THURSDAY, JULY 11, 1907.

THE WOLLEY COLLECTION OF BIRDS' EGGS.

Oötheca Wolleyana, an illustrated Catalogue of the Collection of Birds' Eggs formed by the late John Wolley, jun. Edited from the original notes by Alfred Newton. Part iv., Alcæ—Anseres; with supplement and appendix, map, and three plates. (London: R. H. Porter, 1907.) Price 25*s.* net.

THE recent death of Prof. Alfred Newton attaches a melancholy interest to this work, which, though not of a strictly scientific nature, may, in some respects, be regarded as the *magnum opus* of the editor and joint author; whilst his friends should at least take comfort in the reflection that he was spared long enough to complete it. The publication was commenced in 1864, when part i. was issued; then suspended for a period of thirty-eight years, and recommenced in 1902, when part ii. completed the first volume. Part iii. appeared in 1905, and, together with the present issue, constitutes the second volume.

Part iv. includes the divers, grebes, shearwaters, &c., and also the herons, but the most important entries relate to the swans, geese, and ducks, in which John Wolley took an especial interest on account of the difficulty of obtaining properly identified eggs of these birds. There is also a supplement and appendix, the latter containing the publications of Wolley on natural history other than those included in the text of the "Oötheca," such as papers on mammals, reptiles, batrachians, and especially on insects. The supplement is occupied with corrections, omissions, and additions, the names of species not before included being in thick type. These latter are fairly numerous, and serve to bring the work up to date, especially in those cases where the earlier collectors had been unable to discover authentic eggs. There are also some corrections in nomenclature, especially in the case of the owls, some half-dozen of which receive different names, whether of genus or of species. This reminds us of the protest of the late Dr. Bree against the generic divisions of the owls. He was writing of the Ural owl, which, by the way, is one of the new species recorded, the editor having received an egg from the Lower Danube, taken in 1866; subsequently he obtained two from Finland, as recently as 1905. Again referring to the subject of nomenclature, the editor deplores the necessity for changing the name of *Falco sacer* into that of *F. cherrug*. But Rip van Winkle rubs his eyes when he finds his old friend *Aquila imperialis* become successively *A. mogilnik* and *A. heliaca*, and is very much disposed to ask, "What next?"

Since the "Oötheca Wolleyana" is now completed, we may take a retrospective view of the entire work. The editor disclaims for it any special scientific value, and remarks that

"there is no need to observe too strictly the technicalities of science. The arrangement (I will not call it classification) of the species named is one of them. The ideal taxonomy of birds is beyond the range of my vision."

Thus he only deals with genera and species, and does not further classify under families and orders. It is obvious that in all works on natural history, authors are bound to adopt some kind of sequence. Even the alphabetical plan used in the index is not absolutely free from difficulties, since such are the changes in genera that unless one knows the name likely to have been adopted, the search is apt to be troublesome. But this is a minor matter, for the whole subject of the classification of birds is very much in the condition of the British army at the present time, viz., as we are told, "in the melting-pot." Are the Accipitres or the Passeres ultimately to have precedence?

The scope and object of the work are, however, of much more importance than any questions of classification, and, since it relates to discoveries made chiefly about the middle of the nineteenth century, the present generation of ornithologists might naturally ask for information on these points. The answer would be that it is an illustrated catalogue containing details of the most authentic and probably one of the largest collections of European and Palæarctic birds' eggs that ever was made. Practically there are two authors, since the contributions of the editor equal, if they do not exceed, the extracts from the writings of Wolley himself. John Wolley died in 1859, at the early age of thirty-six, and shortly before his death he requested that his collection of birds' eggs should be handed over to his friend and companion, Alfred Newton, who likewise became his literary executor. The "Oötheca Wolleyana" is therefore justly dedicated to the Rev. John Wolley, of Beeston, Notts (long since deceased), "as an acknowledgment of his generosity in fulfilling the last wishes of his son." The sources for the compilation of the catalogue are letters to friends, fragmentary diaries, and, above all, his "egg-book." In bringing their joint contributions into notice, the editor's method has been to print the observations of Wolley in full-sized type, whilst the editorial explanations, including references to specimens obtained since 1859, are in small type.

It should be understood that there are practically two collections, since the collection originally formed by Alfred and Edward Newton in partnership has been incorporated with the Wolley collection, and increased by subsequent additions. For a few years after his friend's decease, the editor maintained a connection with some of his principal collectors in Lapland, and thus continued the work which commenced in 1853. Moreover, the original collection was confined to European species, but the editor has chosen to extend its limits to those of the western half of the Palæarctic region. Some idea of the magnitude of the catalogue may be gathered from the fact that there are, inclusive of those in the supplement, 6076 entries or sections, consisting of one or more eggs, to which a special history is attached. The number of eggs in each entry ranges from *one* to some *twenty* or *thirty* in the case of birds breeding in colonies. The average may be a little over four, which would give a total of about 25,000 eggs. This

is only a rough calculation, and may be wide of the mark. The number of species listed is approximately 650. Two samples of entries, slightly modified, are given :—

(1) *Falco Gyrfalco*, Linnæus. Sect. 192. *Four.* West Finmark, May 7, 1854. "J. W. *ipse.*"

(2) *Tringa subarquata*, (Guldenstädt). Sect. 6065. *One.* Kotelny Island, New Siberian Group, June 11, 1902.

It might perhaps be objected that the collection contains too many duplicates, and this redundance receives illustration, for instance, in the case of Buffon's skua. The first egg of this species was obtained by Wolley himself near the sources of the Tana on June 20, 1857, both birds being shot, and very few additional specimens were obtained during his lifetime. But from 1860 to 1862, the latter being the great lemming-year, the number of entries, mostly of pairs, occupies about nine pages of the catalogue. The fact is that Wolley had originated a movement which could not be stopped, and his collectors, having been once put on the right track, went on collecting mechanically, as it were, and without remorse. The same thing occurred in the case of the waxwing and some other species, the eggs of which were previously unknown, or at least unauthenticated.

It must not, however, be supposed that the "Ootheca Wolleyana" is a mere list of eggs, for the notes, whether of author or editor, are copious, and both interesting and valuable, not only to collectors, but to ornithologists in general. The above calculations may serve to give some idea of the labour involved in preparing for the press this immense mass of material—a labour of love, in the words of the editor, since he regards the catalogue as largely a record of ancient friendship. Its freedom from typographical errors is remarkable, considering the constant change of type, and the number of technical names. Nor is the editor dismayed by the length of time which has elapsed since its commencement, considering that the delay has not been without its advantages, as specimens unattainable in Wolley's lifetime, and for long after his death, have been acquired, and are recorded, some in the body of the work and others in the supplement. It should also be remembered that the joint collection, of which this is the catalogue, has been given to the University of Cambridge, "in whose museum of zoology," Prof. Newton trusts, "it may long continue."

The primary object of the "Ootheca" is to record the labours of the naturalist whose name it bears, and in further fulfilment of this duty a most interesting memoir of John Wolley is added (part ii., pp. ix–xxxix) by way of introduction to vol. i. There is a good likeness of him, based on a photograph taken about a year before his death. In that likeness we recognise the calm determination which was so characteristic of a man who, in the words of Hewitson, "had become as familiar with the king of birds as others are with crows and magpies." That was in what we may call the heroic stage of his career, when he was equally prepared to scale a precipice after an eagle or to swim out to an osprey's nest in the coldest of water. Four years afterwards the birds'-nester of 1849 had made no inconsiderable progress in the study of natural history, and thus, after the example of Linnæus, as also pointed out by Hewitson, he wended his way into Central Lapland, and laid the foundation of a series of campaigns which have made his memory famous in the annals of oology. It is not so much the hardships which he endured in the quest of eggs, though these were sufficiently severe, as his powers of endurance through three winters in Lapland that astonish us. Perhaps it was this mode of life, in conjunction with his remarkable indifference to ordinary comforts, which was partly the cause of his early death, before he had time fully to work out the results of his great experience. In 1858, together with the editor, he undertook a pious pilgrimage to the last breeding-place of the great auk on Eldey, in Iceland. An abstract by the editor of Wolley's researches in Iceland respecting the great auk appeared in the third volume of the *Ibis*. The same year he became one of the original members of the British Ornithologists' Union, and contributed two classical papers to the first volume of its journal. His death, in 1859, created the first vacancy in its ranks, and it is the opinion of all who knew him that, had he been spared, he would have taken a high place amongst the leading naturalists of the second half of the nineteenth century.

As regards the collection, that portion formed by Wolley dates from the early 'forties, when he was a boy at Eton, sometimes occupied in chasing dabchicks on the Thames. The portion formed by the Newtons was commenced probably somewhat later, and continued at intervals almost to the present time. Whilst residing at Elveden, they enjoyed great advantages for working some of the best districts of East Anglia, and were not slow to profit by their opportunities. When Wolley went to Cambridge in 1843, the fens afforded very good hunting-ground, though harriers were getting scarce even then. That paradise of birds, Whittlesea Mere, was still intact, not being drained until 1850. He succeeded in obtaining eggs of all three species of harrier, though none apparently of his own taking. The other rarities of the fens, such as the grasshopper-warbler, Savi's warbler, bearded tit, &c., likewise great numbers of spotted crake and water rail, he obtained second-hand, sometimes through "Plover George" (Harvey of Baits-bight), whom he always distrusted.

It would lengthen this notice unduly if we were disposed to enter into any detail as to the eggs obtained during his famous Sutherland campaign in 1849. He succeeded in proving that it is the grey-lag goose, and not the bean goose, which breeds in the north of Scotland, whilst his success amongst the eagles was duly recorded by Hewitson, whose third edition was greatly enriched by Wolley's results, both in Scotland and in Lapland. The editor of the "Ootheca" in many cases reproduces these extracts from Wolley's letters to Hewitson, or substitutes for them the original notes from the egg-book, occasionally including passages which had been omitted.

Thus, *apropos* of the pintail, Wolley expresses his feelings on the identification of eggs:—

"In common with some other ornithologists I had long been almost in a state of desperation about several of the ducks—about most of those, in fact, which do not, occasionally at least, breed in Great Britain. *Many a collector could produce the eggs of what ducks you please at a moment's notice, but few, very few, could give any kind of satisfactory account of them.*"

[That portion of the extract italicised was omitted by Hewitson.]

The fact is that a crisis was impending in the history of Wolley's collection. We gather from an inspection of the catalogue that many of the rarer eggs had been supplied, for the most part in single specimens, by dealers from abroad. It must in justice be said of M. Favrier, of Tangier, where Wolley paid a visit about 1845, that eggs of rare birds supplied by him were afterwards proved to be genuine on comparison with well-identified eggs obtained by Tristram's Algerian party in 1857. Subsequently to this date Wolley was enabled to supply deficiencies in his collection from the above source, partly by gifts and partly through exchange. But the problem of the nidification of birds breeding in the north of Europe he determined to solve for himself, and, as we have seen, the cream of his results went to swell the plates and pages of the third edition of "Hewitson." Those who wish to know more of this subject must consult the pages of the "Ootheca," and if we venture to deal with any particular group, by way of illustration, the Limicolæ perhaps will suit our purpose as well as any other, and a partial extract here and there must suffice. *Ex uno disce omnes.* Wolley's pæan of delight in fully identifying the eggs of jack-snipe may be quoted, partly for the purpose of illustrating his methods in Lapland.

"The next morning I went to Kharto-uoma with a good strength of beaters. I kept them as well as I could in line, myself in the middle. . . . Whenever a bird was put off its nest the man who saw it was to pass on the word, and the whole line was to stand, whilst I went to examine the eggs."

At length the expected signal was given, a nest had been discovered, and the sight of the eggs as they lay untouched raised his expectations to the highest pitch, until he succeeded in shooting "a true jack-snipe, the undoubted parent of the nest of eggs." Another most important find were the eggs of the spotted redshank, and these ultimately in considerable numbers, quite close to Muoniovara, his Lapland home. The editor doubts whether any ornithologist previous to this had ever seen a genuine specimen. Three picked eggs of this species were selected for figuring in the third edition of "Hewitson," and the editor expresses his regret that the present condition of these eggs in the collection would not justify him in figuring additional specimens. Another rare egg of this group is that of the bar-tailed godwit. A nest of four was obtained in Kittila, June 12, 1854, in time for Hewitson to figure two of them; the entire clutch is still in the collection. In 1858 and subsequently, some more complete clutches were secured, but on the whole it is probable that the bulk of these birds breed more to the eastward, as none came under Wolley's special notice. Hence eggs with "*Puna Kuovi*" in Wolley's handwriting are not to be found in many collections. Probably all the species of the Limicolæ which breed in Central Lapland were procured with their eggs, but there still remained species the nesting-places of which lie east of the White Sea, such as the grey plover, the little stint, the sanderling, the knot, and the curlew-sandpiper, the eggs of which were not added to his spoils. Their discovery is duly recorded in the "Ootheca" supplement, years after Wolley's death, and the melancholy reflection prevails that in this direction there is nothing more to be done. In the supplement the editor, *apropos* of specimens of knot and curlew-sandpiper from the New Siberian group found in 1902 and added to the collection in 1905, directs attention to an article in the *Ibis* for 1904 by Mr. Dresser. This is a translation in abstract of Dr. Walter's researches in the Taimyr peninsula, where the translator observes that

"Dr. Walter succeeded in taking eggs and young in down of the sanderling (*Calidris arenaria*), curlew-sandpiper (*Tringa subarquata*), and knot (*Tringa canutus*), the eggs of the last being especially valuable, as they are the first well-authenticated specimens yet obtained."

We presume that he is referring to eggs laid in the free state, as the editor claims to have the egg of the knot laid in the late Lord Lilford's aviary.

There are not many illustrations in part iv., but the work as a whole is sufficiently illustrated, especially part i. These illustrations are mainly of two kinds—figures principally of eggs, and lithographic landscapes. The plates of the eggs of raptorial birds by Balcombe are very successful. There are three plates devoted to eggs of the golden eagle, every one of which has a history, mainly Scotch eggs, though some came from Lapland. Nor are these all of Wolley's own taking, since both Alfred and Edward Newton personally shared in some of the Argyllshire captures. In the delineation of the eggs of the Passerines, the artist has perhaps not been quite so successful.

"Of all Mr. Wolley's discoveries," observes the editor, "the one with which his name will be especially perpetuated is his unveiling the mystery that had hitherto surrounded the breeding habits of the waxwing."

These eggs were not obtained in time for the third edition of "Hewitson," but were figured in the *Ibis* for 1861 "as Mr. Hewitson only could depict them." In the "Ootheca" an entire plate is devoted to eggs of the waxwing, which exhibit a fair amount of variety, but the figures do not compare favourably with those in the *Ibis*. One other group of eggs should be mentioned, viz., the double portraits of the seven eggs of the great auk contained in the collection, so well executed by Grönvold. The details regarding these eggs occupy about twenty pages of the catalogue, and it may interest persons who are prepared to give a high price to learn that Wolley's first great auk's egg, obtained on December 12, 1846, from Mr. D. Barclay

Bevan, cost him no more than 28*s*. The lithographic landscapes, especially numerous in vol. i., add greatly to the interest of this work. There are two very spirited sketches by Wolf of eagles' nests in Argyllshire, drawn to illustrate the locality previously mentioned, but the majority of these landscapes depict scenes in Lapland rendered more or less famous in connection with Wolley's exploits. The old Lapp altar near Muoniovara, the osprey's nest on the top of a Scotch fir on the Norwegian side of the watershed, and the great crane marsh, all three from original sketches by the editor, are examples of these landscapes. But perhaps the most interesting of all—certainly the most poetic—is the picture of the hooper asleep on her nest on an islet in the Patsjoki, at midnight, June 17–18, 1855; this is based on a faint sketch made by Wolley on the spot, and most skilfully interpreted by Mr. Jury. Again (Table O), there is a truly Lapland scene, where the facile golden-eye is about to deposit an egg in a *tylla*, fastened to a fir-tree, for the benefit of the wily native. A map of the country between the Gulf of Bothnia and the Arctic Ocean is added. Muoniovara occupies a fairly central position, and the district more especially exploited is comprised within the upper basins of the Muonio Elv and the Ounas Joki—a stretch of about 150 miles from S.E. to N.W. There is something very musical in the sound of many of the Finnish place-names. Those more especially associated with the great "finds" may be observed in considerable numbers in the central area of the map, and collectors who possess marked eggs from Lapland cannot fail to be interested in the topography of the district.

It is not easy to give anything like a synoptic view of a work which appears in the form of a catalogue, so that its general character can only be inferred from such extracts as we have ventured to make. There is abundance of oological lore, relating to a period when great discoveries were being made, and this matter has been carefully sifted by an editor whose critical acumen and extensive knowledge are well known. The work, therefore, cannot fail to be a valuable repertory of facts, and we are bound to admit that in the "Ootheca Wolleyana" the veteran ornithologist of Cambridge, whilst adding largely to the store of information originally acquired by Wolley, has raised a worthy monument to the memory of his long-lost friend, and we can only express our deep regret that since its completion Prof. Newton has likewise joined the majority. W. H. H.

INDIAN MALACOLOGY.

Land and Freshwater Mollusca of India, &c. By Lieut.-Col. H. H. Godwin-Austen. Supplementary to Messrs. Theobold and Hanley's "Conchologia Indica." Vol. ii., part x. Pp. 147–238; plates ci–cxvii. (London: Taylor and Francis, 1907.)

IT is just nineteen years since the first six parts (1882–1888) of this work were noticed in these pages (NATURE, July 5, 1888, pp. 217–218), and the author is now the sole active survivor of the celebrated band of Indian malacologists that included Theobald, the Nevills, Stoliczka, Benson, Beddome, and the two Blanfords. One by one they have nearly all gone from us (Dr. W. T. Blanford's demise is still fresh in our memories), leaving, alas, no successors in the field of their labours.

This but adds to our hope that Col. Godwin-Austen may long be spared to carry on the work he has begun, but, so wide is the field, can never expect to complete, especially since of late it has been only now and then he has been able to find time for the examination of material that has come to hand. As a consequence, seven years have elapsed since the appearance of the preceding part of the work before us.

The present number is on a line with its predecessors, and like them shows no arrangement of subject, the various notes being presumably placed in the order in which they were written, and consequently deal alternately with the two families Zonitidæ and Endodontidæ, to which alone the materials treated belong.

In the former family we find one new subgenus, Dalingia, and two new genera, Sarika and Staffordia, established; while the author transfers Austenia, Girasia, and Cryptosoma from the Helicarioninæ to the Macrochlamyinæ, and places Leptodontaria and Ibycus in the Durgellinæ. He further digresses advisedly to discuss the anatomy of three Japanese species, which have been referred to Macrochlamys, but which he shows must be removed, one to a new subgenus, Petalochlamys, and the other two to Lamprocystis.

The most interesting and aberrant member of the family is Stoliczka's genus Sophina, concerning which our author has much of interest to say.

To the family Endodontidæ, which is chiefly an Australasian group, three Indian representatives are referred, namely, Thysanota, Philalanka, and Sykesia, and a new subfamily, Thysanotinæ, is created for their reception.

The wonderful similarity of these animals to Corilla (a Ceylon genus) and Plectopylis is dwelt on, but Stoliczka's idea that the latter was related to Clausilia is rejected.

To the Thysanotinæ may also possibly belong the new genus Rahula, to which the *Helix macropleuris*, Benson, with other species, some new, is referred.

Among suggestions as to topographical distribution is the hint that the fauna of the Bhutan Himalayas may possibly be rather related to that of western China than to that of India.

At the same time, the author is inclined to consider the eastern Himalayas as the centre of dispersal of the genus Macrochlamys, and points to the geological evidence as tending to show that from Sikkim eastward up to the margin of the present plains was an old land area probably coeval with that of peninsular India, and once connected with it across what is now the delta of the Ganges. The south-eastern limit of the range of the genus appears to be about Tenasserim.

So far as the Gangetic valley is concerned, there has been a natural transport southward by flood-waters

of the mollusca inhabiting the mountain country, and the molluscan fauna of the great delta of the Ganges and Brahmaputra had its origin in the Himalayan slopes, although they have occupied their present quarters for sufficiently long a period to become specifically distinct. (BV)².

WATER AND THE PUBLIC HEALTH.

(1) *The Value of Pure Water.* By George C. Whipple. Pp. viii+84. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1907.) Price 4*s.* 6*d.* net.

(2) *The Bacteriological Examination of Water Supplies.* By Dr. William G. Savage. Pp. xvi+297. (London: H. K. Lewis, 1906.) Price 6*s.* 6*d.* net.

(1) THIS little book is planned on novel lines and deserves recognition. An extract will best serve to define its scope.

"Given two water sources equally available to a city for purposes of supply, both safe to drink, but one high coloured and soft, the other colourless and hard—which is the better selection? A water-works plant is to be appraised: structurally the system is a good one, but the quality of the water is unsatisfactory because of its excessive colour or turbidity—how much should be deducted from the value of the works because of the bad quality of the water? The water-works owned by a private company are to be purchased by the city; the city has a high typhoid fever death-rate, due unquestionably to the water supply—how much less should the city pay because of that fact? A city is using turbid river water—how much can it afford to pay to filter it? A city is using a water so heavily laden with Anabæna that it is nauseous to drink—how much can the city afford to pay to procure a new supply?"

An attempt is made from available data to establish formulæ which may be employed to calculate the allowable depreciation due to sanitary quality, physical characteristics (colour, odour, &c.), hardness, &c., of a water supply.

The following example is a calculation in the case of typhoid fever. The financial loss to the community for each death from typhoid fever is assumed from various data to be equal to 10,000 dollars. A proportion of the death-rate is due to the disease transmitted by means (shell-fish, flies, &c.) other than water. Assuming that all typhoid in excess of N is due to the water supply, that the daily consumption of water is 100 gallons per capita, and that T is the total typhoid death-rate per 100,000, then (T−N) 10,000=loss to the community in dollars for 365×100×100,000 gallons of water, or

$$D=\frac{(T-N)1000}{365}=2\cdot75(T-N),$$

where D stands for the loss in dollars per million gallons of water used. The author is quite alive to the fact that local and other conditions must modify his conclusions, and recognises that more data are required before finality is reached in the elaboration of the formulæ. The book is suggestive and stimulating reading, the various tables add to its value, and we heartily commend it to the sanitarian and water engineer.

(2) This book by Dr. Savage, who has made many important contributions to the subject on which he writes, gives an admirable survey of the present position of the bacteriology of water supplies. Successive chapters deal with the bacterial content of waters and the influences affecting it, excreta, sewage, and soil in relation to the bacteriological examination, the characters of the intestinal bacteria, bacterial evidences of pollution, and full details of the methods employed in the bacteriological examination of water. The chapter on the interpretation of results is particularly to be recommended. A full bibliography is appended. The medical officer of health, the analyst, and the bacteriologist will find this book a trustworthy and useful guide. R. T. HEWLETT.

THREE MATHEMATICAL TRACTS.

Quadratic Forms and their Classification by Means of Invariant Factors. By Prof. T. J. I'A. Bromwich, F.R.S. Pp. viii+100. (Cambridge: The University Press, 1906.) Price 3*s.* 6*d.* net.

The Axioms of Projective Geometry. By Dr. A. N. Whitehead, F.R.S. Pp. viii+64. (Cambridge: The University Press, 1906.) Price 2*s.* 6*d.*

The Axioms of Descriptive Geometry. By Dr. A. N. Whitehead, F.R.S. Pp. viii+74. (Cambridge: The University Press, 1907.) Price 2*s.* 6*d.*

THESE are Nos. 3, 4, and 5 of the Cambridge Tracts in Mathematics and Mathematical Physics, which are intended to help students by providing them with brief and readable introductions to mathematical theories which are important in themselves, and yet for various reasons do not appear in the ordinary text-books. If they serve their purpose they will induce their readers to follow up the paths they indicate, and try to explore still further the mazy garden of the mathematical muse.

The present state of the theory of quadratic forms illustrates very well how much interest there may be in the particular cases of a problem which, in its so-called "general form," has a trite and familiar solution. To put the matter into a geometrical shape; when there are four homogeneous variables, let S=0, T=0 be the equations of two quadratic surfaces; then in general the family $S+\lambda T=0$ will have a common self-conjugate tetrahedron, and by taking this as a tetrahedron of reference, S and T assume a well-known standard form. But there are thirteen other cases to consider, for each of which there is a distinct reduced form of $S+\lambda T$; for instance, if S and T intersect in a cuspidal quartic, the reduced form is

$$2(\lambda+a)xy+2yz+b(\lambda+a)z^2+c(\lambda+a')t^2.$$

If we consider the small oscillations of a dynamical system with four degrees of freedom, we are confronted by precisely the same analytical problem of reduction; the algebraical classification is the same, but certain cases are ruled out by the condition that

the kinetic energy of the system is necessarily positive; still more, if the potential energy is a true minimum.

Prof. Bromwich has given an excellent account of the analytical theory, with various geometrical and dynamical illustrations, and he has added a very useful bibliography. As he has pointed out himself, he has selected Kronecker's method of proof of the invariance of the factors of the discriminant of $S+\lambda T$; and he has made no reference to the specially arithmetical form of the problem, where the coefficients of the forms are integers, and the equations of transformation have to be unitary and integral. For this, the student will consult Frobenius, Hensel, and H. J. Smith, whose memoirs, of course, Prof. Bromwich includes in his list of references.

Dr. Whitehead's chapters deal with a subject which, on the one hand, is more ancient than that of Prof. Bromwich, but, on the other, has changed its aspect recently in a much more remarkable way. Dr. Whitehead is one of the company of sappers who are reducing all the mathematical part of geometry to a system of abstract logic applied to a minimum number of undefinable entities, connected by a minimum number of undefinable relations. Put in this bald way, their work seems purely destructive and hateful, but in reality it is not so. In the tract on projective geometry it is shown how, with the help of Dedekind's axiom, and those of order, it is possible to make rigorous von Staudt's proof that all the points on a line are either reached by harmonic constructions starting from three given points, or definable as limiting points of a set of such points. This leads to definitions of numerical cross-ratios and of numerical homogeneous coordinates *which are independent of any theory of distance or measurement*, a very remarkable and far-reaching result. It is very encouraging to find that the magnificent genius of von Staudt is gradually gaining the recognition that it deserves; the interval between him and his predecessors is at least as great as that between Apollonius and Steiner.

By "descriptive" geometry Dr. Whitehead means "any geometry in which two straight lines in a plane do not necessarily intersect." Besides the discussion of preliminary axioms and definitions, his second tract falls into two principal parts; the first deals with the problem of enlarging a descriptive space into a projective space (the simplest example is that of adjoining the plane at infinity to Euclidean space), the second with the theory of displacements and measurement. The latter is based upon what is, perhaps, the only satisfactory method—that of Sophus Lie. The last chapter gives the formulæ of metrical geometry in the shape given to them by Cayley and Laguerre, so that, neglecting a constant numerical factor, a distance and an angle are each measured by the logarithm of a cross-ratio. The cross-ratio, of course, must be *projectively* defined, otherwise we should be in a vicious circle, and it is in the avoidance of this circle that the latest perfection of the theory consists.

G. B. M.

OUR BOOK SHELF.

Practical Agricultural Chemistry. By F. D. S. Robertson. Pp. x+210. (London: Baillière, Tindall and Cox, 1907.) Price 7*s.* 6*d.* net.

In his introduction the author tells us that his book is intended as a course of laboratory practice for the use of students in agricultural chemistry. How much time does he suppose such students can give to agricultural chemistry to allow them to deal with subjects like the valuation of tea and coffee, or the determination of hop resin and glycerin in beer? To what class of readers is a paragraph like the following of use? "*The Bitter Used.* This is necessarily a tedious operation, and for full particulars the reader is referred to such books upon poisons as describe the processes of Dragendorff and others. The prepared and concentrated beer is subjected to a series of extractions with petroleum ether, benzene, chloroform, and amyl alcohol, each of which is examined in turn."

Even in the more properly agricultural parts of the book there is little evidence that the author possesses any working acquaintance with his subject, *e.g.* the chapter on the analysis of soils is the merest skeleton, possessing small reference to the methods in regular use, and containing actual errors, such as the attempt to estimate humus by solution in ammonia without a preliminary treatment of the soil with acid.

Again, in his description of the Reichert-Wollny process for estimating volatile acids in butter, the author says nothing of the official standardisation of the dimensions of the apparatus and other details, which, however, must be followed if figures are to be obtained comparable with those of other analysts, and indeed are absolutely essential if the analyst is doing public work. We cannot recommend Mr. Robertson's book.

An Episode of Flatland, or How a Plane Folk discovered the Third Dimension, to which is added An Outline of the History of Unaea. By C. H. Hinton. Pp 181. (London: Swan Sonnenschein and Co., Ltd.)

These plane people live on the edge of a disc which is their world. A third dimension exists only in their mathematics. Their astronomers find that a catastrophe will certainly happen. One cranky philosopher believes that there is a third dimension, and shows a scared people how their world may be tilted and the catastrophe averted. The author's characters act and make love much like three-dimensional people, and they talk of a higher dimension just as Mr. Hinton would himself talk of a fourth dimension. There never was an allegory, not even that of Bunyan, which was consistent with itself for one chapter, but Mr. Hinton's is more inconsistent with itself than any other allegory we have seen. J. P.

The Bernese Oberland. Vol. iii. Dent de Morcles to the Gemmi. By H. Dübi. Pp. xxiv+136. (London: T. Fisher Unwin, 1907.) Price 10*s.*

This conveniently arranged pocket-book is the most recent addition to the "Climbers' Guides" edited by Sir Martin Conway and the Rev. W. A. B. Coolidge. The southern limit of the region described is the Rhone Valley from Martigny to Leuk; and the northern is marked by the low passes leading from the Ormonts-Lessus glen to Kandersteg by the heads of the Grande Eau, the Sarine, the Simme, and the Kander valleys, which mark it off from the foothills. The preface of the book directs attention to the fact that the present is the jubilee year of the formation of the Alpine Club and of the ascents of the Oldenhorn and the Wildstrubel, and we are confident that the increase in the number of climbers during the last fifty years will ensure a wide popularity for this workmanlike volume of "marching orders."

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.*]

Layard's Beaked Whale (Mesoplodon layardi, Flower).

ON February 17 a Layard's beaked whale was found stranded on the beach a little south of Zwartkops River, north of Port Elizabeth, by Joseph G. Crawford. The following morning I dispatched my assistant, Mr. Jas. Crawford, to inspect the carcase. He brought the tusks back, when the animal was identified as Layard's beaked whale. Immediate action was taken, with the result that the skeleton is now mounted in the Port Elizabeth Museum. As the carcase was partially decomposed when discovered, it was impossible to save the skin, but measurements and drawings were taken on the spot, and the coloration of the skin noted.

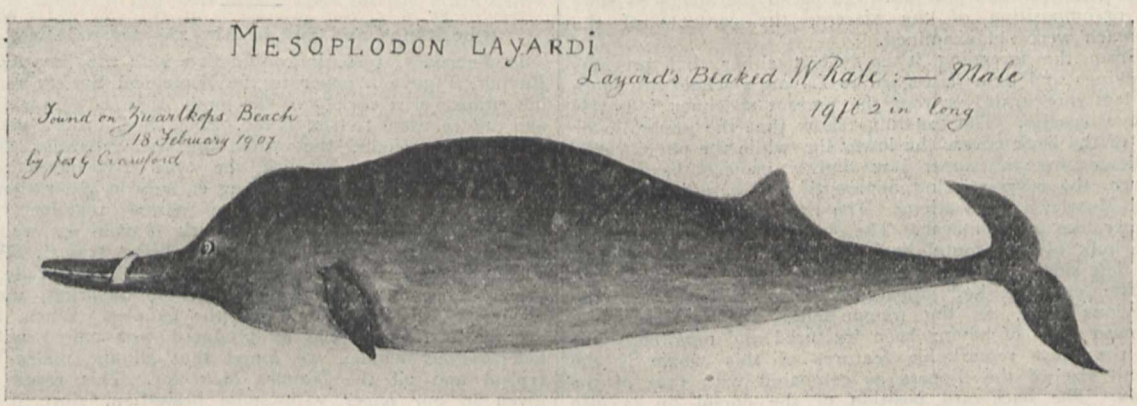


FIG. 1.—Layard's Beaked Whale, from a drawing. Engraving photographed by Mr. F. W. FitzSimons director of the Port Elizabeth Museum.

So little is known of this whale that the present specimen is of considerable importance. The skull, teeth, breast-bones, the entire skeleton, and other parts have been photographed from every point of view, while photographs have also been taken from a sketch, to scale, of the animal while lying on the beach. Any institutions requiring copies of these photographs may have them on application to me if they will defray the expense connected with their reproduction.

The following are the details :—

The animal, which was a male, measured 19 feet 2 inches in length, was entire, and showed no external injury. The colour of the back was dark brown, inclining to black on the dorsal surface, gradually merging to brown on the sides and tail, and becoming whitey-brown or dirty white on the belly. In Prof. Moseley's description there is stated to be a distinct line of demarcation between the black and the white, but in the specimen under discussion the blackish of the back gradually merged to brown on the sides, and dull white on the belly.

The flippers measured 22 inches; the dorsal fin, which is situated far back, was 13 inches wide and 11 inches high; the tail, 4 feet 6 inches across at extremes; and the interval from the point of the beak to the eye was 38 inches, and to the end of the jaw 4 feet. The exposed portion of the teeth was 11 inches long and 2½ inches wide at the base, becoming slightly narrower towards the tip, with the conical real tooth at the front of the summit. This tooth is enamelled and sharply tipped.

In the figure of the skull given by Moseley on p. 157 of "A Naturalist on the *Challenger*," there are marked differences when compared with our specimen. Thus the lower jaw shows an upward bend in front, whilst in our specimen it is straight. The proportion of the slope in the upper jaw is also dissimilar, whilst the teeth show a kind of wearing-away slope toward the middle portion. The teeth in our whale are uniform from base to tip, showing no wearing away or indication of friction. The small real tooth at the summit of each tusk is sharp, and not wart-like. Again, though the figure given by Moseley shows the teeth uniform, and not crossed, it is stated in the text that their extremities cross. The second illustration to this article distinctly shows the absence of any crossing of the tusks. This was ascertained before they were removed from the jaws. The tusks were firmly embedded in their sockets.

In Sclater's "Fauna of South Africa," vol. ii., p. 194, is an illustration of the snout of a Layard's whale with the tusks crossed, and the drawing shows important differences when compared with the photographs of our specimen. Inspection of the muzzle proved that this whale was able to open its mouth from 4½ inches to 5 inches at the tip. The fleshy covering of the upper jaw beneath the teeth showed no mark or abrasion, indicating that the beak was opened only so far as the teeth allowed. Moseley

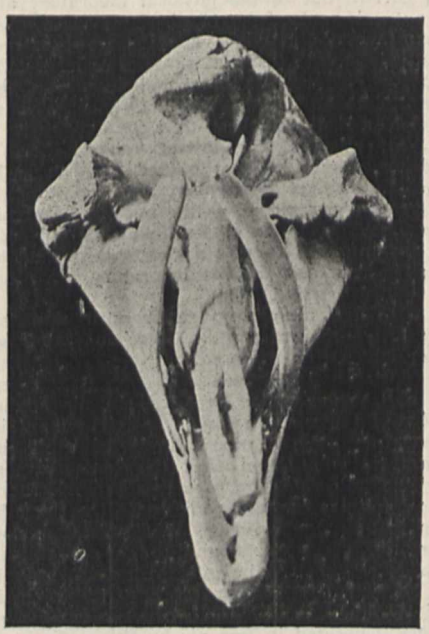


FIG. 2.—Upper views of skull of Layard's Beaked Whale. From a photograph by Mr. F. W. FitzSimons, director of the Port Elizabeth Museum.

states that the hollowing-out of the central part of the tusks figured by him was caused by the friction of the snout when the animal opened its mouth. The tusks of our specimen showed no such sign, and the skin of the beak displayed no indication of coming frequently into contact with a hard body. Judging from the width of the

gullet, this whale does not require to open its mouth very wide; as the gullet is only from 1¾ inches to 2 inches in diameter, it indicates that the food consists of small morsels. The sharp, enamelled tooth at the summit of the tusk is probably used for tearing and rending soft-bodied animals such as cuttle-fishes, and possibly for tearing aside seaweeds when in search of food.

The tusks are 14 inches in length, 2½ inches wide at the jaw, 1⅜ inches at the summit beneath the conical real tooth, and from ⅜ inch to ½ inch thick. On the back the blubber was 3 inches thick, and 1½ inches on the belly. The oil was of fine quality, and had great penetrating power, almost like paraffin. Owing to the advanced state of decomposition of the viscera, the contents of the stomach were not examined.

From the foregoing it is evident either that previous drawings and data in regard to Layard's whale are more or less inaccurate, or that the present specimen indicates a new species. The drawings show that the upper lip or tip of the beak covers the lower lip, while the photographs indicate that the upper jaw slightly projects beyond the lower, the reverse being apparently the case in Sclater's and Moseley's illustrations. The lips were not horny, but rather like hardish flesh. The skull is very asymmetrical, the bulk of the frontal bones inclining from the right to the left side.

The creature had apparently been injured at some previous time, as the tongue-bones and two vertebræ showed signs of having been fractured and repaired. One of the most remarkable features of this whale is the small size of the flippers as compared with that of the body. The backward position of the dorsal fin is also noticeable. With the exception of those of the skull, the bones are remarkably light and porous. Those of the beak are, however, brittle, dense, and hard.

F. W. FITZSIMONS.

Port Elizabeth Museum, May 30.

The Radio-activity of Lead and other Metals.

IN the course of some experiments that have been recently carried out in the physical laboratory at Toronto on the natural conductivity of air confined in vessels made of different metals, a wide variation was observed in the results obtained with different samples of lead. The lowest conductivity observed with air enclosed by this metal corresponded to an average production of 23 ions per c.c. per second, and the highest to a production of 160 ions per c.c. per second. The lowest value hitherto recorded for lead appears to be that quoted by Eve in his paper in the *Phil. Mag.* of September, 1906, in which he gives 96 ions per c.c. per second as the number he obtained with this metal. The sample of lead which exhibited the low activity just referred to was a sheet which had been used as a lining in a case in the laboratory for nearly thirty years.

With zinc and aluminium receivers it was found that on the average 15 ions per c.c. were generated per second in the air which they enclosed.

From measurements made with the gamma rays from radium on the ionisation produced in air confined in a lead cylinder (1) when unlined, and (2) when lined with thin sheet aluminium, due allowance being made for absorption, it was found that the ionisation in a lead cylinder due to the gamma rays was one-half that obtained with the excited secondary radiation. On the other hand, with an aluminium cylinder, the ionisation due to the secondary radiation was found to be approximately one-half that produced by the gamma rays. Assuming these results to hold for the penetrating radiation from the earth, it follows that on the average 9 ions per c.c. per second are generated in free air by this radiation. It also follows that the difference between the natural ionisation in air observed with the aluminium cylinder, viz. 15 ions per c.c. per second, and that found with the least active lead, viz. 23 ions per c.c. per second, can be wholly explained by differences in the secondary radiation excited in the two metals. This result, combined with the observed differences in the conductivity of air enclosed in vessels made of different samples of lead, goes to show that the high activity usually observed with lead is due to the presence of active impurities in it, and not to the existence of any intrinsic activity possessed by the metal. In this connection it is interesting to note that Elster and Geitel (*Phys. Zeit.*, November, 1906, and May, 1907) have recently been able to extract from commercial lead oxide and a sample of lead an active substance which they suggest may possibly turn out to be radium F.

In the experiments described above, the measurements were made with a sensitive quadrant electrometer on air confined in cylindrical vessels 60 cm. high and 24 cm. in diameter.

J. C. MCLENNAN.

University of Toronto, June 25.

Inheritance and Sex in Abraxas grossulariata.

IN February, 1906, in conjunction with the Rev. G. H. Raynor, I gave a paper to the Zoological Society on the inheritance of a variety of the moth *Abraxas grossulariata* and its relation to sex (Proc. Zool. Soc., 1906, vol. i., p. 129). We found that when the var. *lacticolor* (*flavofasciata*) was crossed with the type it behaved as a Mendelian recessive, disappearing entirely in generation F_1. When two heterozygotes were mated together, var. *lacticolor* reappeared, but only in the female sex, roughly half the females and all the males being typical. When a heterozygous male was mated with *lacticolor* female, the variety appeared in both sexes in the offspring, viz. in about half the males and half the females. When, however, a *lacticolor* male so produced was paired with a heterozygous female, we found that all the males were typical and all the females *lacticolor*. This result was given in our paper with some hesitation, since it was founded on a rather small number of specimens (29 ♂, 11 ♀), but this year it is amply confirmed. I have reared 116 males and 74 females from six families of this mating, and every male is typical, every female *lacticolor*. Mr. Raynor has also reared equally large numbers with the same result. From a family of the converse cross, on the other hand (*lacticolor* ♀ × heterozygous ♂), I have reared 24 type ♂, 22 *lacticolor* ♂, 17 type ♀, 18 *lacticolor* ♀, a fair approach to the expected equality in each sex.

I think it may be concluded definitely that in this case

(1) The type is completely dominant.
(2) DR♀ × DR♂ gives DD♂ + DR♂, DR♀ + RR♀.
(3) R♀ × DR♂ gives DR♂ + R♂, DR♀ + R♀.
(4) DR♀ × R♂ gives DR♂, R♀.
(5) R♀ × R♂ gives R♂, R♀.

(In [2] above the absence of DD females has not been proved.)

This confirmation of our previous results seems to me to lend some support to the provisional hypothesis of sex-determination outlined in the paper referred to.

L. DONCASTER.

University of Birmingham, July 2.

THE DOUBLE-DRIFT THEORY OF STAR MOTIONS.

THE problem of determining the motion of the sun amongst the stars has undergone a great change in consequence of Prof. J. C. Kapteyn's investigations, which have recently become known. These researches indicated that the stars surrounding us do not form a simple system, but a dual one. From a discussion of the motions of the stars of Bradley's catalogue, Prof. Kapteyn demonstrated the existence of two great streams of stars passing through one another, and found the directions of motion of these streams relative to the sun and to one another. The Bradley stars, numbering about 2600, are mainly stars visible to the naked eye; they cover nearly three-quarters of the celestial sphere, and throughout the whole of this area Prof. Kapteyn found the same two streams prevailing, and it seemed probable that all the stars he examined belonged to one or other of the two streams.

The investigations with which this article more particularly deals are based on the proper motions

deduced by Prof. Dyson and Mr. Thackeray from their re-reduction of Groombridge's Catalogue. The number of stars included is 4200, all confined to a region within 52° of the North Pole. About 1100 Carrington proper motions were also examined; these were all within 9° of the Pole. These two catalogues contain a large proportion of stars much fainter than those of Bradley, and enable the inquiry to be extended as far as magnitude 9·5. The same two streams are found to prevail among these faint stars, and it seems a fair conclusion that all the stars down to at least magnitude 9·5—more than half-a-million in number—are within the scope of the theory. It should, however, be remembered that only *samples* have been taken, in limited regions of the sky, for these fainter stars, so that there is a possibility of unexpected deviations from theory in the at present unexplored regions.

To indicate how it is possible to distinguish whether the stars in a given region of the sky belong to a single system or to a double system, or to something still more complex, it will be well to take an actual instance. In Fig. 1 the curve P has been drawn to

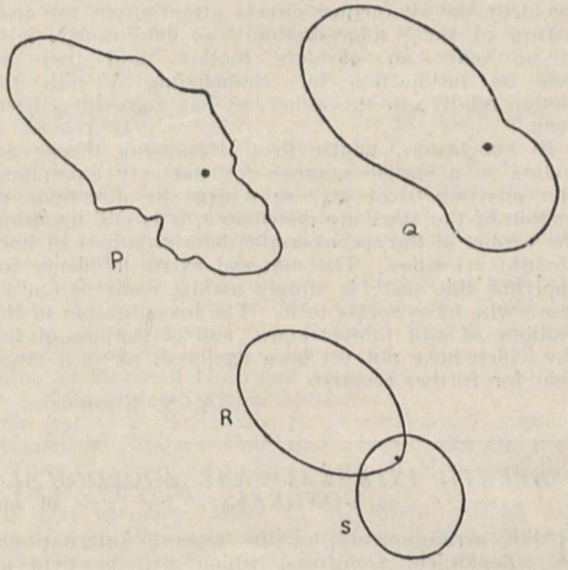


FIG. 1.—Showing the analysis of the observed motions into two simple drifts.

summarise the proper motions of the stars in a region of the sky comprising parts of the constellations Draco, Boötes and Hercules. The radius drawn from the dot to the curve in any direction represents (by its length) the number of stars moving in that direction, or rather within 5° on either side of that direction. Now the distribution of proper motions indicated by this figure cannot possibly be due to a system of stars forming a single "drift," that is, a system in which the motions of the stars *inter se* are haphazard, though the system as a whole may be in motion relative to the sun (or, as it is more usually expressed, the sun may be in motion relative to the system). The type of curve resulting from such a drift can be calculated mathematically; R and S are such curves. It is not difficult to see that, having regard to the position of the origin, no curve of this symmetrical type could be chosen which would at all approximately coincide with the observed curve P. The hypothesis of one drift, therefore, does not give even an approximation to the observed distribution of proper motions. But by combining the two drifts R and S, we obtain the curve Q, which agrees very closely with the observed curve. The differences between P and Q are, in fact, insignificant, and of a purely accidental character.

For each of seven regions into which the Groombridge stars were divided, as well as for the Carrington stars, the observed distribution of proper motions allowed itself to be dissected in this way, and exhibited as the result of two simple drifts intermingled. The agreement between the observed distribution and the theoretical distribution was not always quite so perfect as in the case illustrated. For instance, in one region the observed curve showed twenty-four stars moving where they ought not to have been; presumably they formed a local system; but such an irregularity is small compared with the two main drifts, which in that region each included more than 400 stars. Most of the regions, however, did not show even such a small irregularity as this.

The shape of the simple drift curve depends on the velocity of the drift (relative to the sun) as compared with the mean velocity of the stars of the drift relative to one another. Naturally, for high drift-velocities the curve becomes more elongated, for the tendency then is for all the stars to move nearly in the direction of the drift, the individual motions being relatively

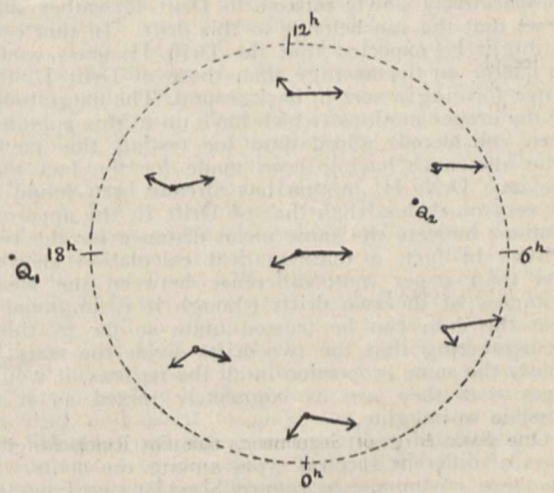


FIG. 2.—The region within 52° of the North Pole. The arrows show the magnitudes and directions of the drift velocities.

small; for low drift-velocity the curve is rounder, approaching the form of a circle about the origin for the limiting case of zero drift-velocity. The curves R and S correspond to drift velocities 1·20 and 0·45 respectively (the unit is 0·886 of the mean peculiar speed of the stars). The analysis, therefore, not only shows the directions in which the two systems of stars are moving, but also their velocities.

Fig. 2 is a diagram of the part of the sky covered by the Groombridge catalogue. At seven points (the centres of seven regions into which the area was divided) are drawn pairs of arrows representing the velocities of the two drifts in magnitude and direction, determined for each region independently, as explained above; but in each case the shorter arrow of the pair has been drawn on twice the scale of the longer one, so that the difference in velocity of the two drifts is even greater than appears from the figure. This attempt to represent a considerable portion of the sphere on a plane surface is necessarily imperfect, but it is sufficient to show that each set of arrows is directed approximately from a point, viz., the longer arrows from the point Q_1 (R.A. 18h., Decl. + 18°) on the left of the figure, and the shorter

arrows from the point Q_2 (R.A. 7½h., Decl. +58°). It will be convenient to refer to the two systems as Drift I. and Drift II.; Drift I. accordingly is a group of stars in rapid motion from the point Q_1, and Drift II. a group in comparatively slow motion from the point Q_2, its velocity being, in fact, not quite one-third that of Drift I. Fig. 2 also shows that the speed of Drift I. appears smaller in the regions nearest Q_1, and of Drift II. in the regions nearest Q_2. This is because that part of the drift motion which is in the line of sight has no effect on the proper motions, and cannot be detected by examining them. The component of the drift motion *across* the line of sight decreases as the apex of the drift is approached, and vanishes at the apex itself.

Another result from the mathematical analysis is that the stars are nearly equally divided between the two drifts, Drift II. having, perhaps, a slightly greater proportion. It is rather remarkable that although some parts of the sky are more than twice as rich in stars as others, the approximately equal division between the two drifts is maintained in every region.

It is natural to inquire whether there may not be some other distinction between stars of the two drifts besides their motions. The fact that the sun moves comparatively slowly relative to Drift II. rather suggests that the sun belongs to this drift. In that case it might be expected that the Drift II. stars would be nearer on the average than those of Drift I., the latter forming a sort of background. The magnitudes of the proper motions (which have up to this point not been considered) afford data for testing this point. Due allowance having been made for the fact that the true Drift II. motion has already been found to be very much less than that of Drift I., the apparent motions indicate the same mean distance for the two drifts. In fact, a mathematical calculation showed less than 5 per cent. difference between the mean distances of the two drifts (though it is improbable that the data can be trusted quite so far as this). Remembering that the two drifts divide the stars in nearly the same proportion in all the regions, it would seem that they are as completely mixed as it is possible to imagine.

One point of great interest is the distribution of the stars of different spectral types among the drifts. It has been customary to regard Secchi's two types as forming to a certain extent two systems, for Type II. stars are very evenly distributed throughout the sky, whereas those of Type I. tend to congregate in the plane of the Milky Way. It is, however, quite certain that the division into two spectral types and the division into two drifts do not correspond. If we examine Type I. stars alone, both drifts are evident; and so also if Type II. stars are examined alone. Nevertheless there is a systematic difference between the distribution of the proper motions of the Type I. and Type II. stars, which manifests itself in every region examined (including the Bradley stars). It may perhaps be interpreted as being due to a higher percentage of Type II. stars in Drift II. than in Drift I., but it now appears more probable that the difference consists in Type II. stars having larger "peculiar" motions (the haphazard individual motions) than Type I. stars. In addition to some satisfactory direct evidence, this latter explanation is supported by the fact that nearly all the "runaway" stars are of Type II., and it also agrees with the difference in distribution of Type I. and Type II. stars; the former mainly congregate in one plane, whilst the latter, perhaps originally in the same plane, would have become more uniformly distributed in consequence of their greater individual velocities.

There is no indication of any relation between magnitude and drift, except possibly in the case of the very bright stars (brighter than magnitude 4·0). These latter seem to belong principally to Drift I., but they are so few in number (in the area examined) that the result may very well be accidental.

Having determined the motions of the two drifts of stars relative to the sun, and knowing also that the stars are nearly equally divided between them, it is easy to determine the motion of the sun relative to the combined drifts—in fact, to determine the *solar apex*. In this way the solar apex is found to be at R.A. 17h. 45m., Decl. +31°; it is naturally fairly close to Q_1, since the velocity of Drift I. predominates. From the same stars, by Airy's method, Dyson and Thackeray found the solar apex to be at R.A. 18h. 20m., Decl. +37°. The somewhat greater R.A. of their determination (and of most other determinations) is probably the result of using the magnitudes of the proper motions. This position, deduced by means of the two-drift theory from the directions of the proper motions only, has the advantage of being free from all assumptions as to the distances of the stars, but the probable accidental error is large. The two-drift theory further directs attention to the true nature of the "solar motion" so determined; it is in no sense an *absolute* motion, and there is now no justification for confounding it with the motion relative to the æther, as has sometimes been done.

In conclusion, whilst Prof. Kapteyn's theory accounts in a simple manner for the very anomalous and unsymmetrical way in which the directions of motion of the stars are distributed, it is still awaiting the verdict of the spectroscopic determinations of line-of-sight velocities. The material exists in plenty for applying this test; it simply awaits examination by those who have access to it. The investigation of the motions of still fainter stars, and of regions of the sky which have not yet been explored, offers a large field for further research.

A. S. EDDINGTON.

SEVENTH INTERNATIONAL ZOOLOGICAL CONGRESS.

THE arrangements for the seventh International Zoological Congress, which will be held at Boston, August 19–23, under the presidency of Mr. Alexander Agassiz, are now well advanced. The congress will open formally on the afternoon of August 19 in the Harvard Medical School, and arrangements will then be made for the meetings of the sections. The subdivision proposed is rather elaborate, for there are to be sections on general zoology, systematic zoology, experimental zoology, marine zoology, evolution, heredity, and so on. There will be three general meetings; the International Committee on Zoological Nomenclature, under Prof. R. Blanchard, will continue its arduous labours; and numerous addresses, communications, and exhibits have already been arranged for. It need hardly be said that the arrangements for hospitality are generous. On each day of the strict congress week there will be luncheon at the invitation of the Boston local committee, and the evenings will be occupied with receptions and dinners.

On the afternoon of August 22 there will be an excursion to Wellesley College; August 24 will be devoted to a visit to the museums of Harvard University; August 25 is Woods Hole Day; August 26 Columbia University Day; August 27 the American Museum Day. On August 28 the members of the

congress will visit the marine laboratory of the Brooklyn Institute of Arts and Sciences, and the Carnegie station for experimental evolution at Cold Spring Harbour. On August 29 the New York Zoological Society will receive in the morning in the New York Aquarium, and in the afternoon in the Zoological Park; in the evening there will be a reception in Columbia University library.

On Friday, August 30, Prof. Henry Fairfield Osborn invites the congress to an excursion up the Hudson to West Point and Garrison. Saturday will be devoted to the Universities of Yale and Princeton.

On Monday, September 2, the congress will move from New York to Philadelphia; there will be luncheon at the Academy of Natural Sciences, followed by inspection of the library and museum; there will be an afternoon drive to the Zoological Gardens and Fairmount Park; in the evening there will be supper at the Philadelphia Country Club.

On September 3 there will be visits to the American Philosophical Society, Independence Hall, Girard College, the University of Pennsylvania, and thereafter the congress will move on to Washington. On September 4 there will be a general meeting in the assembly hall of the Cosmos Club, Washington, at which addresses of welcome will be given by the secretary of the Smithsonian Institution, the president of the Carnegie Institution, and the president of the Washington Academy of Sciences. This will be followed by a visit to the National Zoological Park, the Congressional Library, the United States Department of Agriculture, the Hygienic Laboratory, and other points of zoological interest. In the evening there will be a reception by the Cosmos Club.

On September 5 the congress will proceed by boat on the Potomac River to Mt. Vernon, the home of George Washington, and to the United States Navy Proving Station at Indian Head. There will be dinner at Marshall Hall, and an evening reception at the United States National Museum.

On Saturday, September 7, an excursion has been arranged to Niagara Falls and across Lake Ontario to Toronto, returning to New York on Monday night or Tuesday morning.

If fifty members agree to go, there will be an excursion to Bermuda, which will give the members of the congress an opportunity of becoming acquainted with a very interesting semitropical zoological region. Members will have facilities in collecting and preserving zoological material. The expenses of the expedition for each participating member will be thirty-two dollars for return passage and about two dollars a day hotel charges while in Bermuda. After the party lands in Bermuda, the local committee will supply, free of charge, all transportation, carriages, steamers, &c., and such other incidentals as will ensure a successful expedition. It is to be hoped that this very attractive part of the programme will be carried out. The inclusive dates fixed for the expedition are September 14–22.

It may be noted that the executive committee of the Boston meeting consists of Profs. G. H. Parker (chairman), Samuel Henshaw (secretary), L. O. Howard, J. S. Kingsley, E. L. Mark, and H. F. Osborn.

If two suggestions from experience might be ventured, we would submit that outside each sectional meeting there should be a time-table board showing what precisely is going on, and that each member should wear in his button-hole a number corresponding to a printed list, so that strangers to one another may know at once who's who!

THE LEICESTER MEETING OF THE BRITISH ASSOCIATION.

PROVISIONAL PROGRAMMES OF SECTIONS.

ARRANGEMENTS for the work of the various sections are now approaching completion, and we are able to give the provisional programmes. It is evident from this list of papers and discussions, incomplete thought it is, that many matters of wide scientific interest will be brought forward at Leicester.

Among the foreign representatives who have accepted invitations to be present are the following:—Section A.: Prof. L. Natanson, Prof. D. J. Korteweg, Prof. H. G. van de Sande Bakhuyzen, Dr. Oskar Backlund, Prof. Donner, M. Ch. Féry; Section B.: Prof. R. Abegg, Prof. A. Tschitschibabin, Prof. T. W. Richards, Prof. A. Werner, Prof. F. M. Jaeger; Section C.: Prof. H. Sjögren, Prof. F. Frech, Prof. C. Diener, Prof. J. P. Iddings; Section D.: Prof. H. Simroth; Section E.: Prof. P. Vidal de la Blache, Prof. Max Eckert; Section H.: Prof. E. Naville; Section I.: Prof. N. Zuntz; Section K.: Prof. J. P. Lotsy, Prof. R. Chodat, Prof. H. Conwentz, Prof. O. Uhlworm; Section L.: Dr. Otto Anderssen, Dr. F. Rönning, Prof. M. L. Morel. Corresponding members Baron D. Kikuchi, Prof. P. H. Schoute, Prof. R. Nasini, and Prof. George F. Barker have also expressed their intention of being present.

The address of Prof. A. E. H. Love, F.R.S., the president of Section A (Mathematical and Physical Science), will be delivered on the morning of Thursday, August 1. Several discussions have been arranged. On Friday, August 2, there is to be one on the constitution of the atom, which will be opened by Prof. E. Rutherford, who will be followed by Sir O. Lodge, Mr. G. A. Schott, and others. On Monday, August 5, Dr. L. Holborn, of Charlottenburg, will open a discussion on radiation-pyrometry; he will be followed by M. C. Fery, of Paris. On August 6, a paper by Mr. W. Palin Elderton on modern methods of treating observations will consist of an exposition of the methods of Prof. Karl Pearson, chiefly as applied to meteorological phenomena. It is hoped that all will attend who are interested in the reduction of observations of any kind, and assist to make the discussion useful. The following papers have also been promised:—On the nature of ionisation, Prof. H. E. Armstrong; an analytical study of the meteorological observations made at the Glossop Moor kite station during 1906-7, Miss M. White, Mr. T. V. Pring, and Dr. J. E. Petavel; recent developments of the methods of forecasting by means of synoptic charts, Dr. W. N. Shaw; ether density, Sir O. Lodge; sæcular stability, Prof. H. Lamb; modern work on the calculus of variations, Prof. A. R. Forsyth; exhibition of models of three-dimensional sections of the regular hypersolids in space of four dimensions, Mrs. Stott; a method of obtaining the chief properties of the exponential function, Prof. A. E. H. Love; operational invariants, Major MacMahon; a property of Abelian groups, Mr. Harold Hilton; factorisation of the Pellian terms, Lt.-Col. Cunningham; on the theory of integral equations, Mr. H. Bateman; a mountain observatory in India, Prof. C. Michie Smith. The various committees connected with the section will also present their annual reports.

Section B (Chemistry) has made the following provisional arrangements:—August 1: Presidential address, Prof. A. Smithells; discussion on valency, to be opened by Prof. W. J. Pope, and in which Prof. Werner (Zürich), Prof. Abegg (Breslau), Prof. Richards (Harvard), Prof. Jaeger (Amsterdam), Prof. J. J. Thomson, Mr. W. Barlow, and others will take part. August 2: Joint discussion with Section G on explosion tempera-

tures. The following members will take part:—Dr. Boudouard (Paris), Prof. Haber (Karlsruhe), Mr. Dugald Clerk, Prof. B. Hopkinson, Prof. H. B. Dixon, and others. August 5: Reports will be received from the research committees:—(1) The transformation of aromatic nitramines; (2) the study of hydroaromatic compounds; (3) preparation of a new series of wave-length tables of the spectra of the elements; (4) dynamic isomerism; (5) the study of isomorphous sulphonic derivatives of benzene. The following papers will be read:—The applications of Grignard's reaction, Dr. A. McKenzie; paper by Prof. Tschitschibabin (Moscow); fluid crystals, Prof. Jaeger; atomic weights, Prof. T. W. Richards; carbon suboxide, Dr. Boudouard; carbonyl compounds, Dr. H. O. Jones. August 6: Discussion on the chemistry of wheat and flour with special reference to strength, to be opened by Mr. A. E. Humphries, president of the National Association of British and Irish Millers. The following will take part:—Messrs. R. H. Biffen, T. B. Wood, A. D. Hall, Horace Brown, J. L. Baker, A. J. Banks, E. F. Armstrong, and E. S. Watkins.

The following papers, among others, will be read in Section C (Geology):—Prof. W. W. Watts and Mr. Fox Strangways will give addresses on the geology of the country round Leicester. These will be followed by papers dealing with local geology by Drs. Bennett and Stracey and Messrs. Horwood, Bosworth and Keay. A discussion on the origin and extent of the iron ores of Britain will be opened by Mr. Bennett H. Brough; and other authorities on the subject are expected to take part in it. Among other subjects to be brought forward are:—Earthquakes, Prof. Milne; pisolitic iron ores, Mr. W. G. Fearnsides; desert forms, Mr. H. Ferrar; the ancient volcanoes of Basutoland, Rev. S. S. Dornan; a remarkable occurrence of strontia near Bristol, Mr. H. Bolton; the gravels of Holderness, Messrs. Stather and Sheppard; and the occurrence of a marine peat near Liverpool, Mr. J. Lomas. Reports of various committees will be presented. On the fauna and flora of the Trias, Mr. J. Lomas; Carboniferous faunas and zones, Drs. A. Vaughan and Wheelton Hind; Anglesey Rocks, Mr. E. Greenly; terms used in geography and geology, Mr. W. G. Fearnsides; erratic blocks, Prof. P. F. Kendall; Pre-Devonian rocks of the Mendips, Prof. S. H. Reynolds; and the Kirmington Drifts, Mr. Stather. Excursions will be made to places of geological interest every afternoon during the meeting, and longer excursions have been arranged for the week-end and at the close of the meeting.

The following items have been arranged for Section D (Zoology):—Presidential address, Dr. W. E. Hoyle; discussion (in conjunction with Section of Botany) on the physical basis of heredity, to be opened by Prof. S. J. Hickson; discussion (in conjunction with the Sections of Botany and Education) on the teaching of biology in schools, to be opened by Mr. O. H. Latter, of Charterhouse; afternoon lecture by Dr. C. W. Andrews, adaptation to aquatic life in reptiles and mammals; problems in the sexual organisation of the Crustacea, Mr. G. W. Smith; Pycnogonida, Mr. T. V. Hodgson; demonstration of models, Protozoa, &c., Mr. F. R. Rowley; experiments on seasonally dimorphic forms of African Lepidoptera, Dr. F. A. Dixey; (1) classification of the Haplosporidia, (2) the movements of Spirochætes, as seen in *S. balbianii* and *S. anodontae*, Mr. H. B. Fantham; the rise and recognition of economic biology, Mr. Walter E. Collinge.

The papers offered to Section E (Geography) include the following:—The surveys of British Africa, Major C. F. Close, R.E.; the maps and methods of the present-day explorer, Captain T. T. Behrens, R.E.; the geographical evolution of transport, Prof. Vidal de la Blache (Paris); commercial geography from the modern standpoint, Prof. Max Eckert (Kiel); the hinterland of the Port of Manchester, Mr. J. McFarlane (Manchester); the Jäderin district of southern Norway, Mr. O. J. R. Howarth; Shotover Hill, a study in morphological causation, Rev. C. E. Spicer; regional geography of the Land's End peninsula, Mr. A. W. Andrews; physical geography of the Etbai desert of Egypt, Mr. H. T. Ferrar; travels in the Andes of Peru, Mr. C. R. Enock; the British Museum expedition to Ruwenzori, Mr. R. B. Woosnam; explorations in Labrador, Mrs. Leonidas Hubbard. Afternoon lectures:—The Kurds, Mr. Mark Sykes; the Jamaica earthquake, Dr. Vaughan Cornish; the preservation of "Naturdenkmäle," or natural monuments, Prof. Conwentz (Danzig) (joint meeting with Sections C and K).

The programme of Section G (Engineering) is as follows:—August 1: Presidential address, Prof. S. P. Thompson; the present position of gas and petrol engines, Mr. Dugald Clerk. August 2: Joint meeting with Section B to discuss gaseous explosions with special reference to temperature. August 5 and 6: Pupin's compensated cable for telephone transmission, Sir W. H. Preece; modern machinery and its future development, Mr. H. I. Brackenbury; a machine for weighing the forces on a cutting tool, Mr. J. F. Brooks; ferro-concrete and examples of construction, Mr. J. S. E. de Vesian; examples of ferro-concrete, Mr. W. Noble Twelvetrees; the equipment of the engineering laboratory at the Finsbury Technical College, Prof. E. G. Coker; the ice problem presented in engineering work in Canada, Prof. Barnes; notes on the governing of hydraulic turbines, Mr. R. S. Ball; submarine signalling, Mr. Millet. A practical demonstration of boot and shoemaking machinery will be given by Mr. C. Bennion.

The programme of the proceedings of Section H (Anthropology) is even longer than usual, and many of the communications promise to give rise to interesting discussion. The greater part of the time of the section will be taken up by papers of an archæological character, but the communications in general ethnography, though less numerous than usual, include a number of considerable importance. On August 1 a meeting will be held in conjunction with the Section of Educational Science for the discussion of anthropometrics in schools. In archæology, Prof. W. M. Flinders Petrie will describe the results of his excavations in Egypt during the past season, and Dr. E. Naville will deal with the beginnings of Egyptian civilisation. A discussion on the early Iron age, and the different dates of inception in different areas, in which Sir John Evans has promised to take part, will be opened by Prof. W. Ridgway, and Mr. J. L. Myres will contribute a paper on the Sigynnæ of Herodotus and Cyprian spears. Prof. R. C. Bosanquet will read a paper on the scourging of the Ephebi at Sparta. Accounts of the work of the British Schools of Archæology at Athens and Rome during the past year will be given by their respective directors, Mr. R. M. Dawkins and Dr. T. Ashby. The former will deal chiefly with the excavations in Sparta. In addition, Dr. Ashby, in a paper on the ethnology of Sardinia, will urge the need of archæological and ethnographic investigation in that island for the elucidation of problems of Mediterranean ethnology, and in connection with the report of the Roman Sites Committee will describe the excavations of the past year at Caerwent. A paper by Mr. F. Newberry and Dr. T. H. Bryce deals with the "doorstep art" of Scotland, Mrs. Hobson will give the results of an examination of a large number of souterrains in Ulster, and Dr. G. A. Auden will de-

scribe a number of Scandinavian antiquities found at York. Dr. L. R. Farnell, in a communication on the development of Greek religion, will criticise Dr. Usener's theories concerning Sondergötter and Augenblick-Götter. Among the communications in general ethnography may be mentioned:—Education and evolution, the Rev. A. E. Crawley; a paper by Messrs. T. A. Joyce and E. Torday on the ethnography of the south-west Congo Free State, dealing with the migrations of the inhabitants of the territory drained by the Kwango and Kwilu Rivers; a paper by Dr. W. H. R. Rivers on Morgan's Malayan system of relationship, which adduces evidence against his concept of the "consanguineous family" as the earliest stage of the development of human society. Prof. R. J. Anderson, in a paper on racial types of Connaught, describes the chief physical types of that province, and discusses the chief influences by which they are, or have been, modified; a study of the condition of the Maoris in 1907, by Miss B. Pullen-Burry, after describing their religion and social organisation, deals with their economic and social condition. Among papers of a technical character, considerable interest attaches, in view of the present lack of agreement as to the use of anthropological terms, to a communication by Dr. Rivers in which he attempts to define the use of certain sociological terms, and to a communication by Mr. J. L. Myres on the use of the triangle in decorative art.

The provisional programme of Section I (Physiology) is as follows:—August 1: Presidential address and miscellaneous papers. The president, Dr. A. D. Waller, has been studying chloroform of late, and his address will probably take the form of a general statement on the position of anæsthetics at the present time. August 2: The morning will be devoted to papers on the electrophysiology of animals and plants. Dr. Alcock, Dr. Waller, and others will read papers. August 5: A discussion on the physiological and therapeutical uses of alcohol will be opened by Prof. Cushny. Other speakers will include Sir Victor Horsley, Dr. Dixon, Dr. Rivers, and Dr. Waller. August 6: A discussion on antitoxins will be opened by Prof. Sims Woodhead. The afternoons will be in part given to the reading of reports. There are three committees which should report, the subjects being:—(1) The investigation of the effect of climate upon health; Sir Lauder Brunton, the president of this committee, will read the report; (2) the determination of the metabolic balance-sheet of the individual tissues, president, Prof. Gotch; (3) the ductless glands, Prof. Schäfer. These reports will be presented on the afternoons of August 1, 2, and 6 respectively.

In Section K (Botany), Miss Fraser (of the Royal Holloway College) and others will communicate the results of recent investigations on the cytology of fungi, particularly in relation to sexuality and the reduction division. Mr. V. H. Blackman will take part in the discussion on this subject. Prof. F. O. Bower will communicate the results of his recent work on the embryos of Pteridophytes. Prof. Conwentz, the Prussian State Commissioner for the preservation of natural monuments, will deliver a lecture, illustrated by lantern slides, at a joint meeting of Sections C, E, and K, on the care of natural monuments. Prof. F. W. Oliver is expected to communicate the results of some recent investigations of Palæozoic seeds. Prof. Weiss will give the semi-popular lecture on pollination in recent and fossil plants. There will be a joint meeting with Section D to discuss the physical basis of heredity (opened by Prof. Hickson), and with Sections D and L to discuss the teaching of botany in schools. Prof. Armstrong will communicate a paper on the theory of enzyme-action. There will be a visit to Mr. Hurst's nurseries at Burbage to inspect his experiments in hybridisation, and a botanical excursion to Charnwood Forest.

Discussions on several important subjects have been arranged by the organising committee of Section L (Educational Science); and among the authors and speakers are leading representatives of every grade of educational activity. The chief educational associations have appointed delegates to attend the meeting. After Sir Philip Magnus's presidential address on August 1, there will be a discussion at a joint meeting with Section H (Anthropology) on anthropometrics in schools, with particular reference to the recommendations of the Physical Deterioration Committee. Among the expected speakers are Sir Victor Horsley, Mr. R. C. Lehmann, M.P., Dr. F. C. Shrubsall, Mr. J. Gray, Mr. E. Meyrick, Prof. M. E. Sadler, Dr. J. Gow, Mr. Cecil Hawkins, and Mr. S. R. Brown. Friday, August 2, will be occupied with a discussion of the scholarship system in all its aspects from the primary school to the university, with papers by Miss J. Cleghorn, Mr. A. R. Pickles, president of the National Union of Teachers; Mr. W. A. Brockington, Miss S. Heron, Mr. J. L. Paton, Mr. G. Gidley Robinson, Rev. A. A. David, Dr. H. B. Baker, Prof. H. A. Miers, and Prof. M. E. Sadler. The curricula of secondary schools will form the subject of discussion on the morning of August 5, in connection with the report of a committee appointed at the York meeting last year. Mr. R. E. Thwaites will state the results of an inquiry into science teaching in secondary schools. In the afternoon there will be a joint meeting with Sections D and K on the teaching of biology in schools, to be introduced by Mr. O. H. Latter. Other speakers will be Prof. S. J. Hickson, Prof. J. B. Farmer, Miss Lilian Clarke, Miss Laurie, Mr. M. D. Hill, Mr. E. Meyrick, and Mr. Hugh Richardson. August 6 will be devoted to scientific teaching in relation to trade classes and industrial requirements, this general description to include the consideration of domestic subjects in girls' schools, day trade schools for girls, preparation for technical training in day and evening schools, and the qualifications of teachers. Papers dealing with these subjects will be contributed by Mrs. Ramsay MacDonald, Mr. C. T. Millis, Mr. J. G. Legge, and Mr. J. H. Hawthorn.

THE KING AND HIGHER EDUCATION IN WALES.

THE foundation stone of the new buildings of the University College of North Wales was laid by the King on Tuesday, July 9. The King was accompanied by the Queen, and the ceremony was performed in the presence of a large and brilliant assembly. In his response to an address of welcome, presented by the Lord Lieutenant, the King said that the main object of his visit to Wales was to express again his belief in the necessity of affording the youths of the country the most complete educational equipment possible, both for their self-improvement and in order to enable them to acquire success in life. The King also remarked, in the course of a reply to an address presented by the Mayor and Corporation of Bangor, that "Education, and especially secondary education, is a subject the importance of which cannot be over-estimated, and which engages my cordial interest and encouragement." Replying on behalf of the Queen and himself to an address from the governors of the college, the King again referred to his interest in higher education in the following words:—

The admirable work performed by the college in its temporary buildings has been widely recognised and was

well known to me when I held the office of Chancellor of the University of Wales. I feel confident that increased efficiency will result from the facilities afforded by the commodious premises of which I have to-day laid the first stone. The competition in every branch of industry, especially in those branches which depend largely on science and art, is in these days severe, and it must be met by increased application and improved methods. The world is, I believe, better for such competition, but it behoves individual nations to use every possible effort to hold their own in the struggle. For this purpose higher education is an absolute necessity. However brilliant a man's natural talents may be, he is greatly hindered by the want of early training, and as a rule only those who have enjoyed a good education are capable of acquiring such proficiency in any branch of study as will enable them to succeed. The University College of North Wales will offer to its students exceptional opportunities of instruction. Time and money, energy and perseverance, will, I am sure, not be spared in the endeavour to afford every facility to the acquirement of knowledge, and I have had sufficient opportunities of judging the intelligence of the Welsh people and their eagerness in the pursuit of knowledge to know that your young men and women will take every advantage of the instruction which is offered them.

At the close of the ceremony of laying the foundation stone, the King conferred the honour of knighthood upon Dr. H. R. Reichel, the principal of the college.

NOTES.

WE regret to announce that Sir William H. Broadbent, Bart., F.R.S., physician in ordinary to the King and to the Prince of Wales, died on Wednesday, July 10, at seventy-two years of age.

THE Nettleship gold medal of the Ophthalmological Society of the United Kingdom has been awarded to Dr. J. Herbert Parsons, for his work on "The Pathology of the Eye."

THE council of the Institution of Civil Engineers has appointed Sir William Matthews, K.C.M.G., president of that institution, to succeed the late Sir Benjamin Baker, K.C.B., K.C.M.G., as one of their representatives on the main committee of the Engineering Standards Committee.

THE annual meeting of the Victoria Institute will be held at Burlington House, Piccadilly, on Wednesday, July 17. The chair will be taken by the president, the Earl of Halsbury, F.R.S.; and an address will be given by Bishop Welldon.

THE Women's Agricultural and Horticultural International Union will hold an exhibition and sale of farm and garden produce, and of nature-study teaching apparatus, in the gardens of the Royal Botanic Society, Regent's Park, on Wednesday, July 17. For the convenience of teachers, the nature-study room will be kept open until Saturday, July 20.

THE vacancy in the tidal and optical departments of the National Physical Laboratory, occasioned by the appointment of Mr. J. de Graaf Hunter to the post of mathematical expert on the Indian Survey, has been filled by the appointment of Mr. T. Smith, formerly scholar of Queens' College, Cambridge.

THE recent death of M. Charles Trépied, director of the Algiers Observatory, inflicts yet another severe loss on the ranks of French astronomers. In the organisation of the work of the Astrographic Catalogue and Chart he played an active and prominent part from the beginning, and it is to be deplored that he was not spared to see the completion of his labours. M. Trépied became director of the observatory at Algiers in 1880, and in the following year carried out a scheme of reorganisation. In 1883 the observatory was removed from its temporary site at Kouba to its present position at Bondzavéah, eleven kilometres from Algiers, and was further equipped with an equatorial *coudé*, and later with a photographic instrument of the standard photographic pattern. Since 1875 M. Trépied was a prolific writer on all branches of astronomy, and gave much study to the physical condition of the sun and to cometary spectra, while the observatory under his charge was always most active in observational work of all kinds. On the occasion of the solar eclipse of 1900, he extended the most generous hospitality and assistance to the foreign astronomers who visited Algiers. He was a corresponding member of the Paris Academy of Sciences.

PROF. W. J. SOLLAS, F.R.S., professor of geology and palæontology at Oxford, and his assistant, Mr. M. Allorge, have just taken the geological class to Belgium to study the structure of that country. In the Easter expedition of the students, Dr. Vaughan and Prof. Reynolds explained the zoning of the Carboniferous limestone in the Bristol district; and the object of the present expedition is to bring the results then obtained into comparison with the facts furnished by the Belgian limestones. The leading Belgian geologists, MM. Mourlon, Gosselet, Halet, Simoens, Lohest, Formarié, and Rutot, are acting as guides for the various visits and excursions which have been arranged. The expedition thus provides facilities for geological observations under the best conditions.

THE retirement is announced of Prof. G. Lunge, at the age of sixty-eight, from the chair of technical chemistry at Zurich, a position which he has held during the past thirty-one years. Prof. Lunge's name is intimately associated with the development of chemical industry in Germany, not only on account of the influence he exerted on his many students, but more directly owing to his inventions and treatises on applied chemistry. At the time when he, as a young man, completed his studies at Heidelberg, chemical industry had hardly come into existence in Germany, so that in order to gain practical experience he found it necessary to proceed to England. In this country, in which he spent the twelve years 1864–1876, he was first actively engaged in studying the problems connected with the distillation of coal tar, but subsequently acted as manager of a large soda works at Tyneside. He was one of the founders of the Newcastle Chemical Society, a precursor of the Society of Chemical Industry. In 1876 Prof. Lunge received a call to the professorship of technical chemistry at Zurich, a position which, in spite of many inducements to pass to other universities, he continued to occupy until this year. His books on coal-tar distillation and on the manufacture of acid and alkali have, since the publication of the first volume in 1879, become almost classics in chemical technology.

AN influentially signed appeal was published in the *Times* of July 5 for donations to a fund which is being raised to ensure the preservation of characteristic examples of the "grey wethers" on Marlborough Downs. These boulders are locally known as "Sarsen Stones," and are geologically the solidified boulders of a stratum of Eocene sand formerly covering the chalk which in the course of time has been denuded of the softer portions. For many generations these stones have been broken up and used for building and other purposes, but the breaking up has not been on such a scale as to make any appreciable difference in the appearance of the downs. A recent

change of ownership has made it likely that the process of destruction will be greatly extended. In these circumstances representations have been made to Mr. Alec Taylor, the present owner, by the National Trust and the Wiltshire Archæological Society, who has stated that he intends to preserve the dolmen known as the Devil's Den, and has given the National Trust an option to purchase for 500*l.* about eleven acres in Pickle Dean and about nine acres in Lockeridge Dean, both of which areas are rich in "grey wethers." We trust the sum required will be forthcoming, so that examples of a unique geological phenomenon may be preserved to the nation. It is not too much to say that if British statesmen understood more fully the value and full significance of nature's "monuments," these and similar natural objects of scientific and educational importance would have been secured for the nation long ago. Donations to the fund which is being raised may be sent to Mr. Henry E. Medlicott, Potterne, Devizes; the Rev. E. H. Goddard, Clyffe Vicarage, Swindon; Mr. E. Meyrick, Thornhanger, Marlborough; or to Mr. Nigel Bond, 25 Victoria Street, Westminster.

THE thirty-sixth annual meeting of l'Association française pour l'Avancement des Sciences will be held at the lycée in Rheims on August 1–6. The president for the year is Dr. Henrot, honorary director of l'École de Médecine at Rheims. The work of the meeting will be divided among nineteen sections. The presidents in each case are as follows:—Sections 1 and 2 (Mathematics, Astronomy, Geodesy and Mechanics), Prof. C. Bourlet; Sections 3 and 4 (Navigation and Civil and Military Engineering), M. Bourguin; Section 5 (Physics), Prof. Blondin; Section 6 (Chemistry), Prof. Hugounenq; Section 7 (Meteorology), M. Luizet; Section 8 (Geology and Mineralogy), M. Peron; Section 9 (Botany), Prof. Lecomte; Section 10 (Zoology, Anatomy and Physiology), Prof. Caullery; Section 11 (Anthropology), Dr. Guelliot; Section 12 (Medical Science), Prof. Landouzy; Section 13 (Medical Electricity), Prof. Guilloz; Section 14 (Odontology), M. Francis Jean; Section 15 (Agronomy), M. Armand Walfard; Section 16 (Geography), M. Richard; Section 17 (Political Economy and Statistics), Dr. Papillon; Section 18 (Pedagogy), Dr. Bérillon; Section 19 (Hygiene), Dr. Calmette. M. Jadart is the president of the subsection dealing with archæology. On August 5 an evening lecture will be delivered by Dr. S. Leduc, his subject being "Diffusion and Osmosis." A very full programme has been arranged, and it is possible here to refer to a few of the subjects only. In the physics section the properties of the electric arc will be dealt with, and their application to the production of (*a*) luminous rays, (*b*) electric waves for use in ordinary and in wireless telegraphy, (*c*) nitric acid and nitrates from the oxygen and nitrogen of the air. In the chemistry section the progress made in the study of sugars and the action of soluble ferments on gums will be discussed. In the geology section the classification of the Tertiary beds in the neighbourhood of Rheims will be considered. Visits to places of interest have been arranged, and these include Verzenay, Épernay, Laon, Coucy, Charleville, Dinant, and the Han grottoes. Full particulars of the meeting can be obtained from the secretary to the council, 28 rue Serpente, Paris.

ACCORDING to a paper by Mr. H. Elias, published in *Gegenbaur's Morphologisches Jahrbuch*, vol. xxxvii., part i., the shrill cries of bats are, as might be expected, intimately connected with the structure of the larynx in those animals. Special features are the powerful musculature and the shortness of the glottis, the latter being the main cause of the shrillness of the cry. Details of the variation in structure of the larynx in different groups of insectivorous bats are given. In the same issue Dr. O. Brian gives an illustrated account of the so-called horny teeth on the tongue of the porcupine. These teeth form two isolated oval patches near the tip of the tongue, and although their existence has been long known, the author of the paper claims that he is the first to describe their histology.

FROM a natural history point of view, the *National Geographic Magazine* for June is an unusually interesting number. Among its contents is an article by Prof. A. Heilprin on the Guiana wilderness, in the course of which reference is made to the statement that the tropical American forest is characterised by the absence of flowers. "The picture," observes the author, "does not seem to apply to the forest of the river-banks of the Guianas. . . . The streamers of purple, red, and white which hang down over the forest-curtain easily recall in profusion and wealth of colour the flowers of the north. . . . Indeed, it would be difficult to recall in forests of the north, even as rare instances, that display of flowers which so frequently repeats itself here." Another article to which attention may be directed is one by Mr. H. M. Smith, Deputy Commissioner of U.S. Fisheries, on fish immigrants. It deals largely with the objects and results of fish-acclimatisation in the United States.

"SELECTION and Cross-breeding in Relation to the Inheritance of Coat-pigments and Coat-patterns in Rats and Guinea-pigs" is the title of a paper by Messrs. H. MacCurdy and W. E. Castle recently published by the Carnegie Institution of Washington. After a general discussion on continuous and discontinuous variation as factors in evolution, the authors point out that partial albinism displays itself in rats in a fashion quite distinct from that obtaining in guinea-pigs. In the one group the dark areas tend to become restricted to certain definite parts of the body, while in the other they become irregularly distributed everywhere. In rats pigment-reduction produces a regular series of coat-patterns, each of which breeds true within certain limits. In the case of guinea-pigs regression appears to be indicated by a reduction in the number of pigmented areas; but its occurrence could not be definitely determined in rats. If regression does occur in both groups, the main question is whether we can "with propriety consider the effects of selection permanent. . . . We consider the selection question still an open one."

AMONG several articles in the *Zeitschrift für wissenschaftliche Zoologie*, vol. lxxxvi., part iv., reference may be made to one by Mr. Hermann Jost, of Göttingen, on the developmental history of the larva of the ox-warble fly, *Hypoderma bovis*. From the absence of any reference to it in his list of literature, the author appears to be unacquainted with the paper on the same subject by Mr. A. D. Imms in vol. i., part ii., of the *Journal of Economic Biology*, of which a brief notice appeared in our columns some months ago. Mr. Imms was unable to obtain satisfactory evidence as to the manner in which the larvæ effect entrance into the bodies of the host, that is to say, whether they do so by perforating the skin or by way of the mouth. Dr. Cooper Curtice in an earlier paper came, however, to the conclusion that the young larvæ are licked up by the cattle, and thus conveyed to the alimentary canal. According to Mr. Jost, this is not quite

the true explanation, as his observations lead to the conclusion that the eggs are never hatched on the exterior of their host, but are licked off from the skin by the tongue to undergo their final development in the alimentary canal. Estimates of the enormous commercial losses due to ox-warbles are given in the course of the paper.

THE rind disease of the sugar cane caused by the fungus *Melanconium sacchari* forms the subject of Bulletin No. 7 prepared by Mr. L. Lewton-Brain, of the division of pathology and physiology, and issued from the experiment station of the Hawaiian Sugar Planters' Association. The fungus can only penetrate the cane by wounds due to borers or other agents, but, having penetrated, readily forms fruiting masses from which arise the conidia that are extruded in long black threads. Reference is also made to the "red-rot" fungus, *Colletotrichum falcatum* and to the pine-apple disease induced by *Thielaviopsis ethaceticus*, a fungus that is sometimes regarded as a stage in the life of the Melanconium.

THE introduction of rubber cultivation into the Malay Peninsula has brought the Federated Malay States and the Straits Settlements into prominence, and with the view of supplying information as to their status and resources Mr. H. C. Belfield has prepared a third edition of the "Handbook of the Federated Malay States." The handbook contains much practical information, both for the settler and the tourist; an estimate of the cost of starting a rubber plantation is provided for the planter. As to other crops, the west coast from Perak to Negri Sembilan is well suited to the cultivation of cocoa-nuts, but coffee plantations will cease to exist as the interplanted rubber trees come into bearing, and owing to the wasteful methods adopted, tapioca cultivation is being discouraged. Measures are being adopted to conserve the trees yielding gutta-percha.

TWO curious substances, n'hangellite and coorongite, that have been described as mineral india-rubber or elastic bitumen, the former discovered in Portuguese East Africa, the latter in Australia, are the subject of an article in the Kew Bulletin (No. 5). After examination, Mr. L. A. Boodle arrives at the conclusion that they have been derived chiefly from masses of a gelatinous blue-green alga, and that the bituminous character is due to chemical changes. An account of the method of preparing amber-coloured biscuits of Funtumia rubber in Uganda is based upon a communication by Mr. H. Hesketh-Bell. On the subject of mud-binding grasses that might be utilised to reclaim sand and mud-flats, information is provided with regard to the growth of species of Spartina in Southampton Water. A long list of moths collected during the season of 1906, supplementary to the species recorded in the special volume of the Kew Bulletin on the wild fauna and flora of the gardens, is contributed by Mr. A. L. Simmons.

THE University of California, from funds supplied by Mrs. P. A. Hearst, has added to its series of monographs on American ethnology an account of the language of the Yokuts in the south central region. This tribe, the name of which means "men," inhabits the southern portion of the San Joaquin basin. It includes some forty sub-tribes, each with a distinct dialect, differences of vocabulary being probably due, partly, as among the Nagas of Assam, to inter-tribal feuds, and partly to the taboo of words connected with the dead. The Yokuts are now gradually disappearing, and the author of this monograph, Mr. A. L. Kroeber, has found much difficulty in collecting the materials for a comparative grammar and chrestomathy, the latter including some interesting tribal legends and folk-lore, more complete versions of which he proposes to publish in a subsequent volume.

THE weather still continues most persistently cold for the time of year over the whole of the British Islands, and, indeed, over nearly the whole of western Europe. Rain is falling with considerable frequency, but the measurements are not generally large. The principal feature is the large amount of cloud and the consequent small amount of sunshine. According to the summary of the weather issued by the Meteorological Office for the week ended July 6, the maximum temperature recorded anywhere in the British Islands was 68°, in the Midland counties. The defect of temperature on the mean for the period was mostly from 6° to 8°, whilst the bright sunshine was deficient over the whole of Great Britain. At Greenwich the highest shade temperature for the first nine days of July was 68°, and the observations since 1841 fail to show any other year for the same period with so persistently low a temperature, the previous years always having had a temperature of 70°, and commonly a temperature of 80° or even 90°. The mean highest temperature for the first nine days is rather below 65°, which is in agreement with the average conditions in the middle of May or the end of September. The aggregate rainfall at Greenwich for the first nine days of July is less than 0·2 inch, but rain has fallen on six days. The aggregate rainfall at the London reporting station of the Meteorological Office since the commencement of the year is 8·8 inches, which is about 1·5 inches less than the normal, and April is the only month with an excess of rain. The present outlook promises a further continuance of cool and unsettled weather.

THE Deutsche Seewarte has just published vol. xiv. of *Deutsche Ueberseeische Meteorologische Beobachtungen*, containing summaries of the meteorological observations made at thirty-eight foreign stations for various periods between 1892 and 1904. The first part includes the records from twenty-six stations where the observations were made three times a day, the stations being well scattered over the globe. Labrador, West Indies, Brazil, Morocco, Liberia, Siberia, China, Corea, and the Pacific Islands are all represented. The value of these otherwise good observations is marred by the fact that only from eight of the stations can a continuous record be got for so short a period as three years. The second part contains the results of hourly observations at stations which are all in German East Africa, and deals with the period 1900–4. Here again is the same trouble of discontinuity.

"DISTRIBUTION of Temperature and Air Pressure over the Globe in the 'Polar Year' 1882–3" is the title of the inaugural dissertation chosen by S. B. Ehrhart on obtaining his doctor's degree at Erlangen. It was a gigantic undertaking, and the results of observations at 924 stations have been utilised in preparing isothermal and isobaric charts for each month from September, 1882, to August, 1883; the charts for January and July, 1883, accompany the dissertation. The author states that, on the whole, the charts for this particular year exhibit the same general features as those drawn from means for a series of years, and show that the temperature conditions of any one month influence the pressure conditions of the following month, *e.g.* areas of high temperature favour the development of barometric minima, and *vice versâ*. We fail to find any reference to the synchronous weather charts of the North Atlantic published by the Meteorological Office for that

year, which, although not dealing with mean values, constitute the greatest investigation of synchronous meteorology ever undertaken by any country.

THE paper on the theory of thermoelectricity contributed by Shizuwo Sano to the Proceedings of the Tokyo Mathematico-Physical Society, iv., 1 (February number, recently received), cannot fail to throw light or suggest ideas in connection with this difficult and controversial subject. It is usual to apply to thermoelectric phenomena the equations of reversible thermodynamics which would hold good in the absence of such irreversible phenomena as the Joule effect or conduction of heat, but the author, following on the lines indicated by Boltzmann in 1887, considers that the reversible and irreversible effects may be mutually interdependent. The paper does not claim to be free from assumptions which are not altogether justified, and in particular the deduced property of potential difference in relation to temperature may be open to question. The theory deserves careful consideration; but would it not be possible to throw it into a less analytical form?

THE first part has appeared of the *Rivista di Scienza*, of which a preliminary notice has been already given in these columns. It is an international journal somewhat similar in appearance and arrangement to the present series of *Science Progress*. From the nature of the case the articles necessarily take a somewhat broader view of the progress of science than is possible in a journal published in a country specially characterised by its national apathy to scientific work, and the expectations that were raised by the prospectus have been more than realised in the present number. The character of the journal will best be inferred from the following table of contents:—E. Picard, "La mécanique classique"; W. Ostwald, "Zur modernen Energetik"; G. Ciamician, "Problemi di chimica organica"; F. Raffaele, "Il concetto di specie in biologia"; H. E. Ziegler, "Die natürliche Zuchtmahl"; C. Scipino, "Il carattere delle leggi economiche"; W. Cunningham, "Impartiality in History"; J. Tannéry, "Questions pédagogiques, l'Enseignement secondaire"; in addition to a large number of reviews, notes on physics and physiology, a "review of reviews," and notes. The price of each part is 7*s*. 6*d*. net; Messrs. Williams and Norgate are the London agents. The editorial office is at Milan, 16 Via Aurelio Saffi. The list of forthcoming articles is sufficient to fill a large number of volumes, and nearly every nationality is represented among the contributors.

OF all the numerous publications issued by the United States Geological Survey, none is of greater interest than the volumes dealing with the "mineral resources of the United States," a series of which we have just received the twenty-second annual issue (Washington: Government Printing Office, 1906). Each chapter in this report is a census of the production of the industry under discussion during the calendar year 1905. Although printed in smaller type, the volume is considerably larger than that of the previous year, covering as it does no less than 1403 pages. The publication of the volume has been anticipated to a great extent by the issue in advance, in pamphlet form, of the several chapters which compose it. The volume is edited by Dr. D. T. Day, and the various chapters are written by different statistical experts. The figures dealt with are stupendous. In 1905, for the seventh time, the total value of the United States mineral production exceeded the enormous sum of 200,000,000*l*. The exact figures for 1905 are 324,775,422*l*., iron ore and coal being, as heretofore, the most important of the minerals produced. The arrangement and scope of the volume are practically the same as in previous issues. The production of carbonic acid, especially at Saratoga Springs, New York, is, however, discussed for the first time, and statistics are given of the production and consumption of water-gas. A report is also included directing attention to peat in the United States, and to its great possibilities as a source of fuel. There is, too, a chapter devoted to tin, although, as a matter of fact, during 1905 no metallic tin was made in the United States, and merely an insignificant quantity of ore was obtained from the placers of Buck Creek, Alaska.

IN a paper published in the *Verhandlungen* of the German Physical Society (No. 8, p. 175), Messrs. P. Nordmayer and A. L. Bernoulli give the results of a series of determinations of the specific heat of a large number of substances, both elementary and compound, between the temperatures −185° C. and +20° C. The method used was to ascertain the weight of liquid air evaporated on adding a known weight of the substance in question, the heat required to evaporate 1 gram of liquid air being taken as 50 calories. The results obtained show that, whereas the specific heat of a compound substance such as water or benzene in the solid state diminishes very rapidly as the temperature falls, the specific heat of most solid elements is subject to a much smaller variation. The change of specific heat with temperature is most marked in the case of elements of low atomic weight, for example, sodium and magnesium. For the metals molybdenum, tungsten, and tantalum, the specific heat is almost constant for all temperatures between −200° C. and +250° C.

THE conditions which are essential in order to obtain accurate results in the estimation of potassium by the well-known method based on the precipitation of the metal in the form of its chloroplatinate are studied in a paper by M. J. Morozewicz in the Bulletin of the Cracow Academy of Sciences (1906, No. 9, p. 796). Fresenius recommended that in presence of sodium the chloroplatinate should be precipitated in 70 per cent. to 80 per cent. alcohol, but subsequent workers have advised the use of absolute alcohol instead; it is, however, shown that if absolute alcohol be used, a much larger proportion of platinum chloride is required to ensure the complete transformation of sodium chloride into its chloroplatinic salt. The results obtained are, moreover, generally high, owing to the co-precipitation of some of the sodium chloride. It is therefore advisable to adhere to Fresenius's original procedure.

IN NATURE of June 20 (p. 184) Prince B. Galitzin's experimental verification of Doppler's principle for light rays was briefly noted; and the paragraph stated that use was made of "the graduated spectroscope (Stufenspektroscope)." Mr. J. Twyman, of Messrs. A. Hilger, Ltd., writes to point out that "Stufenspektroscope" is the accepted designation of a spectroscope wherein a "Stufengitter" or echelon diffraction grating is employed.

THE British Sports Publishing Company, Ltd., have issued in their Spalding's Athletic Library the "Lawn Tennis Annual for 1907," edited by H. R. M., and "Spalding's Golfers' Annual for 1907," edited by Mr. Henry Leach. Both books are illustrated by reproductions of action photographs depicting well-known players. The price of the annuals is 6*d*. net each.

WE have received from Marconi's Wireless Telegraph Company, Ltd., a copy of a catalogue dealing with

Röntgen ray and high-frequency apparatus, instruments, and accessories. The list provides full particulars as to a variety of induction coils made by the company, interrupters, fluorescent screens, portable accumulators, and high-frequency sets. The information given as to light baths, vibration apparatus, the Finsen lamp and light, and the orthodiagraph, should appeal specially to medical men. The list is conveniently arranged and admirably illustrated.

A NEW edition of "Bradshaw's Through Routes to the Chief Cities of the World" has just been published. This comprehensive handbook of colonial and foreign travel, besides giving descriptive routes of the chief railways, ocean lines, and caravan tracks, supplies an abundance of maps and plans and some useful vocabularies. The volume has been edited by Prof. A. H. Keane and Mr. Stanley Read, and its price is 5*s*. net. The route numbered 50, dealing with tours round the world, is of special interest, showing as it does the increased facilities for travel since Jules Verne wrote "Round the World in Eighty Days." The actual minimum time required for an all-round journey from London, provided no delay occurred in missing train or boat connections, is 38 days 10 hours, and Lieut.-Colonel Burnley-Campbell recently completed the circuit of the world in 40 days 19·5 hours, following the route Liverpool, Quebec, Vancouver, Yokohama, Tsaruga, Vladivostok, Harbin, Irkutsk, Moscow, Warsaw, Berlin, Ostend, Dover; but the usual quick rate of travel is still 53 days. The book may be commended to teachers as an interesting example of applied geography.

OUR ASTRONOMICAL COLUMN.

TRANSITS OF SATURN'S SATELLITE TITAN AND SHADOW.—In the Publications of the Astronomical Society of the Pacific, vol. xix., p. 125, Hermann Struve gives the following central transits of Titan and shadow during ensuing months:—

1907		G.M.T.	Distance from centre	Semi-duration of transit
		h. m.	"	h.
July 17	Shadow	8 16	0·5 S.	3·0
July 17	Titan	13 48	7·0 N.	1·6
Aug. 2	Shadow	7 30	0·2 N.	3·0
Aug. 2	Titan	12 6	6·3 N.	2·0
Aug. 18	Shadow	6 43	0·9 N.	3·0
Aug. 18	Titan	9 51	5·0 N.	2·5
Sept. 3	Shadow	5 59	1·6 N.	3·0
Sept. 3	Titan	7 42	3·2 N.	2·8
Sept. 19	Titan	5 14	1·3 N.	3·0
Sept. 19	Shadow	5 15	2·3 N.	2·9
Oct. 5	Titan	2 48	0·7 S.	3·0
Oct. 5	Shadow	4 33	2·9 N.	2·9
Oct. 21	Titan	0 31	2·2 S.	2·9
Oct 21	Shadow	3 49	3·6 N.	2·8
Nov. 5	Titan	22 32	3·1 S.	2·8
Nov. 6	Shadow	3 5	4·3 N.	2·6

Saturn Rises at Greenwich.

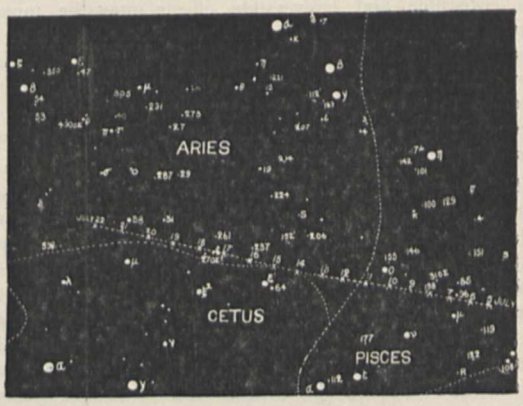
	h. m.
July 1	11 28 p.m.
Aug. 1	9 28 ,,
Sept. 1	7 24 ,,
Oct. 1	5 22 ,,
Nov. 1	3 16 ,,
Dec. 1	1 18 ,,

COMET 1907*d* (DANIEL).—A new set of elements and a daily ephemeris for comet 1907*d* are published by Dr. Strömgren in No. 4187 (p. 191, June 29) of the *Astronomische Nachrichten*. A part of the ephemeris is given here; and, in order to facilitate the location of the object, the daily positions, with respect to the surrounding stars, are marked on the accompanying chart:—

Ephemeris 12h. (M.T. Berlin).

1907	α (true) h. m.	δ (true) ° ′	log *r*	log Δ	Bright-ness
July 10 ...	1 39·0 ...	+ 7 35·1 ...	0·1318 ...	0·0216 ...	3·50
12 ...	1 49·0 ...	+ 8 16·7			
14 ...	1 59·5 ...	+ 8 58·8 ...	0·1133 ...	9·9977 ...	4·25
16 ...	2 10·5 ...	+ 9 41·2			
18 ...	2 22·0 ...	+10 23·6 ...	0·0942 ...	9·9756 ...	5·14
20 ...	2 34·1 ...	+11 5·9			
22 ...	2 46·7 ...	+11 47·8 ...	0·0744 ...	9·9558 ...	6·17

According to Dr. Strömgren's elements, perihelion will occur on September 9·4.



Apparent path of Comet 1907*d*, July 5–22, 1907.

As will be seen from the above ephemeris, the comet is brightening rapidly, and may yet become a faint naked-eye object. At present it is an easy object, when found, in a 3-inch refractor. It has a distinct stellar nucleus which, according to Dr. Zappa, of Rome, was centrally placed and of magnitude 8·5 on June 16. A faint fan-shaped tail was seen on June 21.

MARS: THE DUPLICATION OF THE SOLIS LACUS.—In Bulletin No. 28 of the Lowell Observatory, Prof. Lowell records that the Solis Lacus showed double on May 18, this being the first time that it has appeared divided since the summer of 1894. This is not a case of gemination, for the two portions are not alike either in shape or size, nor were they in 1894. Among the canals which emerge from the eastern part, a new one was detected for the first time on May 18, and has been designated Ichor. The South Polar cap has retreated southward since the last presentation, leaving dark ground behind it, and it is noticeable that the canals connecting with the Solis Lacus on the south are darker and more easily seen than those proceeding from it towards the north, although the tilt of the planet's axis should render the former the more difficult to detect. As the snow has left dark ground behind it, darker than is the case in this region in the later part of the Martian year, Mr. Lowell argues that water, and not CO_2, is concerned. As a consequence, it follows that the temperature in this region—lat. 42°–52°—was already higher than 0° C. on May 18, or, in the Martian year, on a date corresponding to March 13 of our calendar.

VARIABLE STARS.—*Astronomische Nachrichten*, No. 4186 (June 28), contains several important communications concerning variable stars. The first is by Messrs. Müller and Kempf, of the Potsdam Observatory, on the peculiar variable X Persei, which they have now observed regularly for twenty years. The present paper gives the observational record since September, 1899, and is accompanied by a light curve showing the peculiar fluctuations of magnitude which this star undergoes.

In the second paper M. Luizet records some maxima and minima of several long-period variables, among the stars dealt with being *o* Ceti, R Leonis, and S Coronæ.

The third communication is from the Harvard College

Observatory, and gives the designations, positions, magnitudes, magnitude ranges, and spectral classification of fifteen new variable stars discovered in the regions covered by the Harvard maps Nos. 31 and 62.

NAMES FOR THE THREE JOVIAN ASTEROIDS.—Drs. Wolf and Kopff have chosen the three names Achilles, Hector, and Patroclus, respectively, to designate the three important minor planets (588) [1906 TG], [1907 XM], and [1906 VY] discovered by them at Heidelberg. Readers of these columns will remember that the orbits of these three bodies have been found to extend as far from the sun as that of Jupiter (*Astronomische Nachrichten*, No. 4187, p. 192, June 29).

THE MIRA MAXIMUM OF 1906–7.—From a series of observations made at Utrecht, and extending from July 25, 1906, to March 4, 1907, Prof. Nijland found that the maximum brightness of Mira occurred on December 7, when the magnitude was 2·0. The preceding minimum was recorded on August 7, and, as seen from the curve, was a very flat one, from which a sharp rise to an exceptionally bright maximum took place. The previous maximum took place on January 3, 1906, so that the period between these two successive maxima was 338 days (*Astronomische Nachrichten*, p. 113, No. 4183, June 14).

SOLAR PROMINENCE OBSERVATIONS IN 1906.—The annual summary of the results of the prominence observations made at Catania, for 1906, is published by Prof. Riccó in No. 5, vol. xxxvi. (p. 73), of the *Memorie della Società degli Spettroscopisti Italiani*. The daily record is reproduced, and then analysed, under the heads of the extension, height and frequencies of the prominences, in the two hemispheres for each month and quarter and for the year. The similarity of the size and distribution of the prominences recorded to those of the previous year indicates a stationary point characteristic of the maximum, whilst the greater frequency during March points to that month as being the actual month of solar prominence maximum.

CONGRESS OF THE ROYAL INSTITUTE OF PUBLIC HEALTH.

THE congress of the Royal Institute of Public Health, held this year at Douglas, Isle of Man, from June 29 to July 5, was presided over by Lord Raglan, the Lieutenant-Governor of the island, who, in the course of his presidential address, gave a cordial welcome to the members of the congress. He referred to the progress of sanitation during the Victorian era, but pointed out that England was handicapped in the hygienic struggle as compared with Continental nations owing to our exaggerated ideas of personal liberty.

Sir James Barr, in the course of his presidential address in the preventive medicine section, urged medical practitioners to take as deep an interest in sanitation as sanitarians. The health of a nation was its most valuable asset, and he would like to see all his adult countrymen able to handle a rifle and take part in the defence of their country should occasion arise, and he would encourage the military spirit as the best means of developing the moral and physical qualities of the nation. He urged that there should be State aid if needed for every child under sixteen to be properly fed and cared for. Huge trusts and millionaires were a danger to society, and part of their wealth should be appropriated by the State.

Prof. Sims Woodhead, in the section of bacteriology and chemistry, delivered an address on the subject of "antibodies," in which he traced the rise and development of bacteriology, and adduced statistical evidence on the value of diphtheria anti-toxin. Dr. Warrington, of Liverpool, introduced a discussion on cerebro-spinal fever, in which he advocated the isolation of cases and the disinfection of places in which the disease had occurred. Dr. Prudence Gaffitien read a paper on the causes of infantile mortality. She said the high infant death-rate was due to the ignorance of mothers, and advocated the prohibition of the use of soothing syrups, &c. The Infant Life Protection Act was worse than useless; the State should provide for the inspection of foster or nurse children.

Prof. Hele Shaw delivered an address in the engineering and architectural section on road locomotion and the public health. He dealt chiefly with the new conditions occasioned by the advent of motor-cars; he admitted that the public had grievances arising from dust, odour, noise, and vibration, but claimed that much was being done to lessen these.

Dr. Sergeant, of the Lancashire County Council, opened a discussion on the milk supply, and a resolution was passed affirming the desirability of dairy regulations being made compulsory by the Local Government Board.

Many valuable papers were read on notification, tuberculosis, and sanatoria.

The social part of the congress was all that could be desired, and many excursions were made to the places of interest in the beautiful island. The congress dinner was presided over by Lord Raglan, and there was a garden-party at Government House.

RECENT CONTRIBUTIONS TO ELECTRIC WAVE TELEGRAPHY.[1]

PROF. FLEMING said that the achievements of electric-wave telegraphy had not yet ceased to interest the public mind. In little more than eight years from the time when Mr. Marconi sent his first messages across the English Channel, it had become an indispensable implement in naval warfare, and also a means of communication between ships and the shore, greatly adding to the safety of life and property at sea. At the present time practically the whole of the first- and second-class battleships of the British Navy are equipped with apparatus for electric-wave telegraphy, and about 130 cruisers and smaller craft as well. The Marconi Company alone have fitted with their instruments nearly 100 Atlantic liners and other mercantile vessels, and have an elaborate organisation by which all these ships are constantly in communication with the mainland during their voyage from port to port. Concurrently with this, an immense amount of scientific investigation has been carried on having for its object further improvements and the quantitative study of the phenomena. The object of the discourse was to make known some of these recent additions to knowledge.

A cardinal feature of electric-wave telegraphy is the vertical wire or wires at the transmitting and receiving stations, called the antenna. At the transmitting station high-frequency electric currents are set up in the sending antenna, and these create rapidly alternating electric and magnetic forces in the space around, which are propagated outwards from point to point with the velocity of light. Hence at certain distances, called a wave-length, these forces are reversed in the same way at the same instant. In electric-wave telegraphy the wave-lengths used lie between 200 feet and 20,000 feet or so, covering about eight octaves. The measurement of this wave-length is important. Prof. Fleming described an instrument of his own invention, called a cymometer, used for this purpose. It consists of a spiral of wire in series with a sliding tubular condenser, the circuit being completed by a copper bar. Across the terminals of the condenser is placed a neon vacuum tube. If the bar of the cymometer is placed near the transmitting antenna and the handle of the instrument moved, its capacity and inductance can be altered until it comes into tune with the antenna circuit. When this is the case the oscillations in the antenna create violent sympathetic oscillations in the cymometer, and the neon tube glows brilliantly. An index pointer moving over a scale then shows the wave-length of the waves radiated. The same instrument may be used to measure the wave-length of the arriving waves. Also it can be used to determine the decay of the oscillations in a train.

In spark telegraphy the oscillations are set up in the antenna by an electric discharge, and at each spark a group of oscillations takes place. These may come at the rate of ten to fifty groups per second, and each group may contain from ten to 100 decadent oscillations. The cymometer can be used to draw a resonance curve by which the rate of decay and the number of the oscillations in a

[1] Abstract of a discourse delivered at the Royal Institution on Friday, May 24, by Prof. J. A. Fleming, F.R.S.

train are determined. Methods have now been devised for creating undamped or nearly undamped oscillations. One method suggested is by the use of a high-frequency alternator, but the difficulty of constructing such a machine for a sufficiently high frequency is very considerable, and as yet only machines of small power have been made.

Prof. Elihu Thomson in 1892 patented a plan for producing a continuous current electric arc between metal terminals which was acted upon by an air jet or magnetic field. He found that when the metal poles or spark balls were connected by a condenser in series with an inductance high-frequency oscillations were created in the latter circuit.

Mr. Duddell showed in 1900 that continuous undamped oscillations could be obtained when using, in place of the spark balls, an electric arc made between solid carbons. In 1903 Mr. Poulsen went a step farther. He formed the arc between a carbon terminal (negative) kept in rotation and a cold metal terminal (positive), and enclosed them in an atmosphere of hydrogen or coal gas and placed a strong magnetic field across the arc. The arc terminals being then shunted by a small condenser and an inductance, we have undamped high-frequency oscillations suitable for wireless telegraphy created in this latter circuit. Prof. Fleming gave an explanation of the reason for this effect, and showed that it was due to the form of the characteristic curve of the metal carbon arc. He compared the action to that of an organ pipe in which the energy is supplied by a steady jet of air corresponding to the continuous current arc, and this is made to set up aërial vibrations in the resonant organ pipe, equivalent to the condenser circuit, the vibrations in the pipe controlling and drawing their energy from the air jet. In applying the Poulsen method to wireless telegraphy, an antenna circuit is connected either inductively or directly with the condenser circuit.

Experiments were shown illustrating the production of high-frequency undamped electric oscillations in a long wire wound on an ebonite rod. Incidentally it was proved by an ingenious experiment with a neon vacuum tube that the oscillations are not really continuous, but cut up into irregular groups. In reference to the application of the Poulsen method to wireless telegraphy, Prof. Fleming said that the apparatus was more complicated and less easy to use than that for spark telegraphy. It was not true that undamped waves could not be picked up or tapped, and he proved that such advantages as the use of undamped waves in telegraphy might present were not due only to the transmitter, but to the conjoint use of a slightly damped receiver circuit.

Prof. Fleming did not agree with the opinion, confidently expressed in some quarters, that telegraphy by undamped waves would destroy spark telegraphy. Further, he pointed out that the electric arc was not the only method for producing undamped waves. He said that for some months past Mr. Marconi had been working out a purely mechanical method of producing continuous trains of electric waves suitable for wireless telegraphy, and had obtained considerable success. The method was exceedingly simple, and by means of it any existing station for spark telegraphy could be converted easily into a station sending out undamped electric-wave trains instead of intermittent damped trains.

The lecturer then passed on to explain some recent forms of electric-wave detector. When the waves sent out from the sending antenna fall on a receiving antenna they create in it secondary high-frequency oscillations, and these are detected by the use of some device called a wave detector. In addition to the coherer and the Marconi magnetic detector, the latter exclusively used in long-distance work, a receiver called an electrolytic detector is now much used. It consists of a vessel containing nitric acid in which is placed a platinum plate and an exceedingly fine platinum wire as the pair of electrodes. This cell is connected in series with a telephone and a voltaic battery, and when electric oscillations are passed through the cell they annul more or less the polarisation of the small electrode and create an increase of current, which in turn makes an audible signal in the telephone.

Signals are thus sent on the Morse code by interrupting the oscillations in the sending antenna. It has, however, recently been found that this electrolytic detector, in conjunction with undamped-wave trains, affords a means of transmitting, not merely *dots* and *dashes*, but articulate speech sounds, and hence we have now electric-wave wireless telephony as an accomplished fact. Between Nauen and Berlin, a distance of about sixteen miles, successful experiments were recently carried out. From the transmitter continuous undamped waves of constant wave-length are sent out. The antenna is shunted by a microphone, so that words spoken to its diaphragm vary the intensity of the wave train, but not its wave-length. At the receiving station an electrolytic detector is used, and the words spoken to the transmitter are reproduced at the receiving telephone. It is almost practicable at the present moment to speak audibly across the English Channel by wireless telephony, and within the bounds of possibility that at some time we may telephone without wires to a ship in the middle of the Atlantic.

Another new form of electric-wave detector is a glow-lamp detector. A small carbon filament glow lamp has a metal cylinder placed in its bulb so as to surround, but not touch, the filament. This cylinder is connected to third terminal by a wire sealed through the glass. When the filament is rendered incandescent by a continuous current it throws off negatively charged corpuscles or electrons. The space between the filament and the cylinder will pass negative electricity from the filament to the cylinder, but not in the opposite direction. If, then, the oscillatory current in the receiving antenna, or secondary currents induced by them, are passed through the bulb from the carbon filament to the cylinder, only one constituent of the oscillation passes, or the bulb rectifies the oscillations. We can then insert in series with the bulb either a telephone or galvanometer sensitive only to continuous currents and cause it to be affected.

This glow-lamp detector or oscillation valve has already proved itself to be a most sensitive long-distance receiver for wireless telegraphy. It is of great use in connection with undamped electric waves, as it affords a ready means for converting the high-frequency alternating current created in the receiving antenna into a continuous current detectable by a galvanometer or telephone. Prof. Fleming showed by an experiment that it enabled him to revive in another form electromagnetic induction telegraphy.

In the form in which this older system of wireless telegraphy was practised by Trowbridge, Preece, Lodge, and others, a closed primary circuit was traversed by a rather low-frequency alternating current, viz. one of which the frequency lay within the limits of audible sound. In the modification proposed, a closed primary circuit earthed at one point is traversed by a very high-frequency current produced by the electric arc or other mechanical method. With high frequencies, say of 100,000 or so, no disturbance would be created in other earthed neighbouring telephonic or telegraphic circuits. The receiving circuit is a similar closed and syntonised circuit having a glow-lamp detector or oscillation valve and telephone inserted in it. The primary circuit affects the secondary circuit by magnetic induction, and also acts like a Fitzgerald closed magnetic oscillator, and throws off magnetic waves. With these modifications it is possible that induction telegraphy may be extended in range and free from the objection of disturbing neighbouring telephonic circuits.

The lecturer then passed on to consider some advances made in directing electric waves in any required direction. All methods employing mirrors or reflectors are out of the question when long telegraphic electric waves are under consideration. Two methods at the present time presented practical advantages. In one, due to Mr. Marconi, the vertical upright antenna wires are replaced by antennæ having a short part vertical and their greater part horizontal. Such a bent antenna radiates best in the opposite direction to that in which its free or insulated end points. Hence, in accordance with the law of exchanges, which applies to electric radiators, a bent antenna absorbs best electric waves coming from a direction opposite to that to which its free end points. Making use of such bent receiving and transmitting antennæ, Mr. Marconi has been able to limit the radiation in undesired directions, and also to locate the direction of invisible sending stations.

Another method, different in principle, has been devised

by Prof. Braun, of Strassburg, who employs three vertical antennæ placed at equal distances, and sets up in these oscillations having certain assigned differences of phase. Hence, by the interference of these oscillations, the resultant radiation is made a maximum in a certain direction and zero in an opposite one.

In conclusion, some questions were dealt with concerning the varying opacity of our atmosphere to long electric waves and the effects of sunlight and radio-active matter in hindering their transmission. Although much valuable invention and discoveries in connection with this subject have rewarded the labours of workers in many lands, a glance round shows innumerable unsolved problems still remaining. Having regard to its importance for naval and maritime communication, scientific research in connection with wireless telegraphy is not merely desirable, but a positive duty, and it is to be hoped that the tendency to legislate for it by Acts of Parliament or international conferences will not impose shackles upon the freedom of investigation or of commercial work which alone can conduct us to the satisfactory solution of the difficulties and problems which yet remain.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

BIRMINGHAM.—Mr. S. S. Dawson has been appointed to the chair of accounting vacated by Prof. Dicksee.

A sum of about 1000*l.* has been given by the Birmingham Chamber of Commerce to found a scholarship in the faculty of commerce.

MANCHESTER.—During recent years, with the increasing number of students who come from other parts of the country and from abroad, the accommodation in the two halls of residence for men students has had to be extended on several occasions. The opening of the new buildings of Hulme Hall in Victoria Park on July 6, which are to displace the older buildings in Plymouth Grove, marks an important advance, and rooms are immediately available for forty students, whilst this hall will later be extended to accommodate sixty.

ST. ANDREWS.—An important addition to the equipment of the Gatty Marine Laboratory has just been made by the presentation of the late Mrs. Alfred Gatty's extensive collection of British and foreign marine algæ by her daughter, Mrs. Horatia Eden, of Rugby. Begun in 1848 at Hastings, this important collection was constantly added to during the life of the accomplished author of the "British Seaweeds." Moreover, Miss Catherine Cutley, of Exmouth, a well-known algologist, Prof. W. Harvey, Prof. Agardh, and others, largely increased its value by liberal donations. The collection is arranged, though not completely, according to Prof. Harvey's "Index Generum Algarum," and is accompanied by a valuable series of books of reference, many of them finely illustrated, by Greville, Harvey, Turner, Agardh, J. E. Gray, Frauenfeld, Mrs. Gatty, and others. The foregoing, with the collections of algæ by Mrs. McIntosh, Charles Howie, W. Knight, Dr. Drummond, &c., previously in the laboratory, will, with the rich living series in the bay, give workers in algology facilities of no ordinary kind.

THE King will open the new buildings of University College School, in Frognal, Hampstead, on Friday, July 26.

THE Right Hon. Ailwyn Fellowes will distribute the diplomas and prizes on Wednesday, July 24, at the South-Eastern Agricultural College, Wye, Kent.

DR. S. G. RAWSON has been appointed principal of the Battersea Polytechnic in succession to Mr. Sidney H. Wells, who has been principal since the foundation of the institute in 1893, and is resigning to take up the position of director-general of the Department of Agriculture and Technical Education for Egypt. Dr. Rawson is at present director of education for Worcestershire, and was formerly principal of the Technical College, Huddersfield, and lecturer at Liverpool University.

A COMMITTEE has been appointed by the Treasury to inquire and report upon the character of the work accomplished by the University of Wales and its constituent colleges, the financial position and lines of development of the colleges, and their probable requirements for staff or otherwise. The members of the committee are:—Sir T. Raleigh, K.C.S.I. (chairman); Sir John Rhys, Principal of Jesus College, Oxford; Principal D. MacAlister, Glasgow University; Mr. F. G. Ogilvie, C.B.; Prof. W. S. McCormick; and Dr. Alexander Hill, Master of Downing College, Cambridge. Mr. G. L. Barstow, of the Treasury, will act as secretary to the committee.

THE Board of Education has issued its regulations for next session in connection with the work of technical schools, schools of art, and other day and evening schools and classes for further education. A prefatory memorandum directs attention to the changes introduced; but, before enumerating these, some remarks are made on the general condition of the work of the schools concerned. The experience of towns which have provided systematic and graded courses of instruction shows that a good supply of well-considered educational facilities may be made to foster a demand for these advantages without the application of compulsion in the matter of attendance. Another interesting fact is to find it specifically stated that it is regarded as one of the functions of the Board's inspectors to advise educational authorities, where evening and other schools are not so popular as they might be, as to the changes which would probably lead to improvement and to inform them where successful schools may be found. A note has been added to the regulations with the object of making clear to local authorities that the classification of subjects and courses is in no sense a restriction upon the free adjustment of the subject-matter and methods of instruction in any class to the particular circumstances of the students. The necessity for keeping rural interests well in view throughout all educational work in country districts is now fully recognised, and the continuing need for Saturday and holiday courses for teachers who desire to improve their qualifications for duty in such areas is again pointed out.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, May 2.—"The Spontaneous Crystallisation of Binary Mixtures. Experiments on Salol and Betol." By Prof. H. A. **Miers**, F.R.S., and Miss F. **Isaac**.

The authors have inferred from their experiments upon certain salts that a cooling supersaturated solution can at first only be made to crystallise by inoculation with a crystal of the solute, until a perfectly definite temperature is attained at which a mechanical stimulus, *e.g.* shaking or friction, will suffice to produce crystallisation. The temperature of this "spontaneous crystallisation" depends upon the strength of the solution as determined by a curve which they name the "supersolubility curve." They have now traced the complete freezing-point curve, and also the supersolubility curves for mixtures in all proportions of salol and betol, choosing these substances merely because they melt at convenient temperatures and do not form compounds or isomorphous mixtures. Salol melts at 42½°, betol at 92°. The eutectic contains 78 per cent. salol, and freezes at 32½° by inoculation only.

Salol freezes spontaneously at 33°, betol at 79°; the supersolubility curves of their mixtures meet in the "hypertectic" mixture, containing 74 per cent. salol, for which the two substances freeze together spontaneously at 15°.

The freezing-point curve was determined by immersing a minute crystal in the cooling liquid and noting the temperature at which it just ceased to dissolve and began to grow.

The temperatures of spontaneous crystallisation were determined (1) by the crystallisation of the liquid on shaking or scratching when enclosed in a sealed tube, and also (2) by the dense shower of crystals which appears at the same temperature when the liquid is stirred in an open vessel.

The actual change of constitution of the liquid in the crystallising mixture was traced by means of the refractive index.

These experiments show that a binary mixture has, in general, four freezing points. For example, the mixture containing 90 per cent. salol may yield crystals of salol by inoculation at 38°, and by stirring at 28°; crystals of betol by inoculation at 17½°, and by stirring at 10½°.

The actual temperatures of crystallisation in binary mixtures are given by the supersolubility curves.

May 23.—"Studies on Enzyme Action. X.—The Nature of Enzymes." By Henry E. **Armstrong** and E. Frankland **Armstrong.**

The study of enzymes has now reached a stage at which it appears to be desirable to consider what is established and to direct attention to some of the principal issues which remain to be elucidated. The action which each enzyme exercises is clearly specific and limited to compounds of a particular type; the apparent exceptions to this statement in the case of sucroclastic enzymes have been investigated and eliminated: there is little doubt that maltase is capable of hydrolysing α-glucosides alone, whilst emulsin hydrolyses only β-glucosides. Further experiments have been made with carefully purified materials to ascertain what substances control the action of each sucroclastic enzyme; the evidence that enzyme and hydrolyte must be in complete correlation appears to be little short of absolute.

A special study has been made of the hydrolysis of cane sugar by invertase: apparently, glucose and fructose alone retard the action of this enzyme; it would seem to follow that it is so constituted that it can adapt itself to both sections of the biose. Cane sugar, though a derivative of α-glucose, is not a simple α-glucoside, nor is it an α-fructoside: consequently there is little room for doubt that the action of invertase is altogether peculiar and that the enzyme extends its influence over the whole of the cane-sugar molecule. Maltose and lactose differ from cane sugar in that they are hydrolysed by enzymes which also act on the corresponding simple glucosides.

It is conceivable that the enzymes themselves are subject to hydrolysis and simplification—in other words, that a biose may give rise to a monase. The existence of monases in admixture with biases is therefore to be expected. There can be little doubt that the sucroclastic enzymes are products of hydrolytic changes in the protoplasm conditioned by enzymes—mainly proteoclasts.

"Studies on Enzyme Action. IX.—The Enzymes of Yeast: Amygdalase." By R. J. **Caldwell** and S. L. **Courtauld.**

Amygdalin, which on complete hydrolysis yields two molecular proportions of glucose, is only partially hydrolysed by the enzymes extracted from dried yeast, mandelonitrile glucoside and glucose being formed:—

$$C_6H_5CH(CN)O—C_{12}H_{21}O_{10}+H_2O \rightarrow C_6H_5CH(CN)O—C_6H_{11}O_5+C_6H_{12}O_6.$$

The enzyme which effects this decomposition is specific, but being accompanied by *maltase* has been generally supposed to be identical with it. This conclusion, however, appears unwarrantable in view of the evidence recently advanced by the authors that amygdalin is not a derivative of maltose, and in the light of recent work on the specific character of the enzymes (E. F. Armstrong).

Systematic experiments with yeast extracts led to the conclusion that true maltase is without action on amygdalin, for the maltase could be destroyed by heating at 50°, whilst the activity towards amygdalin was unimpaired. Proof was thus obtained of the existence of a specific enzyme not hitherto recognised as a constituent of yeast, which is the active agent in the separation of glucose from amygdalin. This enzyme, "*amygdalase*," is present in larger proportion in top yeasts than in bottom yeasts, and appears to be equally well extracted at all temperatures from 15° to 45°, whereas for the extraction of maltase there is a distinct optimum temperature depending on the variety of yeast.

Although completely freed from maltase by heating at 50°, yeast extract retains not only its power to hydrolyse amygdalin, but also a diminished activity towards methyl-α-glucoside, and unaltered activity towards cane sugar. The inference that methyl-α-glucoside is attacked by the two enzymes maltase and amygdalase cannot well be disputed, particularly as amygdalin is more slowly hydrolysed in presence of methyl-α-glucoside, whereas maltose has no influence. The alternative explanation is that there is yet another *α-glucase* existing side by side with maltase and amygdalase. The enzyme which attacks amygdalin is not identical with *invertase* as Marino and Sericano have recently declared, for a high temperature (60°) quickly destroys amygdalase, leaving active invertase in solution.

Amygdalase, like maltase and invertase, is present in the yeast in the form of a "*zymogen*" or more complex proteid molecule. This zymogen can be dissolved out at 0°, and its hydrolytic activity developed by heating the solution for a short time at 45°. Unlike maltase, amygdalase is not destroyed during autolysis of yeast, but may be precipitated with the invertase by means of alcohol.

June 20.—"Studies of the Processes operative in Solutions."

(2) The Displacement of Chlorides from Solution by Alcohol and by Hydrogen Chloride. By H. E. **Armstrong,** Dr. J. V. **Eyre,** A. V. **Hussey** and W. P. **Paddison.**

(3) The Sucroclastic Action of Nitric Acid as Influenced by Nitrates. By R. **Whymper.**

(4) The Hydrolysis of Methylic Acetate in Presence of Salts. By H. E. **Armstrong** and J. A. **Watson.**

(5) The Discrimination of Hydrates in Solution. By H. E. **Armstrong** and R. J. **Caldwell.**

(2) The effect of different proportions of the non-electrolyte alcohol and of the electrolyte (in solution) hydrogen chloride in displacing ammonium, sodium and potassium chlorides from their saturated solutions has been determined and the proportion of water calculated which it may be supposed is withdrawn by the precipitant in each case. The results afford an interesting picture of the state of the salts in the various solutions; in particular, they show that sodium and potassium chlorides are present in saturated solutions in an easily precipitable, slightly hydrated form and that they pass into a more soluble and more hydrated form as the amount of precipitant is increased. Except that alcohol has less dehydrating power than hydrogen chloride, no distinction can be drawn between the two as precipitants of chlorides.

(3) The method developed in part i. of these studies by R. J. Caldwell has been applied to nitrates, *i.e.* the average concentrating effect which a number of these salts produce has been determined by hydrolysing cane sugar with nitric acid in their presence and ascertaining the extent to which the solution must be diluted in order to reduce the rate of change to the value which it has when the salt is not present. The average degree of hydration deduced for the various salts is as follows:—

$AgNO_3.5H_2O.$
$NH_4NO_3.7H_2O.$
$KNO_3.8H_2O.$
$NaNO_3.11H_2O.$
$LiNO_3.13H_2O.$
$Sr(NO_3)_2.18H_2O.$

(4) To ascertain whether the method followed in (1) and (3) of these studies can be applied to hydrolytes other than cane sugar, the investigation has been extended to the hydrolysis of methylic acetate by chlorhydric acid in presence of various chlorides. The results arrived at are as follows:—

$NH_4Cl.5H_2O.$
$KCl.8H_2O.$
$NaCl.10H_2.$
$BaCl_2.18H_2O.$
$CaCl_2.20H_2O.$

These values are slightly lower than those deduced with the aid of cane sugar. It is suggested that the chlorides enter to some extent into competition with the acid for the ethereal salt and that, consequently, they partially prevent hydrolysis. Nitrates have a still greater effect in competition with nitric acid, the apparent hydration values being $NH_4NO_3.2H_2O$, $LiNO_3.0H_2O$, $KNO_3.1H_2O$, $NaNO_3.3H_2O$.

(5) The results arrived at in these studies and in those

on enzyme action carried out at the Central Technical College are discussed with reference to the general problem of chemical interchange in solution. It is argued that not only is the ionic dissociation hypothesis irrational and unsupported by chemical evidence which compels its acceptance but that proof is not wanting that it is untenable; that the selective action of enzymes as hydrolysts, the action of salts and other dehydrants in promoting hydrolysis by acids and the similar behaviour of non-electrolytes and electrolytes in precipitating substances from solution are all cases of change which it is easy to explain on the assumption that association takes place, although incompatible with the view that dissolution involves separation into free ions. The importance of the part played by hydrates in solution is considered and the evidence bearing on their composition is analysed—especially that to be derived from the change in the solubility of gases produced by salts, &c. It is contended that the values deduced by the cane-sugar hydrolysis method are rational values. Finally, reference is made to the nature of electrolytes and it is argued that it is incumbent on physicists to reconsider the arguments which lead them to accept the hypothesis of ionic dissociation, in order that they may substitute some more suitable hypothesis.

Royal Microscopical Society, June 19.—Lord Avebury, F.R.S., president, in the chair.—A slide of cow's hair presented by J. E. **Lord.** The hair, which showed a wool-like structure, was taken from the flank of the cow. Hair of this description is used in the manufacture of felt for exportation to a foreign port, where, owing to the prohibitive tariff, it has to be free from wool. The felt was refused admittance, except on a higher scale of tariff, on the ground that it contained wool. This led to an examination of the constituents of the felt, and the wool was traced to the cow. Hair is found on many goats, the llama, and the camel, which is commercially known as wool.—Slides of fluid crystals: Dr. **Hebb.** An intermediate physical state exists between the solid and liquid forms of matter, *i.e.* some substances present themselves as liquids whilst retaining certain characteristics of their solid state. This intermediate state has been found to occur in animal tissues, and it is to Adami and Aschoff that we owe the demonstration of potential fluid crystals in certain organs, *e.g.* the adrenal gland. The slides exhibited were sections cut from the fresh tissue of the adrenal gland. In one illuminated by ordinary light the sphero-crystals were indistinguishable from common fat globules, but in one illuminated by polarised light they evidently possessed the power of double refraction, and exhibited a well-marked black cross.—A slide of a group of six specimens of Stephanoceros, mounted: Mr. **Rousselet.**—Eye-pieces for the microscope: E. M. **Nelson.** The paper had reference to a new eye-piece calculated by Mr. Nelson and described by him in his presidential address in 1900. The author said that in his own work these eye-pieces have quite superseded those of the compensation form. There is no reason why they should not be produced at a price only slightly in excess of that of the ordinary Huyghenian, as they are composed of only two biconvex lenses. In these eye-pieces the refractions are equally divided between the two lenses, and the equation for achromatism given by Coddington and others is also satisfied.—The life-history of the tiger beetle: F. **Enock.**

Royal Meteorological Society, June 19.—Dr. H. R. Mill, president, in the chair.—Weather and crops, 1891–1906: F. C. **Bayard.** An analysis was given of the agricultural and horticultural tables which are included in the annual phenological reports. The author had sorted out the various crops into "good," "average," or "bad" for each district, and against each he had placed the temperature, rain, and sunshine for the four seasons, and whether these statistics were above or below the average. Tables were given showing the general results with regard to wheat, barley, oats, beans, peas, potatoes, turnips, mangolds, hay, clover, apples, pears, plums, raspberries, currants, gooseberries, and strawberries.—The relation of the rainfall to the depth of water in a well: Dr. C. P. **Hooker.** The author gave the weekly measurements of the depth of water in a well 101 feet deep at Further Barton, Cirencester, compared with the weekly rainfall for the years 1903–6. The results included the remarkably wet year 1903, and the droughty summer and autumn 1906.—The "step" anemometer, an instrument designed to obviate the "sheltering" error of the Robinson's cups: W. **Child.**

Royal Anthropological Institute, June 25.—Mr. F. W. Rudler, ex-president, in the chair.—A series of lantern-slides illustrating aboriginal rock paintings discovered by him in Western Australia: F. S. **Brockman.** The subjects depicted consist of human figures, animals, and hands, the former being the more interesting. The figures, which are dressed in a long jacket and trousers, are very crudely drawn and painted in red, black and white pigment. A peculiar feature is that the mouth is not shown. There is some difficulty in determining whom the figures represent, but it is clear that they are not Australians, and it seems most probable that a party of shipwrecked Europeans served as the original model.—A collection of so-called Kanaka skulls from the south of New Caledonia: Dr. David **Waterston.** The skulls were very varied in type, but some showed distinct Polynesian and others Melanesian features, while one was of Australoid and another of negroid character.—Instruments employed to obtain contour tracings of the different aspects of the skull: Prof. **Cunningham.** The instruments included Broca's original stereograph, Lissauer's instrument, Rudolf Martin's Kubuskraniophor, and an American periglyph.

Challenger Society, June 26.—Sir John Murray in the chair.—Dr. **Calman** exhibited and made remarks on some plates of tropical Cumacea, followed by a discussion on the comparative rates of growth of the fauna in warm and cold seas.—The secretary reported on the commencement of the society's "Bibliography of Marine Zoology, 1846–1900," of which Mr. L. A. Borradaile has been appointed editor; the bibliography will enable a worker to find readily the faunistic papers on any area or of any group in which he is interested.

DUBLIN.

Royal Dublin Society, May 21.—Prof. S. Young, F.R.S., in the chair.—Some devices for facilitating the study of spectra: Prof. W. N. **Hartley.** The author described the infusible materials used as supports instead of platinum in high-temperature flames, such as carborundum points and quartz fibres. For solutions, quartz tubes with a capillary orifice were used. The use of the Mecke burner was shown both with and without the air-blast. For the production of chloride spectra, an arrangement was shown by which a bye-pass carried a portion of the gas supply through a bottle containing sponge saturated with chloroform. The Mecke blast burner was shown with the blast produced by a water-blower; the pressure should be 2 kilos. per sq. cm. Photographs were shown of spectra of lime and calcium chloride taken with two hours' exposure.—Note on the spectra of calcium and magnesium: Prof. W. N. **Hartley.** In photographing the spark spectrum of metallic calcium in an atmosphere of hydrogen, and also in a vacuum, without a jar in circuit, it was found always very difficult to obtain precisely the same spectrum with the same exposure. The principal features were the bands in the red, orange, and green, with the line λ 4226; also in one instance there appeared the lines at 3968·6 and 3933·8, but these were very feeble. At pressures less than 5 mm. there was no distinct passage of the spark between the electrodes. They glowed with a violet light; bright stationary spots of white light were seen on the negative electrode, and a great number of scintillations, less bright on the positive electrode, not in one spot, but all over it. At intervals there was a small flame of red light lasting a few seconds, evidently due to the calcium, which apparently passed from the positive electrode; but this ceased after a few seconds. Similar observations were made on magnesium electrodes under the same conditions. The phenomena are believed to be connected with discharge of negative electricity from hot calcium and from lime, described by Dr. F. Horton at the meeting of the Royal Society on January 31.—The free gases contained in monazite: R. J. **Moss.** The gas

liberated when Norwegian monazite is ground *in vacuo* consists chiefly of hydrogen and helium, with atmospheric gases. One volume of helium so obtained is associated with about six volumes of hydrogen. It is shown that this evolution of gas is not due to the heat mechanically produced; the gases are probably present in the free state. When the mineral is heated very little hydrogen can be detected in the gas at first evolved, but at a temperature of about 600° C. nearly half the gas evolved is hydrogen. It was found that at temperatures as low as 275° C. some of the oxides present in the mineral were reduced by hydrogen, with the production of water, hence the relatively small quantity of hydrogen in the gas at first evolved in heating the mineral. Hydrogen in other radio-active minerals may escape detection for the same reason.

PARIS.

Academy of Sciences, July 3.—M. Henri Becquerel in the chair.—Some formulæ relating to the number of classes of quadratic forms: G. **Humbert.**—The *rôle* of the spleen in trypanosomatous diseases: A. **Laveran** and M. **Thiroux.** Among animals the spleens of which have been removed, the development of the disease is not sensibly modified.—The direct hydrogenation of the anhydrides of formenic acids: Paul **Sabatier** and A. **Mailhe.** The general method of hydrogenation over finely divided nickel can be systematically applied in this case.—The synthesis of secondary isoamyl alcohol,

$$(CH_3)_2{=}CH{-}CHOH{-}CH_3:$$

Louis **Henry.**—A prehistoric syphilitic skull: L. **Lortet.**—A mineralogical study of the silicated products of the eruption of Vesuvius (April, 1906), and conclusions to be drawn therefrom: A. **Lacroix.**—Finger-prints as a method of identification: M. **Dastre.** The finger-prints of any particular individual, from the youngest age to the most advanced, are invariable, and the concordance of the impressions of the ten digits would constitute practical certainty of identification, the calculable chance of error being less than one part in sixty-four billions.—The evolution of forces: Gustave **Le Bon.**—The integrals of the differential equation $y^1+A_2y^2+A_3y^3=0$: Pierre **Boutroux.**—A mechanism which allows the maintenance of a train of prisms rigorously at minimum deviation: Maurice **Hamy.**—The ionisation of air: L. **Bloch.** A current of air across ordinary or, better, distilled water acquires a negative charge, which is, however, a difference between two unequal charges. The intensity of the ionisation thus implied is greatly augmented with increased pressure.—The electrolysis of very dilute solutions of silver nitrate and oxide: MM. **Leduc** and **Labrouste.** There is little doubt but that silver liberated by electrolysis under a sufficient voltage behaves as an alkaline metal reacting upon water to produce an oxide.—The absolute atomic weight of chlorine: G. D. **Hinrichs.**—The volumetric estimation of phosphorous acid: C. **Marie** and A. **Lucas.**—The action of chlorine and sulphur chloride on some oxides: F. **Bourion.**—The atomic weight of hydrogen: Daniel **Berthelot.** The mean result as deduced from the densities of nitrous oxide, nitric oxide, and nitrogen is calculated to be 14·005.—The specific heat and cryoscopic constants of mercuric iodide: M. **Guinchant.**—Diglycollic acid and its homologues: E. **Jungfleisch** and M. **Godchot.**—Synthesis by means of mixed organometallic derivatives of zinc. Unsaturated $\alpha\beta$-acyclic ketones: E. E. **Blaise** and M. **Maire.**—Some new bromo-derivatives of pyridine: L. **Barthe.**—The action of some γ and δ-bromo-ethers on cyanoacetic, malonic, and methylmalonic ether: G. **Blanc.**—The alkaline rocks of Central Africa: A. **Chudeau.**—A new Myxosporidia parasite in the sardine: L. **Léger** and E. **Hesse.**—The genital organs of the *Taenia nigropunctata*: Pasquale **Mola.**—The action of low temperatures on the eggs of *Paralipsa gularis*, Zeller: J. **de Loverdo.**—Calcification and decalcification in man: P. **Ferrier.** There exists naturally in certain organisms an epoch in life when an elimination of chalk is necessary. This can be brought about by the use of inorganic acids, sodium and magnesium sulphates, sodium phosphate, and alkaline sulphides.—Artificial serums: C. **Fleig.**—A new method of measuring the surface of the human body: M. **Roussy.**

NEW SOUTH WALES.

Linnean Society, May 23.—Mr. A. H. Lucas, president, in the chair.—Special meeting to mark the occasion of the bicentenary of Carl von Linné (1707–1778).

May 30.—Mr. A. H. S. Lucas, president, in the chair.—Studies in Australian entomology, No. xiii., new genera and species of Carabidæ, with some notes on synonymy (Clivinini, Scaritini, Cunipectini, Trigonotomini, and Lebiini): T. G. **Sloane.**—Dimorphism in the females of Australian Agrionidæ (Neuroptera: Odonata): R. J. **Tillyard.** In *Ischnura heterosticta* the male is bronze and blue; of the females, form A (ordinary) is dull black, and form B (dimorph) imitates the male; and the proportion of form B to total number of females is 30 per cent. to 40 per cent. In *I. delicata*, ♂ red and blue; ♀ form A, dull black or olive-green; form B, imitates ♂; 10 per cent. in S.W. Australia. In *Agriocnemis pruinescens*, ♂ black with grey bloom; ♀ form A (wanting); form B, orange; 100 per cent. In *A. splendida*, ♂ bronze and blue; ♀ form A, similar to ♂; form B, red; 40 per cent. In *A. argentea*, ♂ silvery-white (ground colour black); ♀ form A, black; form B (wanting); 0 per cent. In *A. velaris*, ♂ bronze with red tip; ♀ form A (wanting); form B, red; 100 per cent.—The Lake George Senkungsfeld: a study of the evolution of Lakes George and Bathurst, N.S.W.: T. G. **Taylor.** Lake George, situated twenty-five miles south-west of Goulburn, is the largest lake in New South Wales. It is bounded on the west by a *fault scarp* nearly thirty miles long and about 400 feet above the level silt-bed of the lake. The rivers running into the lake originally entered the Yass River, but have been blocked by the fault. The old outlet, 300 feet above the lake, is represented by alluvial boulders up to 2 feet in diameter, which can be traced for three miles across the fault scarp. The second portion of the paper deals with the origin of Lake Bathurst. This is a broad valley probably blocked by the talus and débris carried down by the Mulwaree River.

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