRS. MACMILLAN AND CO. will shortly publish "An Intermediate Course of Practical Physics," by Prof. Arthur Schuster, F.R.S., and Dr. C. H. Lees. The book will set forth the course of instruction in practical physics followed in Owens College during the last five years. The explanations having thus passed through the refining fire of a physical laboratory, have been cleared of all the obscurities which tease the intelligence of the average student. The book was primarily designed for use in preparing for the Intermediate B.Sc. and First M.B. examinations of the Victoria University, but the requirements of other Universities are so nearly identical that it will appeal to a much wider circle of students.

DURING the year 1895 the Albany Museum, Grahamstown, made excellent progress. From Dr. Schönland's report we gather that, owing to the large influx of specimens, the capacity of the museum is overtaxed, and the erection of a new building has become a matter of absolute necessity. The Government have therefore been asked for a sum to devote to this purpose, and, considering the value of the collections and the useful work the museum is doing, and can still more effectually perform in a suitable building, it is hoped that the grant desired will be regarded as a judicious outlay. Owing to the rapid growth and increasing value of the herbarium formed in connection with the museum, the Committee think it desirable that the expenses incurred by its management should be borne by a fund apart from the general revenue of the museum, and they have, therefore, asked the Government to grant an annual sum of £100 for this purpose. Dr. Schönland has been experimenting with formaline as a substitute for spirits of wine in preserving specimens. The results obtained have been satisfactory, but he is afraid to discard spirits of wine until he is sure that formic aldehyde is a perfectly stable compound, and will keep for a considerable length of time in the hot climate in which the museum is situated.

THE additions to the Zoological Society's Gardens during the past week include a Rhesus Monkey (*Macacus rhesus*, ♀), two Sambur Deer (*Cervus aristotelis*, ♂ ♂) from India, presented by Mr. Greswolde-Williams; a Brown Capuchin (*Cebus fatuellus*) from Brazil, presented by Mrs. J. Hicks; three young Cheetahs (*Cynælurus jubatus*) from Somaliland, presented by Mr. Kenneth Foster; two West Indian Agoutis (*Dasyprocta cristata*) from the West Indies, presented by Mr. W. Weldon Symington; a Chinese Goose (*Anser cygnoides*, ♂) from China, presented by Mr. L. G. Leverson; a White-crested Cockatoo (*Cacatua cristata*) from Moluccas, presented by Mrs. Crofts; two Pennant's Parrakeets (*Platycercus pennanti*) from Australia, presented by Mr. Clifford Brooks; a Porose Crocodile (*Crocodilus porosus*) from Java, presented by Mr. A. W. Richmond; two Bennett's Wallabys (*Halmaturus bennetti*) from Australia, a Spotted Ichneumon (*Herpestes nepalensis*), two Hamadryads (*Ophiophagus elaps*) from India, deposited; an Entellus Monkey (*Semnopithecus entellus*, ♀) from India, a Great Anteater (*Myrmecophaga jubata*), two Picui Doves (*Columbula picui*) from South America, two Blue-headed Pigeons (*Starnœnas cyanocephala*) from Cuba, two Auriculated Doves (*Zenaida auriculata*) from Chili, four Cape Doves (*Ænas capensis*) from South Africa, two Crowned Pigeons (*Goura coronata*) from New Guinea, a Southern Fruit Pigeon (*Crocopus chlorogaster*) from India, a Nicobar Pigeon (*Calœnas nicobarica*) from the Indian Archipelago, purchased.

OUR ASTRONOMICAL COLUMN.

COMET SWIFT, 1896.—The following is Dr. Schorr's ephemeris for Berlin midnight (*Ast. Nach.*, 3349).

	R.A. h. m. s.	Decl. ° ′	Brightness.
May 14 ...	1 30 19 ...	+67 33·9 ...	0·26
16 ...	1 15 49 ...	68 38·1 ...	
18 ...	1 1 20 ...	69 31·9 ...	0·20
20 ...	0 46 52 ...	70 16·9 ...	
22 ...	0 32 32 ...	70 54·3 ...	0·16
24 ...	0 18 19 ...	71 25·1 ...	
26 ...	0 4 14 ...	71 50·3 ...	0·12
28 ...	23 50 16 ...	72 10·5 ...	
30 ...	23 36 28 ...	+72 26·3 ...	0·10

The path of the comet lies in the northern part of Cassiopeiæ until May 25, when it passes into Cepheus.

A PHOTOGRAPHIC TRANSIT CIRCLE.—Many attempts have been made to replace the observer of star transits by a photographic plate; but as most of them require the plate to register star-trails, it is impossible in this way to record the fainter stars. Dr. H. C. Russell has recently proposed another method, which he believes will be capable of giving star positions with much greater accuracy than is possible with the existing transit circles, and is at the same time good for the fainter stars. The instrument is virtually a photographic telescope of thirteen inches aperture, mounted alongside a visual telescope in a rectangular box, which turns on trunnions within a polar axis of the "English" form. An electrically-controlled driving clock, and circles for declination and right ascension complete the instrument. On the scale suggested the circles may be large ones, so that declinations may be read by microscopes to 0″·1 and right ascensions to 0·01 sec. The polar axis would be adjusted by the familiar processes, and the instrument would be collimated like an ordinary transit circle; the line of collimation of the star camera must also be made parallel to that of the telescope. The telescope would be set on the desired star before the meridian, and the star would be constantly kept on the cross wire while the plate was being exposed; meanwhile the R.A. would be read off by a second observer noting the times at which the divisions of the circle pass a fixed microscope, the relation of each division to the meridian being very accurately determined. A third observer would read the declination circle. The instrument would next be reversed in the polar axis, and the observation repeated. If there were no collimation errors or flexure due to the position of the telescope the photographic images of the star would be superposed, and if they are not, the point midway between the spots may be assumed to be the mean of the unknown errors. There would of course be two images of any stars, except the guide star, that might be in the photographic field, and their positions relative to the guide star would be determined by measurement of the photograph. The advantages specially claimed are (1) the observation does not depend upon a flying shot at the bisection of a stellar image; (2) at least a partial elimination of unknown errors is effected; (3) the determination of R.A.'s with equal and extreme accuracy for stars in all declinations.

MR. TEBBUTT'S OBSERVATORY.—The report for 1895, which we have just received from Mr. Tebbutt, of Windsor, N.S.W., is a splendid illustration of what can be accomplished almost single-handed by an enthusiastic astronomer. Not less than 957 transits of stars were observed during the year, and this in addition to a varied series of other observations. A large number of occultations of stars was observed, and what may be regarded as a feat in this class of work was accomplished on August 29, when both phases of the occultation of the fifth magnitude star B.A.C. 6127 were observed in full sunlight. The micrometric work includes numerous measures of the positions of the minor planets Hebe and Ceres, and of seventeen double stars which are of peculiar interest. Jupiter's satellites and certain variable stars also received attention, and the various meteorological phenomena were recorded. Eleven papers on the results of the astronomical work were published during the year.

THE ROYAL SOCIETY CONVERSAZIONE.

FEW conversaziones of the Royal Society have exceeded in interest the one held on Wednesday of last week. Many of the exhibits were very striking, while all of them presented novel features. Physical science predominated, and Röntgen photography attracted a large share of attention throughout the evening. Mr. A. A. C. Swinton had an elaborate exhibit to illustrate experimentally the production of Röntgen rays, and the visible and photographic effects produced by them. By means of several binocular cryptoscopes, all who so desired were able to see shadow pictures of the bones in the living body, and of objects enclosed in opaque boxes, while Röntgen photographs of the hands of many persons were taken during the evening.

Mr. Herbert Jackson's demonstration of the use of phosphorescent materials in rendering Röntgen rays visible, brought out the supremacy of potassium platino-cyanide as the salt for phosphorescent screens. The tube used to produce the rays was a slight modification (described in the *Proceedings* of the Chemical Society) of a tube originally introduced by Mr. Crookes to illustrate the heating effect of kathode rays. These are brought to a focus at the centre of curvature of the concave kathode, whence they proceed in nearly a straight line to a platinum plate, from the surface of which they are apparently scattered in all directions. The rays penetrating the glass were caused to fall upon phosphorescent bodies and were rendered visible, thus showing the different intensities of response of these bodies to such rays. By means of a large phosphorescent screen covered with platino-cyanide of potassium, all the effects seen individually with a cryptoscope were viewed by a number of people at the same time.

Mr. Sydney Rowland exhibited a series of "skiagrams" illustrating the applications of the "new photography" to medical and surgical diagnosis. The following analysis, based on a record of some fifty cases, is useful as showing the branches of surgery in which the new process will probably be found of most use. About 20 per cent. of these include the discovery and location of foreign bodies, needles, bullets, &c., lodged in soft tissues, and in one case a coin lodged in the intestine, which caused troublesome symptoms. In one of these cases two previous operations had been fruitlessly performed. 15 per cent. of the cases were instances of pathological conditions of the elbow-joint of more or less obscurity, on which new and unexpected light was thrown by the diagnosis thus obtained. In 10 per cent. of the cases the object in view was the determination of the extent and distribution of tuberculous lesions in bone. Various ankyloses and deformities of the bones and joints of the extremities have made up the remainder of the cases.

A self-testing resistance box and bridge were exhibited by Mr. E. H. Griffiths, F.R.S. This apparatus presented many novel features, the chief advantages being as follows:—(1) The observer can (without use of standards, &c.) ascertain accurately, and quickly, the comparative errors of all the coils, including those in the ratio-arms. (2) An exact calibration of the bridge wire can be made by means of the box itself. (3) The temperature of the coils can be accurately determined. (4) The resistance of leads to any object is self-eliminated. (5) Resistances from 0·00001 ohm to 105 ohms can be directly read by a null method, without observation of galvanometer swings. (6) All coils after adjustment have been heated to a red heat, and are thus very free from strain, &c. (7) There are special arrangements for securing constancy of all plug contacts, &c.

A resistance box, standard coils, and wire bridge were exhibited by Mr. F. W. Burstall. The resistance box was of the dial pattern, wound in bare platinum silver wire on strips of mica, the wire being immersed in pure mineral oil; there were five dials, ranging from $\frac{1}{10}$ ohm to 1000 ohms, and four pairs of proportional arms. The four standard coils were of similar forms, but were intended to be used with mercury cups. In conjunction with Mr. H. R. J. Burstall, the same exhibitor showed bare wire resistance thermometers for use in vessels under high pressure. The measuring wire was wound on mica plates carried by slender columns from a metallic plug which was screwed into the vessel. The change of resistance was measured by comparing the drop of E.M.F. over the measuring wire, with the drop over a standard coil put in series with it and a battery. A thermometer was exhibited which had been in a steam superheater for more than a week continuously, at a pressure of 160 lb. per square inch. Both these exhibits should prove of great assistance in electrical and thermometric measurements.

New apparatus for measuring the magnetic permeability of iron or steel was shown by Prof. Ewing, F.R.S. The apparatus allows measurements of permeability to be made with samples in the form of short rods, and greatly simplifies the process. It acts by making a magnetic comparison between the rod to be tested and a standard rod, the magnetic qualities of which have been determined beforehand. The magnetic detector, which shows when the two rods have the same induction, consists of a compass needle placed in a gap in an iron bar joining the two yokes. From its analogy to the Wheatstone Bridge, the author proposes to call the instrument a Permeability Bridge. It forms a companion instrument to the hysteresis tester exhibited last year.

A flint glass prism of nine inches aperture and 45° refracting angle was exhibited by Mr. J. Norman Lockyer, C.B., F.R.S. The prism has been constructed by the Brothers Henry, of the Paris Observatory, and will be used as an objective prism for photographing the spectra of stars. Mr. Lockyer also showed the following:—Photograph showing positions of coronal spectrum rings in the total eclipse of the sun, April 16, 1893. The original negative was taken by Mr. Fowler, at Fundium, West Africa, with the 6-inch prismatic camera near the middle of totality, with an exposure of forty seconds. In addition to the images of a number of prominences, there were portions of rings representing the radiation spectrum of the corona. The brightest of the rings corresponds to the well-known corona line 1474 K, but the others have not been previously photographed. All the rings are most intense in the brightest coronal regions, near the sun's equator.—Photographic spectra of α Cygni, γ Cygni, and Arcturus. The photographs were taken at South Kensington with a 6-inch objective prism of 45°, and illustrated the difference between stars of increasing and stars of decreasing temperature. Arcturus is a cooling star, almost identical with the sun, while α Cygni differs very widely from the sun and is getting hotter. The spectrum of γ Cygni, like that of Arcturus, consists of a very large number of lines, but as many of the more prominent lines agree with those of α Cygni, and are absent from the solar spectrum, this star must be classed with those of increasing temperature.—Photographs showing the spectra of helium and gas X in relation to the spectra of Orion stars. The lines of the two gases were arranged in the series deduced by Messrs. Runge and Paschen, and their distributions in the spectra of Bellatrix, Rigel, δ Orionis, and Spica were shown. —Photographic map of the spectra of metals of the iron group. The map extended from wave-length 3900 to 5900, and included the spectra of iron, manganese, cobalt, nickel, chromium, and uranium, as shown at the temperature of the electric arc. Rowland's map of the solar spectrum formed the term of comparison, so that the wave-lengths of the lines could be read off directly from the map.

Mr. F. McClean, F.R.S., exhibited photographs of the spectra of twenty-three characteristic helium stars. These stars correspond to Class I.*a* of Lockyer (*Phil. Trans.*, December, 1892), who further attributed their spectrum to helium (*Proc. Roy. Soc.*, May 9, 1895). The hydrogen and helium were indicated below the scale of wave-lengths. The enlargement was 8½ times the original negatives. Mr. McClean also showed photographs of the spectra of six stars of the third magnitude, illustrating the transitions from type to type.

Another spectroscopic exhibit was by Prof. Hartley, F.R.S., whose subject was, however, terrestrial. He showed a series of photographed spectra illustrating an investigation of the Bessemer flame, as seen at the North Eastern Steel Co.'s Works, at Middlesbrough-on-Tees, in which the presence of the rare element gallium was recognised by a single line in its spectrum, and separated from both the metal and the ore of the district.

A remarkable exhibit, by Mr. Joseph Goold, consisted of steel tuning-bars and synchronising sound-generators. The new synchronising sound-generator was a vibrating rubber having the pitch or vibration-period of the note to be elicited. The separate partial-tones were thus developed singly with remarkable power and sweetness. These appliances have already led to the further discovery of *vibration-axes and -vortices*, examples of which were exhibited.

The rapid photographic printing machines, exhibited by Mr.

W. Friese Greene, turned out prints at a rate almost beyond belief. The machines are for the production of prints wholly or partly by photography, and their chief object is to effect a very rapid production of copies adapted for use as illustrated supplements, newspapers or magazines, or for other purposes where a large number of copies of the same picture, design, or other objects are required. A roll of rapid bromide paper was fed in at one end of each machine, and finished prints were turned out at the other end at the rate of two or three thousand an hour. Mr. Greene also showed a new type-setting machine dispensing with movable types.

Instantaneous photographs of splashes were shown by Prof. Worthington, F.R.S., and Mr. R. S. Cole. These photographs were taken each with an electric spark giving an exposure of less than 3-millionths of a second (see NATURE, vol. l. p. 222.) The spark could be so timed as to pick out any desired stage of the splash within limits of error not exceeding, as a rule, about 2-thousandths of a second. In this way the progress of a great variety of splashes has been followed in minute detail. Specially interesting were those which illustrated the formation of a bubble, and those which showed how the nature of the disturbance produced by the entry of a solid sphere depended on the condition of its surface.

By means of the colour patch apparatus exhibited by Captain Abney, C.B., F.R.S., it becomes possible to throw on a screen, or on a photographic plate, the image of a luminous object in monochromatic light. An image is first formed on the face of a prism or grating by means of a lens of proper focal length, placed close to the slit of the spectroscope. The spectrum is formed in the usual way, and the colour in which the image of the object is to be formed is allowed to pass through a slit placed in the spectrum. A second lens placed close to this slit forms the image in monochromatic light of the image on the prism or grating on a screen or photographic plate.

Prof. Roberts-Austen, C.B., F.R.S., showed his interesting modifications of an experiment of M. Charles Margot. A wire of aluminium was raised, by a current of 30 amperes, to a temperature far above the melting point of aluminium, but a film of oxide on its surface prevented the wire from breaking. The molten wire through which a current was passing, could then be attracted by a magnet.

On behalf of Mr. Carl Zeiss, new portable binocular field-glasses and stereo-telescopes were exhibited. The objects of the new types are (1) to obtain a considerably larger field than that possessed by a Galilean telescope of similar magnifying power: (2) to enhance the stereoscopic effect of the images formed, by placing the object-glasses further apart than the eye-pieces. These objects were attained by prisms and astronomical oculars. The rays passing from the object-glass to the eyepiece undergo four reflections at the surfaces of the prisms, and emerge from the last prism with undiminished intensity. The interposition of the prisms serves to erect the inverted image formed by the object-glass, and, at the same time, to displace the axis of the eyepiece with respect to that of the object-glass, the amount of this displacement being variable within wide limits.

Mr. F. E. Ives had on view his stereoscopic photo-chromoscope. The photo-chromoscope camera makes, at a single exposure on a commercial photographic sensitive plate, three pairs of images, which by differences in their light and shade constitute a record of everything that excites vision in the two eyes. The stereoscopic photo-chromoscope translates this record to the eyes, so that the object photographed appears to be seen through it.

The composite archer's bow, its structure and affinities, was the subject of an exhibit by Mr. Henry Balfour. Archers' bows of composite construction, of wood or horn, or both, overlaid with a "backing" or reinforcement of animal sinews, were shown. There were complete bows from North-west America, Japan, Corea, Manchuria, China, North India, &c., a composite cross-bow from Germany, and an unique specimen of composite bow from a tomb of the twenty-sixth dynasty, Thebes, Egypt. A map and diagram showing the distribution and affinities of the various types of composite bows were also exhibited.

A bifilar pendulum in action was exhibited by the Cambridge Scientific Instrument Company. This instrument was designed by Mr. Horace Darwin for observing and recording slow tilts and pulsations of the earth's crust, by whatever cause they may be produced, and is a modification of that used by the Messrs. Darwin in 1881, at the suggestion of Lord Kelvin. It is possible to observe with this pendulum a tilt of less than $\frac{1}{3000}$ of a second, an angle less than that subtended by a line an inch long placed at a distance of a thousand miles, as was shown by the experiments made at Birmingham by Dr. Charles Davison.

The results of experiments on steel gas cylinders were shown by the Gas Cylinder Committee, lately nominated at the request of the Home Office. These showed (1) the danger of using hard or unannealed steel for gas cylinders; (2) the extraordinary amount of violent ill-treatment to which a good soft annealed cylinder may be subjected without destruction, even when charged to 120 atmospheres; (3) the effect of very great internal pressure steadily applied, in this case due to the expansion of liquefied ammonia gas which completely filled the cylinder when cold; (4) the violently destructive character of the explosion of mixed gases under pressure which no practicable cylinder can withstand.

Portable apparatus for gas-testing in electric culverts was shown by Prof. Clowes. A standard hydrogen flame, fed from a small steel cylinder of the compressed gas, is enclosed in a brass vessel provided with a transparent front. This apparatus is mounted on a camera tripod, and is observed by throwing a black cloth over the head. The air to be tested for inflammable gas is pumped over the flame by dropping the end of a flexible tube into the culvert, and compressing a rubber ball provided with suitable valves. A constant stream of the air is thus caused to pass over the hydrogen flame, and by the appearance and dimensions of the flame-cap produced, gas is detected and its percentage is accurately measured. The hydrogen flame can be adjusted to two standard heights, and thus percentages of gas from 0·2 to 5 can be detected and measured.

Geometric wall brackets were exhibited by the Rev. F. J. Smith, F.R.S., and Prof. C. V. Boys, F.R.S. The brackets have been designed with the object of providing wall supports with definite position for physical apparatus. After the apparatus and bracket have been adjusted, they may be removed, and at any time immediately restored to their original position. This is found to be convenient where a class or lecture room is used for some portion of a day only for physical demonstration. The construction is as follows:—Three small projections, A, B, C, are fixed to the wall, one of the two upper projections is furnished with a three-sided indentation, the other with a V-groove, the third is a flat surface; two hemispherically ended screws drop into the upper projections, and the third screw at the bottom of the bracket rests against the flat surface.

Geometric steady blocks were also exhibited. These have been designed so as to rest each on the one below it, upon six independent small surfaces, so as to be geometrically clamped. Thus any number of blocks may be piled to the desired height, and carry physical apparatus with perfect steadiness. Both square and triangular forms were shown.

M. Maurice d'Ocagne, Professor at the École des Ponts et Chaussées, exhibited a very complete series of "abaques" of his invention, intended to perform certain calculations, such as the solution of a cubic equation, or of Kepler's equation, and generally of any equation involving three or four variables. The interest was purely mathematical, appealing to a select few; but the applications of the principle are numerous and important.

Mr. W. Barlow exhibited models to show the nature of the repetition in space which characterises a homogeneous structure having cubic symmetry.

Specimens of ancient "astrolabes" and other instruments were exhibited by Mr. Lewis Evans.

Messrs. Read, Campbell, and Co. showed "aerators" for aerating water and other liquids. The aerator is used in combination with a soda-water bottle and patent stopper. It is made of sheet steel, and contains compressed carbonic acid gas; the soda-water bottle being filled with water or other liquid, the aerator is inserted in the stopper, and the closing of the latter liberates the gas, producing strongly aerated water or other liquid. The aerators may be charged with other gases and used for other purposes than aerating liquids.

There were exhibited by the Meteorological Council: (1) Current charts of the Indian Ocean for the months of January, April, July, and October. The currents shown on these charts had been generalised from a very large number of observations, the arrows and figures attached to them indicating the direction and maximum and minimum velocities of the current likely to be experienced at any particular spot. (2) Wind charts of the South Indian Ocean, between the Cape of Good Hope and New Zealand, for the months of January, April, July, and October.

These charts showed, by a new form of wind rose, recently adopted by the Meteorological Council, not only the frequency of the winds, but their strength, over areas contained by 3° of latitude and 10° of longitude. Isobars were also drawn on the charts so that the relation of the winds to the barometrical pressure could be compared. In the corners of the wind areas the percentage of fog and the number of weather observations were given. A small inset chart showed the temperature of the air, which was represented by isothermal lines, and the limits of fog were also indicated. (3) Sea surface temperature charts of the South Indian Ocean, between the Cape of Good Hope and New Zealand, for each month of the year.

Coming now to natural science, Dr. Woodward, F.R.S., showed a part of the collections made by Dr. C. I. Forsyth Major in Madagascar, 1894–95; and Dr. J. W. Gregory exhibited a geological map of part of British East Africa, with sketches, sections and specimens. The map showed the main features in the structure of British East Africa. The region consists of a plateau of Archean rocks (gneiss and schist) sinking beneath strips of Carboniferous and Jurassic deposits in the coastlands, and buried by piles and sheets of volcanic rocks in the interior. Volcanic activity probably lasted from the Cretaceous to the present day. The lavas have been ejected by plateau eruptions and by crater eruptions. The former poured forth sheets first of trachytoid phonolite, and then of basalt. The country is traversed by the Rift Valley, on the floor of which are thick series of lacustrine deposits; on its walls are the terraces of extinct lakes. Dr. Gregory also showed specimens of Hemiptera (*Flata nigricincta*, Walk.), the colonies of which resemble inflorescences. Mr. H. W. Seton Karr, and Sir John Evans, K.C.B., Treas.R.S., exhibited (1) palæolithic implements from Somaliland; (2) palæolithic implements from Somaliland, together with European, Asiatic, and African specimens for comparison.

Gold nuggets showing internal crystalline structure, formed an exhibit by Prof. Liversidge, F.R.S. The specimens (Australian) had been sliced and polished, and then etched with chlorine water or other reagents, so as to show the internal crystalline structure and the presence of enclosures of quartz, iron oxide, &c.

Prof. McKenny Hughes, F.R.S., exhibited (1) specimens illustrating the amount and mode of shrinkage of bog oak; (2) mulberry, showing symmetry in the twigs and asymmetry in the leaves; (3) travertine lining a wooden pipe, and reproducing all the details of the surface on which it was thrown down.

Photographs of "cup and ring" markings naturally formed upon stucco, were exhibited by Mr. C. Carus-Wilson. The wall of a house, built about forty years ago, was covered with stucco. Alternations of temperature, to which the face of the wall had been subjected, had rearranged the particles composing the stucco, producing linear and annular ridges and depressions similar to those occasionally seen on rock-faces, and usually ascribed to the hand of prehistoric man.

Prof. Ray Lankester, F.R.S., showed a cast of enlarged model (eight times natural size) of the type specimen of *Amphitherium prevostii* (lower jaw, Stonesfield slate). Casts taken direct from these very small jaws are of little use. Drawings necessarily fail to show clearly the modelling of the teeth. Accordingly Prof. Lankester has obtained, through the skill of Mr. Pycraft (one of his assistants in the Department of Comparative Anatomy, Oxford), a careful wax model of each of the unique Oxford mammalian fossil jaws, eight times the natural size. A coloured cast of the wax model of one of these jaws, the type specimen of Amphitherium, was exhibited, and similar casts will be offered to the chief European and American museums.

The Marine Biological Association had on view a series of specimens illustrating the boring habits of certain marine animals, amongst them being a series of shells showing the gradual disintegration due to the action of boring sponges. Some rare or interesting marine organisms recently found at Plymouth were also shown by the Association.

Mr. Walter Garstang demonstrated certain adaptations, subservient to respiration, in sand-burrowing Annelids and Crustacea. In aquatic animals which burrow in fine sand, the activity of the gills would be impaired by the accumulation of sand around the gills, or in the course of the respiratory currents. To prevent this, the water before passing to the gills is sieved in the Annelid *Aphrodite* by a felted mass of fine hairs, and in Decapod Crustacea by the hairs bordering the branchiostegite. In the crabs *Atelecyclus* and *Corystes* the normal respiratory current is reversed, and the water passes to the gills through a sieve-tube formed by the interlocking of rows of special hairs on the apposed antennæ. In *Atelecyclus*, which burrows to a shallow depth, the reversal of the current takes place only when the crab is imbedded; in *Corystes*, which burrows deeply, the antennal tube is elongated, and the reversal of the current is all but constant.

A wax model of a single electrical nerve cell from the spinal cord of *Malapterurus electricus* (River Senegal), and microscopic serial sections, was exhibited by Dr. Gustave Mann. The model was made from camera lucida drawings of a complete series of sections through the cell. It showed one axis cylinder process, and an enormous number of dendritic processes which in many cases are joined by their ends to form loops. The model was 500 times the natural size of the nerve cell.

A selection of the dried plants collected in Tibet by Mr. St. George R. Littledale, was exhibited by the Director, Royal Gardens, Kew. The plants were collected in the Gooring Valley, between Tengri Noor and Lhassa, in lat. 30° 12′ N., and long. 90° 25′ E., at an altitude of about 16,500 feet; they represented the general character of the vegetation.

Nuclear division in the spores of *Fegatella conica* was shown by Prof. J. B. Farmer. The spindle in these spores is of a very unusual form at first, but becomes normal subsequently. The primary cell wall remains free in the cytoplasm, and during the two second divisions of the nuclei it becomes rotated through an angle of 90°, and the spore is thus divided into four cells. The ultimate position taken up by the walls corresponds with that of a system of soap films, introduced into a box similar in shape to that of the Fegatella spore, when the cavity of the box is to become divided into four chambers by such films.

Mr. A. Francis Dixon showed a model to illustrate the method of reconstruction from serial microscopical sections by the use of glass plates. This exhibit illustrated a method of reconstruction which is especially useful in tracing the crossing and branching of fine structures, such as nerves and vessels in the embryo. The model was composed of a number of glass plates covered with a transparent varnish. On each plate was traced the outline of a portion of a section belonging to a series, multiplied in the case shown fifty diameters. The thickness of each glass plate was fifty times that of the section drawn on it. When the different plates were placed one over the other in order, a transparent model of the whole structure results, multiplied fifty times. The model shown illustrated parts of the distribution of the trifacial nerve in a rat embryo of the fifteenth day.

During the evening two lectures, with demonstrations by means of the electric lantern, took place. At one of these Prof. Meldola described the exhibits, by M. le Prof. Lippmann, of colour photographs by the interferential method. The photographs, which were projected upon a screen, represented stained glass windows, landscapes and flowers taken from nature, vases, and a portrait from life.

Experiments with liquid air were described by Prof. Dewar, F.R.S., at the second of the two demonstrations.

THE IRON AND STEEL INSTITUTE.

THE annual general meeting of the Iron and Steel Institute was held last week in London, commencing on Thursday, the 7th inst., and continuing over the following day. From the Report of the Council it would appear that the Institute is in a flourishing state. The membership is increasing, and naturally with it the income, whilst the expenditure shows a very remarkable diminution during the last two years. Those who are acquainted with this society know that this lessening cost of management has not been accompanied by any diminution of efficiency.

On the members assembling on Thursday morning, Sir Lowthian Bell occupied the chair in the absence of the President, Sir David Gale, who was prevented from being present by indisposition. The first business of the meeting was the presentation of the Bessemer medal, which had been awarded to Dr. Hermann Wedding, Professor at the Berlin School of Mines, in recognition of the services he has rendered to the iron and steel industries by his valuable contributions to metallurgical literature. An interesting feature in this ceremony was the presence of Sir Henry Bessemer, the venerable founder of the modern steel industry, who made a speech congratulating Dr. Wedding on being selected by the Council as the recipient of the medal.

The following list of papers to be read and discussed was on the agenda.

"On the Rate of Diffusion of Carbon in Iron," by Prof. W. C. Roberts-Austen, C.B., F.R.S.

"On some Alloys with Iron Carbides," by J. S. de Benneville, of Philadelphia.

"On Mond Gas as applied to Steel Making," by John H. Darby, of Brymbo, North Wales.

"On Hot Blast Stoves," by B. J. Hall, of Westminster.

"On the Hardening of Steel," by H. M. Howe, of Boston, U.S.

"On the Introduction of Standard Methods of Analysis," by Baron Hans Jüptner von Jonstorff, of Neuberg, Austria.

"On the Production of Metallic Bars of any Section by Extrusion," by Perry F. Nursey, London.

"On Mr. Howe's Researches on the Hardening of Steel," by F. Osmond, of Paris.

"On the Treatment of Magnetic Iron Sand," by E. Metcalf Smith, of New Zealand.

"On the Making of the Middle Lias Ironstone of the Midlands," by E. A. Walford, Banbury.

Mr. Hall's paper was first taken. It described a form of hot blast stove which has now been in use many years, the first, we believe, having been erected about twelve years ago. It is known as the Ford and Moncure stove, and is of fire-brick, having the ordinary chequer work, although the arrangement varies somewhat from the Cowper or Whitwell patterns, the chief difference being that the stove is divided by walls into four parts. The object is to give facilities for clearing from dust. When the change is made from gas to air the whole of the blast is passed through one of the four divisions, naturally in a very concentrated form. This blows the dust out of the chimney-top, or deposits it in the flues, from whence it can be removed at convenient times. Details given by the author showed that the stoves have a long life, a fact which is perhaps as much due to the excellent proportion on which they are designed as to any special novelty in the construction. From what was said during the discussion, it would appear that the dust-removing device answers satisfactorily.

The next paper taken was Mr. Nursey's contribution, which described a very interesting departure in the production of metal bars of various sections.

The author stated that the system of manufacture was the invention of Mr. Alexander Dick, the inventor of Delta metal. It related to the production of all kinds of metallic sections, from thin wire or plain bars to complex designs, by simply forcing metal, heated to plasticity, through a die by hydraulic pressure. He referred to the fact that although the principle of extrusion was employed in the manufacture of lead pipe and lead wire, yet the temperature was very much lower than in Mr. Dick's system, which required the metal to be red-hot, or about 1000° F. The process consisted in placing the red-hot metal in a cylindrical pressure chamber, or container, at one end of which is a die. Upon pressure being applied at the opposite end the plastic metal is forced through the die, issuing therefrom in the form of rods or bars of the required section and length. The container of the first apparatus made was a solid steel cylinder, bored out to the required diameter to form the chamber for the hot metal, and heated in a coke fire. In practice, however, it was found that the strain set up by the unequal expansion and contraction of the walls of the cylinder, added to that caused by the internal pressure applied to force the metal through the die, developed cracks in the cylinder which rendered it useless. After a long series of experiments with various kinds of steel cylinders, Mr. Dick abandoned the solid wall principle and devised a built-up container. It is composed of a series of steel tubes of different diameters, placed one outside the other, with annular spaces between them, these spaces being filled with a dense non-conducting packing. This device proved perfectly successful, and machines on this principle are now in operation on a commercial scale at the works of the Delta Metal Co., in Germany, and at one of the large Midland metal rolling mills. These machines are served by two men and one boy, so that the cost of labour per ton is very small. The author described the working of the system, and referred to the great variety of sections, some of a very complex nature, produced in Delta metal, brass, aluminium, aluminium bronze, and other alloys and metals, samples of which were exhibited on the table of the theatre. They ranged from wire weighing about 1/100 of a pound per foot run, to heavy rounds, squares, and hexagons weighing 40 lb. and over per foot run. Among the examples was a complex moulding that could not possibly have been made by rolling in the usual way followed for making metal articles of this nature. Mr. Nursey pointed out that the pressure put upon the metal greatly increased its strength, and at the same time rendered it still more homogeneous. Some tests made at Woolwich Arsenal with Delta metal bars produced by extrusion showed a tensile strength of 48 tons per square inch with 32·5 per cent. elongation on 2 inches, as against 38 tons per square inch tensile strength and 20 per cent. elongation of rolled bars of the same metal. The author concluded by stating that Mr. Dick was engaged on experiments with the view of producing sections in iron and steel similar to those at present turned out in Delta metal.

In the discussion which followed the reading of Mr Nursey's paper, Mr. Snelus described a process of covering telephone cable with lead, somewhat analogous to that referred to by the author. This cable contained over 150 wires, and was three inches in diameter. The fluid lead was pressed over it through dies. The great difficulty in all processes of formation by extrusion is to get a material for making the dies which will stand the hard usage to which they are put. Mr. Dick uses tungsten steel, a very hard material which does not require tempering; this, it seems, is good enough for Delta metal, one of the many new bronzes, and for the other materials mentioned. But if it were necessary to deal with metals having a higher melting point, a still more refractory metal would be required, and one of equal hardness, as the dies must not only withstand heat, but erosion. Mr. Snelus was of opinion that if the container, or cylinder, used for forcing out the fluid metal, were made of some highly refractory earth, that steel pipes could be made in this way. That, of course, would be a great commercial success, for not only could the pipes be cheaply manufactured in long lengths, but the quality would doubtless be much improved. In the present day of water-tube boilers this is a matter well worth considering. The difficulty in making steel tubes, however, does not appear to rest with the production of a refractory container. Mr. Dick said that he had made steel bars by extrusion, although it was done accidentally, and the trouble was, not that the cylinder gave way, but that the dies would not stand the work; if, therefore, an ingenious metallurgist can discover an alloy as hard as tungsten steel, and more refractory, he will possibly make a considerable fortune.

Mr. Metcalf Smith's paper was next taken. The author described the method adopted in New Zealand of smelting, or perhaps one should say melting, the iron sand found so largely in that country. The paper stated that the sea cliffs on this part of the coast consist of a combination of silica sand and a rich magnetic iron sand; the gradual crumbling of these cliffs, together with large quantities of iron sand brought down by the rivers and streams, draining the slopes of Mount Egmont, result in a deposit of almost pure iron sand on the beach, a large proportion of the lighter silica sand being washed out to sea. Excavations have been made on the beach showing a depth of iron sand of fourteen feet, whilst the same material has been dredged up at a distance of three miles out to sea. Nature seems to have devised this district most fitly for an iron industry; for not only are these vast deposits of magnetic iron so easily obtainable, but in close proximity there are extensive coal beds. There is also limestone containing 88 per cent. of calcium carbonate, timber for charcoal if required, and, indeed, provision for supplying all the needs of iron manufacture. Here is an analysis of the iron sand, made by Sir James Hector:

Peroxide of iron } Protoxide of iron }	82·0
Oxide of titanium	8·0
Silica	8·0
Water and loss	2·0
	100·0

Of course iron sand is known in other countries besides New Zealand, and efforts have often been made to smelt it. The difficulty, however, has been that it comes down and chokes the furnace when melting begins, so that it descends to the hearth unreduced. This is got over in New Zealand by kneading it into bricks with clay, which is found close by. In this way hard and compact lumps are procured, which will stand the pressure and grinding action in travelling through the furnace. One ton 12 cwt. of iron sand is mixed with 10 cwt. of clay; and in this

way, what is equivalent to a very rich ore is produced. The pig iron made gives an excellent analysis. It is not, however, necessary to smelt all the iron-sand in this way, for a certain part of it can be mixed with fluid iron, tar being added. The liquid metal will melt and absorb the iron sand, the tar giving sufficient carbon to retain the metallic iron in a fluid state. There is, of course, a saving in cost in this method of procedure, and the metal may be run direct for castings, thus avoiding the loss in re-melting. Bar iron is made by puddling from tarred iron sand and smelted metal. In the Siemens furnace, also, the same method of procedure is followed. Figures are given in the paper as to the cost of these processes, but the most remarkable details are those referring to the quality of the product. Thus we are told that by the treatment described, bar iron, equal in quality to BBH, can be produced for £7 per ton, and wrought iron, which will give what the author truly described as "the extraordinary tensile stress of 52 tons to the square inch." One would be inclined to describe this tenacity in wrought iron, not only as extraordinary, but as almost incredible; at any rate, one would wish to see the test authenticated by at least more than one experimenter of high reputation before accepting it as unquestionable. This would be more especially the case if, as we understood the author to say, the elongation was 33½ per cent.

Mr. Walford's paper was next taken. Its object was to describe the character of the Middle Lias ironstone of the Midlands and its organic origin, and the making of the stone and its ferruginous changes.

At the conclusion of the reading of this paper the meeting adjourned until the next day.

On the members again assembling on Friday morning the paper of Baron Jüptner was the first taken, being read by Mr. H. Bennett Brough in the absence of the author. This was a very long contribution consisting of thirty-six pages, but, as was said during the discussion which followed its reading, it was not a word too long. The subject is one of great importance, and has been far too long neglected. The want of uniformity in analysis has led to much confusion and consequent loss of money in the iron and steel industries. In a general description of the meeting, such as this, it would be impossible to do justice to a subject of this magnitude, and at present we can only make brief reference to the proposals contained in the paper, hoping to return to the question so as to deal with it at greater length on a future occasion. A large part of the paper was occupied in giving examples of discrepancies in analyses; thus, in an instance quoted, a chill roll was examined in two laboratories, and quite incredible differences were obtained. In one case the carbon was returned as 3·5 per cent., in another 2·785 per cent. Silicon in the first analysis was given at 1·3 per cent., the second laboratory gave 0·668 per cent. Other instances almost as striking were quoted by the author. What is proposed now to be done is to establish an international laboratory in Switzerland. All the important nations are to nominate honorary directors of work. For the purposes of making analyses, however, paid investigators will be necessary. Dr. Wedding, who spoke during the discussion, said that it was estimated the cost would be about £3000 a year, and he thought that if 300 of the principal iron and steel works in the world would contribute yearly £10 apiece, the work for a period of ten years could be done. Sir Lowthian Bell was of opinion that there should be no difficulty in getting this amount of money, and promised that his own works should contribute. It is perhaps unnecessary to point out that English iron and steel works are in some cases—there are, of course, notable exceptions—lamentably deficient in the scientific department. Mr. Stead, whose experience is very wide, and who speaks as a disinterested observer, said that in some establishments of considerable importance the chemist only received a salary of £100 a year. How can a man be expected, not only to work with that enthusiasm with which all scientific men must work for their labours to be effective, but to keep abreast of knowledge by the purchase of books, and subscriptions to technical or scientific societies, on such a stipend as this, which can allow no surplus after the barest necessities of life have been supplied? Mr. Stead pointed out that technical libraries were not common enough in this country, and he would suggest that in all large manufacturing centres libraries of that nature should be instituted. This, however, would not quite meet the difficulty. Abroad, especially in Germany, one finds iron and steel works have libraries of their own, the collection of books they possess being sufficiently large in most cases to be dignified by the name. Unfortunately in England, beyond a few elementary treatises or text-books, very little literature is seen in the laboratories, the chemist too often contenting himself with following well-known and stereotyped methods of analysis, and not troubling himself with any original work which might lead to fresh industrial developments. A good deal has been heard lately about German competition in the iron and steel trade, and there has been an inclination to attribute it to higher wages paid in this country. It may be, however, that there is something to be said not only against labour, but against capital in this matter; and certainly German steel makers have gone ahead of those in England in many cases. We have in mind, perhaps just now more especially, the development of the basic steel industry, the invention of which originated in this country. By the exercise of greater foresight, greater enterprise, and improvement in processes, Germany has gained a commercial advantage from which England is now suffering. In the discussion that followed the reading of the paper, one or two suggestions were made which should be put on record. Prof. Arnold drew attention to the effect of segregation, of which he has met with some striking examples of late. In a tyre examined, sulphur was in one case 1 per cent.; in another sample, taken an inch and a half from the first, the sulphur was ·043. Mr. R. A. Hadfield said that allowance should be made for previous treatment of metal, and, in considering the history of a sample, its size, previous mechanical treatment, and from what part of the ingot it was taken, should be noted. Dr. Readel was of opinion that the iron and steel industry was behind other industries in devising standard methods of analyses. The British Association Commission, he said, did good work, but there was the defect of want of organisation. Each member went on his own line, so that the same ground was covered more than once. An orderly scheme of procedure was the first thing necessary, certain work being allotted to different individuals; he had had, recently, occasion to look into the subject of chromium, and had found even for this metal some thirty or forty processes for determining its presence. What was necessary was that some one with authority should make a selection showing that which might be the most desirable to retain. Mr. Ainsworth made a suggestion which it is to be hoped will not be lost sight of. The accumulated funds of the Institute are about eight or nine thousand pounds, and with the improved management of the present day, the sum is likely to be increased at a rapid rate. Mr. Ainsworth pointed out that it is not desirable to hoard this money, and no better means could be devised for spending it than bringing out of the present chaos an orderly method of chemical analysis. The suggestion was warmly supported by the Chairman, Sir Lowthian Bell.

It may be said that chemical analysis has fallen somewhat into disfavour with iron and steel makers of late, and also with engineers, the tendency being to trust wholly to physical experiment, aided latterly by microscopical examination. It is certain, however, that nothing can take the place of chemistry in metallurgical research; and the disfavour with which it is now regarded is not the result of faults inherent to the system of chemical examination, but to the imperfect manner in which it is carried out.

Mr. Darby's paper was taken next. It described a process which promises to be of great importance in the iron and steel trade, by means of which sulphate of ammonia is obtained from producer gas without the gas being rendered unfit for steel making. For many years steel makers have had such a process in view, and experiments have been made with a view to bring it to practical shape. So far as we are aware, however, they have all hitherto resulted in failure, or, at any rate, have not been a commercial success. Mr. Darby's experiments, however, go to show that Dr. Mond has solved the problem. We have not space to enter into details here, but must refer our readers to the very interesting paper which will be published in the *Transactions*, and in which the method of working the apparatus is shown by a diagram. Although the experiments of Mr. Darby were carried out on a practical scale, the furnace was a small one; but this was rather against the process, as it is more difficult to work a small steel furnace, and keep the metal fluid, than a large one. The plant required for carrying out the process is undoubtedly very costly, but as the return in ammonia will enable a dividend of 25 per cent. to be paid on the outlay, there doubtless will be little difficulty in finding the money in large steel works. It is to be hoped that the English steel makers will not neglect to inquire into and consider this oppor-

tunity of adding to their returns, and will not once more allow the foreigner to develop a system originally devised in this country.

In the discussion on the paper, several steel makers, who had seen Mr. Darby's plant in operation, spoke as to the excellent way in which the furnace worked when using gas which had been treated for the extraction of the ammonia.

Prof. Roberts-Austen next gave a brief address on the diffusion of carbon in iron, he not having prepared a paper in the usual way. The subject has recently been described by the same author in the Bakerian Lecture of the Royal Society and will shortly be treated in these columns; it is therefore unnecessary for us to go into the matter on the present occasion.

The remainder of the sitting was almost wholly occupied by the reading and discussion of M. Osmond's and Mr. Howe's papers, the paper of M. de Benneville being taken as read. It would be impossible at the end of a report of this nature to deal with the highly controversial matters which form the subject of these two papers; and indeed, without the introduction of the micro-sections supplied by Mr. Howe, the matter would not be intelligible. The allotropic theory of the hardening of steel, which has already caused so much discussion, did not appear to be carried very much further on Thursday last, or, at any rate, the majority of those present at the meeting did not seem to see their way much further towards the end of the problem. M. Osmond welcomes Mr. Howe as a friend and ally. He looks on the latter's carbo-allotropic theory as not antagonistic to his own. The discussion was confined principally to Prof. Arnold and Mr. Hadfield, who are the chief opponents of the school represented principally by M. Osmond and Prof. Roberts-Austen, now, we suppose, with Mr. Howe as an ally.

The summer meeting of the Institute is this year of an unusually ambitious nature, and will be held in September in Bilbao, a steamer having been chartered for the conveyance of members to that port. The vessel is the Orient liner *Ormuz*, which will also serve as a floating hotel for members during the meeting.

A REMARKABLE DUST-STORM.

THE American journal *Electricity* for February 19 contains an account of an unusual kind of storm which occurred in January of this year. The details were communicated by L. H. Korty, telegraph superintendent of the Union Pacific System, of Omaha, Neb. It was on the telegraph lines of this system between Weber and Peterson, Utah, that considerable difficulty was experienced in working, owing, as it is stated, to the peculiar character of the storm in question. The description is as follows:—

"On the afternoon of January 16, a very peculiar rain-storm occurred in Eastern Utah and Western Wyoming, along the Union Pacific Railway, extending from Ogden, Utah, to Evanston, Wyoming, a distance of 75 miles. The rain consisted of salt water or brine. The clothing of persons exposed to the shower had, when dry, the appearance of having been sprinkled with whitewash. The windows in the stores and residences at Evanston were so encrusted with salt deposit as to make it impossible to look out. Dr. C. T. Gamble, of Almy, Wyo., a gentleman of undoubted trustworthiness, states that the storm deposited in Almy alone 27 tons of salt. 'This assertion may appear fabulous,' says the doctor, 'but nevertheless is true, as it has been proved by carefully estimating the quantity on a given surface in different parts of the camp. The area of Almy is something over nine miles, and three tons to the mile would make 27 tons of the sodium deposited. The salt if collected and sacked would make ten ordinary wagon-loads. Those who doubt the above statements, go to figuring.'

"The salt-storm lasted about two hours. After it had ceased raining, the sun came out, and as fast as things dried they turned a whitish colour, and it was found that everything was covered with a thick coating of salt. Cars, buildings, trees, telegraph poles, insulators and wires all looked ghastly in their white coats. Through Weber Cañon the salt storm turned into snow later. A peculiar effect of the salt deposit on the telegraph poles, arms and insulators through Weber Cañon was noticed in operating the wires. During the day, when the sun came out, the wires worked clear and without interruption, while at night, when it turned cold, the wires were rendered unserviceable, which was attributed to the fact that the snow, having melted, some during the daytime and again freezing at night, created a moisture in conjunction with the salt deposit underneath, so as to entirely destroy the insulation of the wires. After several unsuccessful attempts to remove the cause of the trouble, an engine with a pump and long hose was sent over the line, and the deposit thoroughly washed off the poles and fixtures for a distance of 40 miles. The wires of the Rio Grande Western Railroad between Ogden and Salt Lake City were slightly affected in the same way, as were also those of the Southern Pacific for a short distance west of Ogden."

It has been suggested, as an explanation of the facts, that the salt was raised in vapour over Great Salt Lake, and was carried by the wind and deposited over the country for many miles to the eastward. This, of course, could not have happened, as *salt could not be raised in vapour*. It seems likely, however, that the white residue may have had the appearance of salt, but was not actually salt. Would not a more reasonable explanation be that fine white dust in the region about the lake may have been carried into the upper regions by the wind, and after traversing some miles brought to earth again owing to the condensation of the vapour surrounding them?

SCIENCE IN THE MAGAZINES.

THIS month's magazines contain numerous articles on scientific topics or with scientific bearings. Röntgen photography naturally forms the theme of several contributions. The *Quarterly Review* contains a short descriptive account of methods employed, results obtained, and theories propounded, and even blossoms into illustrations reproduced from radiographs taken by Mr. A. A. C. Swinton. The *Century Magazine* has "a Symposium on the Röntgen Rays," the writers being T. C. Martin, R. W. Wood, Elihu Thomson, Sylvanus P. Thompson, J. C. McLennan, W. J. Morton, and Thomas A. Edison. The result of this composite article is vain repetition of experimental conditions, and a confusion of tongues; Prof. Thompson referring to pictures obtained by Röntgen rays as "sciographs," while other writers describe them as "shadowgraphs," and all the illustrations are designated "cathodgraphs."

Dr. St. George Mivart writes on "Life from the Lost Atlantis" in the *Fortnightly*, his paper being concerned chiefly in pointing out the significance of the discovery of *Cœnolestes obscurus*, a still-existing survivor of Ameghino's Epanorthidæ, and the representative of a new family of recent marsupials, described by Mr. Oldfield Thomas before the Zoological Society on December 17, 1895.

"This little, apparently insignificant, mouse-like creature," to quote the author, "turns out to be an animal of extreme interest, for it affords strong evidence that what we now know as South America and Australia must have been connected, and the Atlantic at least bridged by dry land, if even an Antarctic continent may not have existed, of which South America and Australia are divergent and diverse outgrowths."

Mr. G. E. Boxall puts forward, in the *Contemporary*, the view that the vast sedimentary plains of Australia, which thirty years ago were so "rotten" that no stock could be kept upon them, have been trampled into compactness by large herds of cattle and sheep. He gives reasons for believing the dry plains of Western Australia to be similar to those described by Oxley and others as once existing in the delta of the Murray, where about one hundred millions of sheep are now pastured, besides large herds of cattle and horses; and therefore he thinks that the present sandy plains will sooner or later be consolidated and rendered secure for stock. He concludes:

"The plains of Australia are, from the accounts given of them by explorers in all parts of the continent, singularly alike, and if the plains of Northern and Western Australia can be consolidated by the trampling of stock, as I believe those of the eastern districts have been, the time is not far distant when the word 'desert' may be wiped off the map of Australia, and the true character of its vast plains become more generally understood and appreciated."

Psychologists will be interested in a paper by Mr. Havelock Ellis, in the same review, on "The Colour-Sense in Literature." Mr. Ellis has examined the works of a series of imaginative writers, usually poets, dating from the dawn of literature to the present time, and has noted the main colour-words that occur, and has also noted how these words are used. His paper

contains the numerical results arrived at, together with certain observations suggested by them. The tables given lend support to the following interpretation :—

"The predominance of green or blue—the colours of vegetation, the sky, and the sea—means that the poet is predominantly a poet of nature. If red and its synonyms are supreme, we may assume an absorbing interest in man and woman, for they are the colours of blood and of love, the two main pivots of human affairs, at all events in poetry. And where there is a predominance of black, white, and, I think I would add, yellow—the colours that are rare in the world, and the colour of golden impossibilities—there we shall find that the poet is singing with, as it were, closed eyes, intent on his own inner vision. . . . Although I cannot claim to have put this numerical test of colour-vision into a final shape, there can be little doubt that it possesses at least two uses in the precise study of literature. It is, first, an instrument for investigating a writer's personal psychology, by defining the nature of his æsthetic colour-vision. When we have ascertained a writer's colour-formula and his colours of predilection, we can tell at a glance, simply and reliably, something about his view of the world which pages of description could only tell us with uncertainty. In the second place, it enables us to take a definite step in the attainment of a scientific æsthetic, by furnishing a means of comparative study. By its help we can trace the colours of the world as mirrored in literature from age to age, from country to country, and in finer shades among the writers of a single group."

Another article in the *Contemporary* is of scientific interest : it is on "The Proposed Gigantic Model of the Earth," by Dr. A. R. Wallace. It may be remembered by our readers that M. Elisée Reclus has drawn up a scheme for constructing a terrestrial globe on a scale of one-hundred-thousandth the actual size, that is, 418 feet in diameter. Another globe would be required as a cover for the actual earth-model, so that the expense of such a duplex structure would be enormous. Dr. Wallace gives a qualified support to M. Reclus' proposal ; for he thinks only one globe should be constructed, showing all the great geographical features of the earth on its outer surface, while on the inner surface would be formed that strictly accurate model which M. Reclus considers would justify the expense of such a great work.

Miss Mary Kingsley contributes to the *National* an interesting account of her ascent of "The Throne of Thunder," or the Peak of Cameroons, the highest point on the western side of the African continent. Twenty-seven white men have reached the peak, and Miss Kingsley describes the twenty-eighth ascent, the second successful one from the south-east face. In the same review Mr. A. G. Boscawen, M.P., gives his impressions of Japan, and concludes his remarks with a few words about British commercial interests in the Far East. It is satisfactory to note his remarks on the advantages to be gained by the appointment of commercial and technical advisers to foreign Legations. He says :—

"And now I would suggest what I have suggested elsewhere, that the Government ought to give a helping hand by appointing a commercial *attaché* to the Legation at Tōkyō, who I feel sure would prove most useful at the present moment, when the Japanese are friendly to us, and are certainly inclined to buy from us if we will only take the trouble to adapt our manufactures to their markets. Such an official, by keeping us constantly informed at home of what articles the Japanese require, would prevent a large portion of our trade from going to foreigners, especially to the Germans and Americans, who have for years taken far more trouble than we have to secure the goodwill of the Japanese."

A passing mention must suffice for the remaining articles of scientific interest in the magazines and reviews received. Sir Robert Ball writes on "The Scenery of the Moon," in the *Strand Magazine*, his description being illustrated by reproductions from lunar photographs. Miss Agnes Giberne treats the well-worn theme of "The Far Distance of our Universe," in *Chambers's Journal*, which also contains popular articles on the electric supply of London, jumping beans, and house-flies. Some suggestive points in connection with the evolution of language will be found in the article entitled "The Genesis of Expression," by M. L. Johnson, in the *Westminster Review*. A well-illustrated paper on "The Evolution of the Trotting Horse," contributed by Mr. Hamilton Bushey to *Scribner*, is not without interest to scientific readers. Under the title "Through Scientific Doubt to Faith," the *Quarterly Review* traces the mental history of Romanes, as evidenced by his own works, and in the lately published "Life and Letters," written and edited by his wife. The article is a complacent statement from the religious side. The Viscount Harberton writes on "Muzzling and the Prevention of Rabies" in the *Humanitarian*. Mr. P. C. Knapp brings forward evidence, in the *Century*, against the view that nervous disorders are increasing, and shows that, without more evidence in its favour, the belief in the greater nervousness of Americans is an error. Finally, the *Geographical Journal* contains Mr. St. George Littledale's account of "A Journey across Tibet, from North to South, and West to Ladak," and Mr. Edward A. FitzGerald's paper on "The First Crossing of the Southern Alps of New Zealand." Attention may profitably be drawn to the maps which illustrate Mr. Littledale's journey, and to a new map of the Upper Kuyuni River, British Guiana, from a recent survey.

THE METRIC SYSTEM IN THE UNITED STATES.

STRENUOUS efforts are being made by the American Metrological Society to secure the adoption of the Bill making the use of the metric system obligatory in the United States after a specified date. Letters have been sent to all who are interested in the question, soliciting their help and influence, and petitions are being numerously signed and sent in to Representatives. The Committee on Coinage, Weights and Measures, of the House, recently reported unanimously in favour of the Bill, and the introduction and conclusion of their interesting report are reprinted in *Science*, from which source the subjoined summary has been made.

For more than a generation after the construction of the constitution, the American people lived with no legal standard by which could be determined even the amount of metal which went into the coin that came from their mints. Gallatin procured from France a platinum kilogram and meter in 1821, and from England a troy pound in 1827, and in 1828 the latter was recognised as the standard for mint purposes by the following Act :

"For the purpose of securing due conformity in weight of the coins of the United States to the provisions of this title, the brass troy pound weight procured by the Minister of the United States at London in the year eighteen hundred and twenty-seven for the use of the mint and now in custody of the mint at Philadelphia, shall be the standard troy pound of the mint of the United States, conformably to which the coinage thereof shall be regulated."

Meantime both the people and the Government were using such weights and measures as were nearest at hand, derived in the main from the English ancestry, but made by themselves without any authoritative standard for comparison, and as a consequence differing materially from each other. In 1830 the Senate directed the Secretary of the Treasury to have a comparison made of the standards of weight and measure used at the principal custom houses of the United States, and report the same to the Senate. This was done, and large discrepancies and errors were found to exist. These discrepancies were nullifying and violating the provision of the Constitution which prescribes that "all duties, imposts and excises shall be uniform throughout the United States." Varying scales and varying measures inevitably produced varying rates of duty. The Treasury Department, therefore, in the exercise of its executive power and as a necessary incident and means to the execution of the law and the observance of the Constitution, adopted for the use of that Department the Troughton scale, then in the possession and use of the Coast Survey, as the unit of length, and the troy pound of the mint as the unit of weight. From the latter the avoirdupois pound was to be derived, assuming that there were 7000 grains in the pound avoirdupois to 5760 in the pound troy. For measures of capacity the wine gallon of 231 cubic inches, and the Winchester bushel of 2150·42 cubic inches, were adopted. This gave to the Treasury Department the basis of a system of weights and measures to be used in its operations, and in order to promote the general adoption and use of the same throughout the country, Congress, in June 1836, adopted the following joint resolution :

"That the Secretary of the Treasury be, and he hereby is,

directed to cause a complete set of all the weights and measures adopted as standards, and now either made or in the progress of manufacture for the use of the several custom houses, and for other purposes, to be delivered to the Governor of each State in the Union, or such persons as he may appoint, for the use of the States, respectively, to the end that a uniform standard of weights and measures may be established throughout the Union."

In accordance with this resolution, sets of the weights and measures adopted for use in the custom houses were sent to the several States, and only in this indirect and inferential way have the customary weights and measures of the United States been legally recognised. By the Act of March 3, 1881, similar sets of standards were directed to be supplied to the various agricultural colleges which had received land grants from the United States at a cost not exceeding 200 dols. for each set. This law was complied with as best it could be under the limitation of cost prescribed.

Meantime the metric system had come into extensive use among other nations, and into almost universal use in the realm of exact science the world over. The Americans touched it at every turn in their commercial relations and scientific investigations. Uniformity in weights and measures throughout the world was urged not only by men of science, but by sagacious business men, seeking to keep pace with the rapidly growing tendencies to closer commercial and business relations among the nations resulting from the improved facilities of communication and transportation which had largely removed the barriers of space and distance. Hence in 1866 Congress, with the approval of the President, placed on the statute books the following law :

"AN ACT to authorise the use of the metric system of weights and measures.

"*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled*, That from and after the passage of this Act it shall be lawful throughout the United States of America to employ the weights and measures of the metric system, and no contract or dealing, or pleading in any court, shall be deemed invalid or liable to objection because the weights or measures expressed or referred to therein are weights or measures of the metric system.

"Sec. 2. *And be it further enacted*, That the tables in the schedule hereto annexed shall be recognised in the construction of contracts, and in all leading proceedings, as establishing, in terms of the weights and measures now in use in the United States, the equivalents of the weights and measures expressed therein in terms of the metric system ; and said tables may be lawfully used for computing, determining and expressing, in customary weights and measures, the weights and measures of the metric system."

To make this law of practical use the following joint resolution was adopted :

"JOINT RESOLUTION to enable the Secretary of the Treasury to furnish each State with one set of the standard weights and measures of the metric system.

"*Be it resolved by the Senate and House of Representatives of the United States of America in Congress assembled*, That the Secretary of the Treasury be, and he is hereby authorised and directed to furnish to each State, to be delivered to the Governor thereof, one set of standard weights and measures of the metric system for the use of the State respectively."

By inadvertence, and without important legal significance, the resolutions providing for furnishing the standards became a law before the Act authorising the use of the system. In the same year Congress put it in the power of the Post-Office Department to make extensive use of metric weights in its operations. The law of that year was re-stated and re-enacted in 1872, and now stands in the Revised Statutes in the following terms :

"The Postmaster-General shall furnish to the post-offices exchanging mails with foreign countries, and to such other offices as he may deem expedient, postal balances denominated in grams of the metric system, fifteen grams of which shall be the equivalent for postal purposes, of one-half ounce avoirdupois, and so on in progression."

The International Postal Convention of two years later, and which by subsequent renewals is now in force between the United States and fifty other nations, uses only metric weights and terms, and to-day the mail matter transported between America and other nations, even between the United States and England, is weighed and paid for entirely in terms of metric weights.

Here legislation on the subject of weights and measures rested till 1893. In the meantime important action was taken by the Executive Department of the Government. The progress of science, carrying with it the capability of more accurate observation and measurement, had disclosed the fact that the metric standards in use in different countries differed among themselves, and indicated that even the standards in the archives of France could be constructed with greater precision and accuracy, and preserved with greater safeguards against possible variation from influence of the elements or other forces. Hence France invited the other nations to join in an international Commission for the purpose of constructing a new metre as an international standard of length. America accepted the invitation, and was represented in the Commission, which met in 1870, and continued its labours from time to time till they were finally consummated in the conclusion of a metric convention signed on May 20, 1875, by the representatives of the following nations, viz. the United States, Germany, Austria-Hungary, Belgium, Brazil, Argentine Confederation, Denmark, Spain, France, Italy, Peru, Portugal, Russia, Sweden and Norway, Switzerland, Turkey, and Venezuela.

The first name signed to this convention is that of E. B. Washburn, the United States Minister and Representative. The treaty provided for the establishment and maintenance, at the common expense of the contracting nations, of "a scientific and permanent international bureau of weights and measures, the location of which shall be Paris," to be conducted by "a general conference for weights and measures, to be composed of the delegates of all the contracting governments." Beyond the construction and custody of the international standards and the distribution to the several countries of copies thereof, it was expressly provided as to this conference by the terms of the treaty or convention that "it shall be its duty to discuss and initiate measures necessary for the dissemination and improvement of the metrical system." This convention was duly ratified by the Senate, and since that time the United States has been regularly represented in the International Conference, and has paid its proper proportion of the cost of maintaining the International Bureau of Weights and Measures. By the terms of the convention the privilege of acceding thereto and thus becoming a party to it was reserved to any nations desiring to avail themselves thereof, and accordingly the following nations have since become parties to the convention, viz. Servia in 1879, Roumania in 1882, Great Britain in 1884, Japan in 1885, and Mexico in 1891.

New standards were prepared with extreme care and accuracy, and duplicate copies thereof distributed to the several nations. Those for the United States were received with much ceremony at the White House, January 2, 1890, by the President in the presence of members of his Cabinet and other distinguished gentlemen, and are now carefully guarded in a fire-proof room set apart for the safe-keeping of the standards of weights and measures in the Coast Survey building.

By formal order of the Secretary of the Treasury of April 5, 1893, the metre and kilogram thus received and kept were recognised as "fundamental standards" from which the customary units of the yard and pound should be thereafter derived in accordance with the law of July 28, 1866.

Meantime Congress by Act of March 3, 1893, established a standard scale for measurement of sheet and plate iron and steel, expressed in terms of both the customary and metric measures. "An Act to define and establish the units of electrical measure" was passed by the Fifty-third Congress and approved July 12, 1894. It is based on the metrical system exclusively.

From this *résumé* of United States legislation on the subject of weights and measures it appears that a legal standard of weight has been established for use in the mint, but that beyond that the weights and measures in ordinary use rest on custom only with indirect legislative recognition ; that the metric weights and measures are made legal by direct legislative permission, and that standards of both systems have been equally furnished by the Government to the several States ; that the customary system has been adopted by the Treasury Department for use in the custom houses, but that the same Department by formal order has adopted the metric standards as the "fundamental standards" from which the measures of the customary system shall be derived. This presents a condition of legal complication and practical confusion that ought not to continue. The constitutional power vested in Congress should be exercised.

The Committee confessed that considerable temporary inconvenience would probably accompany the change, but they

believed that this was greatly over-estimated, and that it would be of short duration. But whether the inconvenience be little or great, it must some time be encountered, and it will not be decreased by the increase of the population. It will be no easier for a hundred millions of people ten years hence to make the change than for seventy millions to-day. It is simply a question whether this generation shall accept the annoyance and inconvenience of the change largely for the benefit of the next, or shall the people of to-day selfishly consult only their own ease and impose on their children the double burden of learning and then discarding the present "brain-wasting system." The present generation must meet this test of selfishness or unselfishness, and answer to posterity for duty performed or neglected.

The Committee, after a careful consideration of the whole subject, unanimously reached the conclusion that the metric system of weights and measures should be put into exclusive use in the various Departments of the Government at such future date as shall allow adequate preparation for the change, and at the end of a fixed time thereafter that said system shall be recognised as the only legal system for general use. They, however, do not deem it wise at present to require a change in the methods of surveying the public lands, as this would in that respect destroy rather than promote uniformity.

The Committee deemed it prudent to enlarge the time for the proposed system to take effect to a date somewhat later than the date proposed in the Bill submitted, adopting for America about the average time deemed necessary by other nations. It is therefore recommended that the time for adoption in the Departments and operations of the Government, except in the completion of the survey of the public lands, be fixed for July 1, 1898, and that the adoption of the metric system for use in the nation at large be fixed as coincident with the dawn of the twentieth century, and that date be accordingly changed to January 1, 1901, the first day of the new century.

The Bill reads as follows :—

"A Bill to fix the standard of weights and measures by the adoption of the metric system of weights and measures.

"*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled*, That from and after the first day of July, eighteen hundred and ninety-eight, all the Departments of the Government of the United States, in transaction of all business requiring the use of weight and measurement, except in completing the survey of the public lands, shall employ and use only the weights and measures of the metric system.

"Sec. 2. That from and after the first day of January, nineteen hundred and one, the metric system of weights and measures shall be the only legal system of weights and measures recognised in the United States.

"Sec. 3. That the metric system of weights and measures herein referred to is that in which the ultimate standard of mass or weight is the international kilogram of the International Bureau of Weights and Measures, established in accordance with the convention of May twentieth, eighteen hundred and seventy-five, and the ultimate standard of length is the international metre of the same bureau, the national prototypes of which are kilogram numbered twenty and metre numbered twenty-seven, preserved in the archives of the office of standard weights and measures.

"Sec. 4. That the tables in the schedules annexed to the Bill authorising the use of the metric system of weights and measures passed July twenty-eighth, eighteen hundred and sixty-six, shall be the tables of equivalents which may be lawfully used for computing, determining and expressing the customary weights and measures in the weights and measures of the metric system."

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The first Smith's Prize is awarded to Mr. W. S. Adie, bracketed Senior Wrangler 1894; the second is divided between Mr. A. Y. G. Campbell, bracketed ninth Wrangler, and Mr. F. W. Lawrence, bracketed fourth Wrangler in the same year. All the prizemen are members of Trinity College.

Prof. Newton, F.R.S., has been reappointed one of the managers of the Balfour Studentships in Animal Morphology until June 1901.

The School of Medicine of the University of Toronto has been placed on the list of Colonial Schools recognised by the Special Board for Medicine.

The Council of the Senate recommend for affiliation to the University the Roman Catholic College of St. Edmund's, Ware, the successor since 1793 of the former English College at Douai.

On account of the increasing length of the practical examinations for the Natural Sciences Tripos, the Medical Board propose that the examinations for M.B. shall in future take place at a later date in the Michaelmas and Easter Terms. It is noted that a number of medical students are following with advantage the course for the ordinary B.A. degree, and a rearrangement of the dates of the examinations has become necessary to meet their case.

The next examination for the diploma in Agriculture will begin on July 6, and last a week.

SIR WILLIAM PRIESTLEY, the distinguished physician, has been elected parliamentary representative of the Universities of Edinburgh and St. Andrews.

THE City and Guilds of London Institute is inviting applications for the Professorship of Mechanical Engineering and Applied Mathematics at the Technical College, Finsbury, rendered vacant by the appointment of Prof. John Perry, F.R.S., to a Professorship at the Royal College of Science. Applications for the appointment should be addressed to the Honorary Secretary at the office of the Institute, Gresham College, E.C.

THE following are among recent appointments :—Dr. Zuber, Privatdocent in Geology in Lemberg University, to be Extraordinary Professor; Dr. Henking, Privatdocent in Zoology in Göttingen University, to be Extraordinary Professor; Dr. Oertel to be Observer in the Observatory at Munich; Dr. Ludwig Kathariner to be Professor of Zoology and Comparative Anatomy in the University of Fribourg; Prof. Dr. Buchner to be Extraordinary Professor of Chemistry at Tübingen; Dr. Albert Fleischmann to be Director of the Zoological Institute at Erlangen; Dr. George Rörig to be Extraordinary Professor of Zoology in Königsberg University.

MR. JAMES G. LAWN, Instructor in Mine Surveying at the Royal College of Science, London, has been appointed Professor of Mining at the South African School of Mines. The School was started some years ago, but it is undergoing reorganisation. It is proposed that the course of instruction shall extend over four years; the first two years—in which scientific instruction will be given—being spent at the South African College, Cape Town. The third year will be spent at Kimberley, where theoretical and practical instruction in mining will be given. The fourth year will be chiefly taken up with practical work at Johannesburg. The Cape of Good Hope University is to be asked to establish a Mining degree, the final examinations for which the students would attend at the end of their fourth year. So far only the preliminary scientific instruction has been given, and Mr. Lawn is going out to organise and initiate the instruction to be given in the third and fourth years of the course. The salary is £800 a year.

FULL recognition is being given to the scientific attainments of women in America. We learn from *Science* that at Bryn Mawr College Miss F. Cook has been appointed Fellow in mathematics; Miss F. Lowwater, in physics, and Miss C. Fairbanks, in chemistry.

Science records the following gifts to education and research in America. Mrs. Lydia Bradley, of Peoria, Ill., has made known her attention of giving 1,000,000 dols. for a polytechnic institute in Peoria.—A Boston citizen, whose name is withheld, has given 100,000 dols. to establish a chair of Comparative Pathology in the medical school of Harvard University.—Mrs. J. S. T. Stranahan, of Brooklyn, has given 5000 dols. to the building fund of Barnard College.—The Catholic University has received 5000 dols. by the will of the Rev. Father Dougherty, of Honesdale, Pa.—It is expected that Mayor Strong will approve the Bill authorising the Board of Estimate and Apportionment to give the College of the City of New York 175,000 dols. a year instead of 150,000 dols., the amount it has received for several years.

AT the general meeting of Convocation of the University of London, held on Tuesday, it was resolved—"That some means should be devised for a more thorough preliminary investigation

than has hitherto been usual of the mathematical questions proposed to be set in the University examinations." The following resolutions were also carried. (1) That a special Committee of thirteen members, including the Chairman of Convocation, be nominated to prepare for presentation to any Statutory Commission which may be appointed a memorandum of points in the scheme of the Royal Commission in which modification is desirable, and with power to confer with such said Statutory Commission, and with the Senate or any Committee thereof. (2) That this special Committee consist of the following members:—The Chairman of Convocation, Dr. Allchin, Dr. Benson, Mr. Bompas, Mr. Stanley Boyd, Dr. Cave, Mr. Cozens-Hardy, Mr. Thiselton-Dyer, Dr. Heber Hart, Dr. Napier, Mr. Blake Odgers, Dr. Sansom, Prof. S. P. Thompson. (3) That the new and enlarged special Committee recommended for appointment in the report of the special Committee on the memorandum to be presented to such said Statutory Commission should have full powers, if it thinks fit, to prepare amendments to the London University Commission Bill and to have them proposed on behalf of Convocation in either House of Parliament.

AT a special meeting of the Technical Instruction Committee of the Cheshire County Council the following resolutions were adopted, and instructions given for them to be forwarded to the President and Vice-President of the Council.

(1) "That in the opinion of this Committee the Education Bill of this Session, as printed, will have the effect, by adding new subjects (not technical nor manual) for assistance out of the Customs and Excise grant, of making it impossible for the successors of this Committee, without recourse to a rate in aid, to continue the maintenance grants to those Science and Art Committees which their predecessors have, in good faith, on the assurance of her Majesty's Ministers in the past that the grant or its equivalent would not be withdrawn, fostered, or created. That the financial clauses of the Bill, confirming only a rate of one penny in the pound, in addition to the local taxation (Customs and Excise) grant, are inadequate for the work of secondary and technical education it is proposed the new Education Committee shall undertake."

(2) "That this Committee would respectfully urge upon her Majesty's Government that a County Council may have the option of nominating two school committees, one an elementary school committee, and the other a secondary school committee, with a view to secure for service in each committee members specially qualified for the work of each grade who would not have leisure time to attend to the two combined, and ventures to express a hope that for the purpose of education other than elementary the cost thereof may be wholly borne by the Imperial Exchequer, or, failing that, the Education Committee may have the benefit of at least a rate of 2*d.* in the pound."

(3) "That, in the opinion of this Committee, Clause II., Subsection 3, relating to the performance by the education authority of the work of the numerous school attendance committees in the county, is impracticable, and cannot be undertaken by the education authority."

SCIENTIFIC SERIALS.

American Journal of Science, April.—The morphology of *Triarthrus*, by C. E. Beecher. Most of the recent advances in the knowledge of trilobite structure have come from the study of Triarthrus. Much time was spent by the author in carefully working out the numerous specimens from the abundant material in the Yale Museum. Altogether upwards of five hundred individuals with appendages more or less complete have been investigated; and at the present time all the important exoskeletal features have been seen and described. The appendages of *Triarthrus* are exceptionally long. It must have been a sort of "Daddy Long-legs" among the Trilobites, as *Scutigera* is among the Myriapoda. The delicacy of the appendages and ventral membrane of trilobites and their rarity of preservation are sufficient demonstration that these portions of the outer integument were of extreme thinness, and therefore perfectly capable of performing the function of respiration. The paper is accompanied by a plate showing a dorsal and a ventral view of a specimen fully restored.—Climatic zones in Jurassic times, by A. E. Ortmann. The author proves that the argument given by Neumayr for the non-existence or non-action of topographical differences upon the distribution of the Jurassic faunas is a complete failure. Only one point may be granted, that a separation by land was not present in an extensive manner. On the other hand, it is highly probable that on the one side differences of depth of the seas, on the other differences of facies, are the laws governing the faunistic differences. The first cause applies especially to the distinction of the Mediterranean and Middle-European provinces, the second to that of the Middle-European and Russian (Boreal) provinces.—Metamorphism of a gabbro occurring in St. Lawrence County, N.Y., by C. H. Smith, junr. The extreme effect of metamorphism on this gabbro has been to produce complete recrystallisation, yielding a granulitic structure. This metamorphism takes place in three stages. The first is marked by the formation of scapolite and some scaly hornblende, with little or no sign of crushing, the probable agents of change being pressure, heat, and solutions. In the second stage the effects of crushing are pronounced. All of the constituents are granulated, and the rock becomes more or less gneissoid. At the same time the scaly hornblende increases in quantity, seeming to reach its maximum in this phase of the rock. Finally, in the third stage, the rock undergoes complete recrystallisation, the newly-formed constituents being arranged normal to the pressure that has crushed the rock, and thus producing a pronounced gneissoid structure.—An occurrence of free gold in granite, by G. P. Merrill. A piece of quartz described as "gold ore, Sonora, Mexico," was found to be not superficially impregnated with gold, but to contain flecks of free gold throughout its substance. There is no other way of accounting for it other than by considering it a true constituent of the rock, crystallised from the original magma. It is completely embedded in the clear grassy quartz and unfissured felspars. No pyrite or other sulphides could be detected. This is believed to be a unique occurrence.

Wiedemann's Annalen der Physik und Chemie, No. 4.—On the nature of the X-rays, by D. A. Goldhammer. The author believes the X-rays to be not longitudinal light waves, but ultra-violet rays of extreme shortness. The absence of refraction would be quite consistent with this view, since in several theories of dispersion the index of refraction for infinitely short waves is unity. The absence of reflection would be due to the smallness of the waves compared with the unevenness of ordinary polished surfaces. This also explains the absence of polarisation. As regards the variation of absorption with the density simply, this is analogous to the absorption of light by aniline and other solutions, which simply depends upon their concentration. The author gives no reason against these rays consisting of longitudinal vibrations.—On the determination of overtones, by C. Stumpf. Careful investigations show that wherever overtones may influence the result of an experiment, the source of sound must always be specially tested as regards its composition, and that theoretical proofs of the simplicity of a tone are often misleading. Wherever simple tones are to be produced, the sound must be as faint as possible, or the overtones must be excluded by interference.—On the origin of contact electricity, by C. Christiansen. To establish a difference of potential between mercury and either zinc, cadmium, lead, or tin amalgam, the presence of oxygen is essential. Further experiments were made with hydrochloric and sulphurous acids, carbon bisulphide and nitrous oxide. Hydrochloric acids gave a polarisation effect with all the amalgams for which it was found in the case of oxygen, and for copper in addition. SO_2 gave effects with zinc and cadmium. The other gases gave no effect.—Polarisation and resistance of a galvanic cell, by Franz Streintz. The author shows that the determination of galvanic polarisation in an electrolytic cell in a closed circuit is an impossibility, since the "resistance" of the cell is an unknown function of the current strength.—The iron sphere in a homogeneous magnetic field, by O Grotrian. By induction experiments made with coils of wire laid over an iron sphere so as to cut off segments of various sizes the author shows that the sphere is evenly magnetised throughout its substance, as predicted by theory. The result is not affected by the direction of "grain" of wrought iron.—Diminution of the intensity of sound with the distance, by K. L. Schaefer. Sound does not diminish in intensity strictly with the square of the distance, but at first more slowly, and then more rapidly. This was proved by means of a telephone attached to a clock and brought to different degrees of sensitiveness.

Memoirs (Zapiski) of the Caucasian Branch of the Russian Geographical Society, vol. xviii., Tiflis, 1896.—Review of the atmospheric sediments fallen in Caucasia during the spring and summer of 1894, by A. Woznesensky, with four maps.—A journey to the mountain region of the district Tchernomorsk, by N. Albof, with a map of the district, 6·7 miles to the inch. The author has visited, for botanical purposes, some of the least-known valleys of the region, and now gives the diary of his journey.—Studies in the geographical botany of Western Transcaucasia, by the same author. The article is full of valuable data. Several interesting finds are mentioned, such as the new species *Amphoricapus elegans*, and a *Campanula*, which so much exceeds all known species of the same genus by its beauty, that M. Albof proposes for it the name of *Campanula regina*, and remarks that its general shape so much differs from all other now living *Campanula* species that it must be, without doubt, a remainder from a foregone geological flora.—On the Kumyks, an anthropological sketch, by J. Pantukhof.—The Pshaves and their land, by M. Khizanachwili.—A journey to the central part of the land of the Chechenes, by Mdme. A. Rossikof, with a map, three miles to the inch, of this very little part of the main ridge.—A statistical description of the governments of Baku and Kars, from the "Caucasian Calendar."—The state of the glaciers on the northern slope of the Caucasus, by K. Rossikof, being the results of the measurements of the motion of several glaciers in 1893 and 1894; and on the present state of the desiccating lakes of the northern slopes of the Caucasus, by the same author. The same volume contains, as a supplement, a most welcome atlas of ethnographical maps of Transcaucasia, drawn by the Secretary of the Society, E. Kondratenko. The maps are the result of many years' work. The classification of the more than sixty different stems which inhabit Transcaucasia is the result of the remarkable works of Baron Uslar and his follower, M. Zagursky; and the numerical data as to the numbers of inhabitants belonging to each stem are obtained from a census made in the years 1886–1891. The maps, on the scale of thirteen miles to the inch, are seven in number, and represent the governments of Tiflis, Kutais, Baku, Elizabethpol, Daghestan, Erivan, and Kars. The limits of each village community are indicated, and the nationality which prevails in each village is shown in different colours; while, on the borders of each map, special coloured diagrams give the ethnographical composition and the numbers of each nationality for each town and district, as well as for the whole government, so that one sees at a glance their numerical proportions. Full tables of figures are given by M. E. Kondratenko in the text of the *Zapiski*. The value of this work is enhanced by an ethnographical map of Turkish Armenia and Kurdistan, published in the same volume. It is based upon V. Cuinet's statistics, given in his work, "La Turquie d'Asie," and shows in different colours the percentage of Turks and Armenians in each *kaza*, or sub-district.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, April 30.—"The Total Eclipse of the Sun, April 16, 1893. Report and Discussion of the Observations relating to Solar Physics." By J. Norman Lockyer, C.B., F.R.S.

The memoir first gives reports by Mr. Fowler and Mr. Shackleton as to the circumstances under which photographs of the spectra of the eclipsed sun were taken with prismatic cameras in West Africa and Brazil respectively on April 16, 1893. These are followed by a detailed description of the phenomena recorded, and a discussion of the method employed in dealing with the photographs. The coronal spectrum and the question of its possible variation, and the wave-lengths of the lines recorded in the spectra of the chromosphere and prominences, are next studied.

Finally, the loci of absorption in the sun's atmosphere are considered.

The inquiry into the chemical origins of the chromospheric and prominence lines is reserved for a subsequent memoir.

The general conclusions which have been arrived at are as follows:—

(1) With the prismatic camera, photographs may be obtained with short exposures, so that the phenomena can be recorded at short intervals during the eclipse.

(2) The most intense images of the prominences are produced by the H and K radiations of calcium. Those depicted by the rays of hydrogen and helium are less intense, and do not reach to so great a height.

(3) The forms of the prominences photographed in monochromatic light (H and K), during the eclipse of 1893, do not differ sensibly from those photographed at the same time with the coronagraph.

(4) The undoubted spectrum of the corona in 1893 consisted of eight rings, including that due to 1474 K. The evidence that these belong to the corona is absolutely conclusive. It is probable that they are only represented by feeble lines in the Fraunhofer spectrum, if present at all.

(5) All the coronal rings recorded were most intense in the brightest coronal regions, near the sun's equator, as depicted by the coronagraph.

(6) The strongest coronal line, 1474 K, is not represented in the spectrum of the chromosphere and prominences, while H and K do not appear in the spectrum of the corona, although they are the most intense radiations in the prominences.

(7) A comparison of the results with those obtained in previous eclipses confirms the idea that 1474 K is brighter at the maximum than at the minimum sun-spot period.

(8) Hydrogen rings were not photographed in the coronal spectrum of 1893.

(9) D_3 was absent from the coronal spectrum of 1893, and reasons are given which suggest that its recorded appearance in 1882 was simply a photographic effect due to the unequal sensitiveness of the isochromatic plate employed.

(10) There is distinct evidence of periodic changes of the continuous spectrum of the corona.

(11) Many lines hitherto unrecorded in the chromosphere and prominences were photographed by the prismatic cameras.

(12) The preliminary investigation of the chemical origins of the chromosphere and prominence lines enables us to state generally that the chief lines are due to calcium, hydrogen, helium, strontium, iron, magnesium, manganese, barium, chromium, and aluminium. None of the lines appear to be due to nickel, cobalt, cadmium, tin, zinc, silicon, or carbon.

(13) The spectra of the chromosphere and prominences become more complex as the photosphere is approached.

(14) In passing from the chromosphere to the prominences, some lines become relatively brighter but others dimmer. The same line sometimes behaves differently in this respect in different prominences.

(15) The prominences must be fed from the outer parts of the solar atmosphere, since their spectra show lines which are absent from the spectrum of the chromosphere.

(16) The absence of the Fraunhofer lines from the integrated spectra of the solar surroundings and uneclipsed photosphere shortly after totality need not necessarily imply the existence of a reversing layer.

(17) The spectrum of the base of the sun's atmosphere, as recorded by the prismatic camera, contains only a small number of lines as compared with the Fraunhofer spectrum. Some of the strongest bright lines in the spectrum of the chromosphere are not represented by dark lines in the Fraunhofer spectrum, and some of the most intense Fraunhofer lines were not seen bright in the spectrum of the chromosphere. The so-called "reversing layer" is therefore incompetent to produce the Fraunhofer spectrum by its absorption.

(18) Some of the Fraunhofer lines are produced by absorption taking place in the chromosphere, while others are produced by absorption at higher levels.

(19) The eclipse work strengthens the view that chemical substances are dissociated at solar temperatures.

May 7.—"On the Occurrence of the Element Gallium in the Clay-Ironstone of the Cleveland District of Yorkshire." By Prof. W. N. Hartley, F.R.S., and Hugh Ramage.

The evidence of the existence of gallium in the ore and in the metal rests on the measurements of the wave-lengths of the lines in a large number of photographed spectra and upon the relative strengths of the lines in the different materials examined and in the precipitates obtained therefrom.

Examples are given showing the nature of this evidence.

Chemical Society, April 23.—Mr. A. G. V. Harcourt, President, in the chair.—The following papers were read:—The constitution of the cereal celluloses, by C. F. Cross, E. J. Bevan, and C. Smith. The cereal celluloses may be resolved by acids into a residue of normal cellulose and a soluble furfuroid con-

stituent; the latter seems to be a pentosemonoformal of the constitution $C_5H_8O_3\begin{matrix}O\\ \diagup\\ \diagdown\\ O\end{matrix}\!\!>CH_2$.—On a new compound of cobalt and a rapid method of detecting cobalt in presence of nickel, by R. G. Durrant. On adding excess of an alkali bicarbonate, and then hydrogen peroxide, to a solution of cobalt salt, a green solution, which appears to contain a salt of cobaltic acid H_3CoO_4, is obtained.—Ethereal salts of optically active malic and lactic acids, by T. Purdie and S. Williamson. The specific rotations of the ethereal salts of active lactic and malic acids vary with the method of preparation of the substances; the variations in rotatory power do not seem to be altogether due to the occurrence of partial racemisation.—Metadichlorobenzene, by F. D. Chattaway and R. C. T. Evans. A convenient method of preparing large quantities of 1:3-dichlorobenzene from acetanilide is described.—On the temperature of certain flames, by W. N. Hartley.—The determination of the composition of a white sou by a method of spectrum analysis, by W. N. Hartley. A photograph of the spectrum of a white sou coined during the French Revolution of 1798 was taken, and by comparison with the quantitative spectra of the constituent metals, the composition of the coin was determined within certain limits; alloys, the compositions of which varied within these limits, were then made, and their spark spectra photographed. An alloy, consisting of 13·93 per cent. of lead, 72·35 of copper, 0·85 of iron, and 12·70 per cent. of zinc, was ultimately obtained, which gave a spark spectrum identical with that of the sou; the coin consequently has the above composition.—Halogen additive products of substituted thiosinnamines, by A. E. Dixon.—Acidic thiocarbimides, thioureas, and ureas, by A. E. Dixon.—Apparatus for the detection of boric acid, by W. M. Doherty. A method is given for the detection of boric acid in milk, wine, or other substance, depending on the fact that when boric acid is heated in a current of coal-gas which is then burnt, a characteristic colouration is imparted to the flame.

Zoological Society, April 29.—Sir William H. Flower, K.C.B., F.R.S., President, in the chair.—After the Auditors' Report had been read, and other preliminary business had been transacted, the Report of the Council on the proceedings of the Society during the year 1895 was read by Mr. P. L. Sclater, F.R.S., the Secretary. The total receipts of the Society for 1895 amounted to £26,958 9*s.* 1*d.*, showing an increase of £1851 8*s.* 6*d.* as compared with the previous year. This increase was attributable to the prevalence of fine weather during the summer and autumn of 1895, and also to the acquisition of a giraffe, and several other specially interesting additions to the Society's menagerie. A new edition of the list of animals in the Society's collection, of which the last (the eighth) was published in 1883, has been prepared under the direction of the Secretary. It contains a list of all the specimens of vertebrated animals that had been received by the Society during the past twelve years. This volume is now going through the press, and will, it is hoped, be ready for issue before the close of the present year. The number of visitors to the gardens in 1895 was 665,326, which was greater than it had been in any year during the past ten years. The corresponding number in 1894 had been 625,538. The number of animals in the Society's collection on December 31 last was 2369, of which 768 were mammals, 1267 birds, and 334 reptiles. Amongst the additions made during the past year, twelve were specially commented upon as of remarkable interest, and in most cases new to the Society's collection. Amongst these were a male lion from Somali-land (presented by her Majesty the Queen), a female South African giraffe, a pair of brindled gnus, a pair of sable antelopes, a Brazilian three-banded armadillo, a male Panolia deer from Southern China, an Alexandra parrakeet from the interior of Australia, a frilled lizard from Western Australia, a martial hawk-eagle from British East Africa, and two examples of Forsten's lorrikeet. The Report having been adopted, the meeting proceeded to elect the new Members of Council and the Officers for the ensuing year. The usual ballot having been taken, it was announced that General the Hon. Sir Percy Feilding, K.C.B., Prof. Alfred Newton, F.R.S., Sir Thomas Paine, Mr. E. Lort Phillips, and the Lord Walsingham, F.R.S., had been elected into the Council in the place of the retiring Members; and that Sir William H. Flower had been re-elected President, Mr. Charles Drummond Treasurer, and Mr. P. L. Sclater Secretary to the Society for the ensuing year.

PARIS.

Academy of Sciences, May 4.—M. A. Cornu in the chair.—On the theory of gases, by M. J. Bertrand. A critical examination of the well-known formula of Maxwell for the relation between the velocities of the gaseous molecules and their components in any arbitrarily chosen direction. This formula is described as necessarily absurd, since it gives an apparent solution of a problem insoluble from its very nature.—On the constitution and history of the lunar surface, by MM Loewy and Puiseux. The results of a study of a new serie of lunar photographs tend to show that it is unnecessary to assume the action of natural forces other than those now at work on the earth to explain the condition of the surface of the moon.—On the birds and butterflies observed in the centre of an intertropical tempest, by M. H. Faye. The author shows that the occurrence of birds and insects in the calm centre of a cyclone, a fact frequently observed, is in full accord with his theory of storms.—Concerning hematozoa in marsh-fever, by M. A. Laveran. Although the presence of amœboid parasites in the blood during marsh-fever is now well established, there is hardly any ground for the assumption of distinct species peculiar to each variety of the disease, one for tertiary ague, another for quaternary ague, and a third giving rise to irregular fevers. This assertion is supported both by the microscopical study of the parasite and by the clinical study of the disease.—Observations of the new Swift comet (*b* 1896 = 1896, April 13), made at the Observatory of Paris by M. G. Bigourdan.—On the approximate development of the perturbation function in the case of inequalities of a high order, by M. Maurice Hamy.—A property of movements on a surface, by M. Hadamard.—On the absorption of light by media possessing rotatory power, by M. E. Carvallo.—Electrostatic deviation of the kathode rays, by M. G. Jaumann. A reply to some criticisms and suggestions of M. Poincaré. By immersing the vacuum tube in oil forming the anode, the rays are much reduced in intensity, and in this state are strongly deviated by electrostatic forces.—Observations on the preceding communication, by M. Poincaré. The suggestion of M. Jaumann that inside a Crookes' tube the lines of force are rectilinear, is directly opposed to the conclusion drawn by Hertz from his experiments.—Apparatus for measuring currents of high frequency, by MM. G. Goiffe and E. Meylan.—Reply to some observations of M. Aug. Righi, by MM. L. Benoist and D. Hurmuzescu.—On the relation between the maximum production of the X-rays, the degree of vacuum and the form of the tubes, by MM. Victor Chabaud and D. Hurmuzescu. The pressure giving the maximum result varies with the shape of the tube. A form of tube is figured giving a choice of two anodes from which excellent results were obtained.—Radiography; some applications to the physiology of motion, by MM. Imbert and Bertin-Sans.—On a new method of preparing synthetically urea, and its symmetrical derivatives, by M. P. Cazeneuve. The carbonate of guaiacol, now easily obtained commercially, on treatment with alcoholic ammonia or amines, gives the corresponding urea in nearly theoretical yield.—Transformation of tariric and stearoleic acids into stearic acid, by M. A. Arnaud. This reduction, which is not effected by sodium amalgam, takes place readily with hydriodic acid and amorphous phosphorus.—On the presence, in the *Monotropa Hypopithys*, of a glucoside of methyl-salicylic ether, and on the hydrolysing ferment of this glucoside, by M. E. Bourquelot.—On maize, by M. Balland. Some analyses showing the superior nutritive power of Indian corn as compared with wheat.—On zeolites and the substitution of the water they contain by other substances, by M. G. Friedel. The dehydrated mineral readily takes up sulphuretted hydrogen, carbonic acid, hydrogen, and even atmospheric air, the last to such an extent as to render it impossible to determine the amount of water by loss or ignition.—On the Annelids at great depths in the Bay of Biscay, by M. Louis Roule. The results of soundings from the *Caudan* in April 1895.—On the first cause of potato-scab, by M. E. Roze.—On the age of the ophitic eruption of Algeria, by M. L. Gentil.—On a method of photographing the retina, by M. V. Guinkoff.—The fermentation of uric acid by micro-organisms, by M. E. Gerard. In the experiments cited the uric acid was split up into urea and ammonium carbonate.—Researches on the serotherapy of urinary infection, by MM. J. Albarran and E. Morny.—On the relations between the composition of the blood, the quantity of hæmoglobin, and the general state of the organism, by M. P. Lafon.—Projection of a thermometer column on a sensitive plate, by means of the Röntgen rays, by M. H. Bentéjac.

AMSTERDAM.

Royal Academy of Sciences, March 28.—Prof. van de Sande Bakhuyzen in the chair.—Prof. Kamerlingh Onnes exhibited a series of extremely clear photographs, obtained with Röntgen rays by Prof. Haga at Groningen. The exposure did not last longer than one minute.—Prof. Kamerlingh Onnes presented, on behalf of Dr. Siertsema, a paper to be published in the report of the meeting, on measurements of magnetic rotation dispersion in gases.—Prof. Franchimont on the action of nitric acid upon methyl and dimethyl amides at the ordinary temperature. The author showed to what extent the action depends upon the acid-residue of the amides, and proved that the same rules also hold good for the piperidides. For this purpose the author, in conjunction with Dr. van Erp, examined oxal-piperide, which enters into an unstable compound with nitric acid, but is not otherwise influenced, resembling in this tetramethyloxamide, previously studied in conjunction with Mr. Rouffaer. The author and Dr. Taverne examined (1) trichloracetpiperidide, a beautifully crystallised substance, fusing at 45°; (2) benzolsulphonepiperidide; (3) picrylpiperidide; and, as they had expected, they found that the first was not influenced, the second yielded nitropiperidine, and the third a picryldehydronitropiperidide as a red, beautifully crystallised body, fusing at 95°.—Prof. Franchimont further treated of the action of alkalies upon nitramines, in examining which action Dr. van Erp found that a great quantity of nitrous acid is formed. With some nitramines, as nitrohydantoin, nitromethylhydantoin, nitrolacetylureum, nitroamidoacetamide, when treated with baryta-water, the formation of nitrous acid already takes place at a low temperature; others, as nitroacetonyl-urea, ethylenedinitro-urea, dinitroglycoluril, &c., behave differently.

DIARY OF SOCIETIES.

LONDON.

THURSDAY, MAY 14.

ROYAL INSTITUTION, at 3.—The Art of Working Metals in Japan: W. Gowland.
SOCIETY OF ARTS, at 4.30.—Tea Planting in Darjeeling: G. W. Christison.
MATHEMATICAL SOCIETY, at 8.—On the Application of the Principal Function to the Solution of Delaunay's Canonical System of Equations: Prof. E. W. Brown.
INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The Influence of the Shape of the Applied Potential Difference Wave on the Iron Losses in Transformers: Stanley Beeton, C. Perry Taylor, and I. M. Barr.

FRIDAY, MAY 15.

ROYAL INSTITUTION, at 9.—Cable-laying on the Amazon River: Alexander Siemens.
EPIDEMIOLOGICAL SOCIETY, at 8.
QUEKETT MICROSCOPICAL CLUB, at 8.

MONDAY, MAY 18.

SOCIETY OF ARTS, at 8.—Applied Electro-chemistry: James Swinburne.
ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Journey from Talifu to Assam: H.R.H. Prince Henry of Orleans.
VICTORIA INSTITUTE, at 4.30.—Climate in India: Grant "Bey."

TUESDAY, MAY 19.

ROYAL INSTITUTION, at 3.—Ripples in Air and on Water: C. V. Boys, F.R.S.
SOCIETY OF ARTS, at 8.—Bronze Casting in Europe: George Simonds.
ZOOLOGICAL SOCIETY, at 8.30.—On an interesting Variation in the Pattern of the Teeth of a Specimen of the Common Field-Vole: G. E. H. Barrett-Hamilton.—Contributions to the Anatomy of Picarian Birds. No. III. The Anatomy of the Alcedinidæ: F. E. Beddard, F.R.S.
INSTITUTION OF CIVIL ENGINEERS, at 8.—The Magnetic Testing of Iron and Steel: Prof. J. A. Ewing, F.R.S.—Magnetic Data of Iron and Steel; Horace F. Parshall.
ROYAL STATISTICAL SOCIETY, at 5.
PATHOLOGICAL SOCIETY, at 8.30.—Annual Meeting.
ROYAL PHOTOGRAPHIC SOCIETY, at 8.—Photo-mechanical Methods in Austria: Ignatz Herbst.
ROYAL VICTORIA HALL, at 8.30.—A Visit to Armenia: Prof. A. V. Markoff.

WEDNESDAY, MAY 20.

SOCIETY OF ARTS, at 8.—Orthochromatic Photography: Captain W. de W. Abney, F.R.S.
ROYAL METEOROLOGICAL SOCIETY, at 7.30.—The Exposure of Anemometers: Richard H. Curtis.
ROYAL MICROSCOPICAL SOCIETY, at 8.

THURSDAY, MAY 21.

ROYAL SOCIETY, at 4.30.—On the Changes produced in Magnetised Iron and Steels by cooling to the Temperature of Liquid Air: Prof. J. Dewar, F.R.S., and Dr. J. A. Fleming, F.R.S.—Note on the Larva and of the Post-Larval Development of Leucosolenia variabilis, n. sp., with remarks on the Development of other Arconidæ: E. A. Minchin.—Helium and Argon. Part III. Experiments which have yielded Negative Results: Prof. Ramsay, F.R.S., and Dr. Collie.—On the Amount of Argon and Helium contained in the Gas from the Bath Springs: Lord Rayleigh, Sec.R.S.
ROYAL INSTITUTION, at 3.—The Art of Working Metals in Japan: W. Gowland.
CHEMICAL SOCIETY, at 8.—The Diphenylbenzenes. I. Metadiphenylbenzene: F. D. Chattaway and R. C. T. Evans.—Derivatives of Camphoric Acid: Dr. F. S. Kipping.—Some Substances exhibiting Rotatory Power both in the Liquid and Crystalline states: W. J. Pope.

FRIDAY, MAY 22.

ROYAL INSTITUTION, at 9.—Hysteresis: Prof. J. A. Ewing, F.R.S.
PHYSICAL SOCIETY, at 5.—On Dielectrics: R. Appleyard.—The Field of an Elliptical Current: J. Viriamu Jones.—An Instrument for Measuring Frequency: A. Campbell.

SATURDAY, MAY 23.

GEOLOGISTS' ASSOCIATION (Paddington at 11.45).—Excursion to Chippenham, Calne, Kellaways, and Corsham.
YORKSHIRE NATURALISTS' UNION, at Hellifield.—Four Days' Excursion for the investigation of Bowland.

BOOKS, PAMPHLET, and SERIALS RECEIVED.

BOOKS.—Alembic Club Reprints. No. 12. The Liquefaction of Gases: M. Faraday (Edinburgh, Clay).—Report on the Work of the Horn Scientific Expedition to Central Australia. Part 2. Zoology (Dulau).—Hausaland: C. H. Robinson (Low).—A Theoretical and Practical Treatise on the Manufacture of Sulphuric Acid and Alkali: Dr. G. Lunge, Vol. 3, 2nd edition (Gurney).—Electric Lighting and Power Distribution: W. P. Maycock, 3rd edition, 2 Vols., Vol. 1 (Whittaker).—The Whence and the Whither of Man: Prof. J. M. Tyler (Blackwood).—Graphical Calculus: A. H. Barker (Longmans).—A Handbook to the Order Lepidoptera: W. F. Kirby. Part 1. Butterflies, Vol. 2 (Allen).—Les Rayons X: Dr. C. E. Guillaume, deux édition (Paris, Gauthier-Villars).—Regenwaarnemingen in Nederlandsch-Indie, 1894 (Batavia).—Observations made at the Magnetical and Meteorological Observatory at Batavia, 1894 (Batavia).
PAMPHLET.—On Germinal Selection: A. Weismann (Open Court Publishing Company).
SERIALS.—Bulletin de L'Académie Royale des Sciences, 1896, No. 3 (Bruxelles).—Centralblatt für Anthropologie, &c., 1896, Heft 2 (Breslau).—American Journal of Science, May (New Haven).—Journal of the Franklin Institute, May (Philadelphia).—Psychological Review, May (Macmillan).

CONTENTS.