THURSDAY, JANUARY 27, 1910.

AN AMERICAN AGRICULTURAL CYCLOPEDIA.

Cyclopedia of American Agriculture. A Popular Survey of Agricultural Conditions, Practices, and Ideals in the United States and Canada. Edited by L. H. Bailey. Vol. IV. Farm and Community. Pp. xiv +650. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1909.) Price 21*s.* net.

DR. BAILEY is surely the most energetic of the agricultural editors of to-day. Besides writing a dozen or more books himself, he has edited a long series of text-books, a great Cyclopedia of American Horticulture, and has now completed the companion Cyclopedia of American Agriculture. So much has he found this task to his liking that he tells us he

"would like to make another. It is much satisfaction to assemble the opinions of the best men and women in a particular field, and to work them out into a harmonious arrangement."

The subject-matter is not set out under headings in alphabetical order, but is grouped in four great divisions; the first volume dealt with the laying out and organisation of a farm, the second with the crops, the third with the animal products, and in this fourth and last volume we come to

"the larger question of the relation of the farmer to his fellow men, and of the farm to the other assets of the commonwealth."

This volume, reviewing as it does all those economic, social, and political aspects of rural life which are of never-failing interest, will therefore appeal to a much larger circle of readers than did the others. Most people will be surprised at the magnitude of agricultural industries in the United States. They employ more capital than do all the manufactures put together, and more than one-third of the entire working population, as compared with one-fourteenth in Great Britain. The agricultural exports are larger than any others, whilst the imports form nearly one-half the total imports. Maize is the most important crop, exceeding in annual value any other two combined; further, it is the largest single American product of any kind, agricultural, mineral, or manufactured. A considerable section of the volume is devoted to the history of North American agriculture from Indian times to the present day. Maize has always been the chief cultivated food plant. Jacques Cartier found large fields of it growing in 1534 where Montreal now stands. Champlain in 1604 found it cultivated almost everywhere from Nova Scotia to points far up the Ottawa river. Much was eaten green, generally after it had been roasted or boiled; indeed we may trace not a few of the characteristic American and Canadian dishes to an Indian origin. Beans, pumpkins, squashes, and tobacco were raised by the Indians; fruit was preserved in wild honey; sugar was made from the juice of the maple. An account of this operation can be found in the Philosophical Transactions of the Royal Society for 1684–5 (p. 156), while the Indian maize culture is described in the preceding volume, p. 466. This paper is, as usual, overlooked, probably because it was somehow omitted from the index to the volume. The Indians kept meat in cold storage, *i.e.* in snow, they cured tobacco by heat, they practised irrigation in the dry districts, they cultivated cotton, preserved fruit berries and vegetables by sun and air drying, and they preserved vegetables from rotting by burying them in the ground—the idea of the modern silo.

Coming to historic times, five main periods can be noticed. In the colonial period, 1607–1783, the settlers were adapting and improving on the Indian methods. Next follows the time of the western expansion. From 1830 an enormous change arose in consequence of the introduction of railroads, the repeal of the English corn laws, and the wars and other events in Europe which created a demand for American food products. Lastly, American agriculture has been largely reorganised since 1887, when the Experiment Station Act (Hatch Act) was passed by Congress. Since this time there has been developed that wonderful system of experiment stations and agricultural colleges that is without equal in the whole world. Irrigation and drainage are also attracting attention. It is estimated that there are still eighty million acres of swamp land, not only practically valueless, but a hindrance to travel and a menace to health, which, if properly drained and cultivated, could probably support a population of 10,000,000 people. Various chapters in these historic movements are worked out in considerable detail; we have, for instance, what has probably never been attempted before, a chapter on historic farm animals. Much space is devoted to the present position of agriculture. Various means of checking the rural exodus are suggested, among others that the country schools should teach the love of country life and train for life in the country. Mr. Booker Washington brings out the interesting point that while negroes constitute less than one-twelfth of the population of the United States, they conduct 13 per cent. of the farms, and raise 5·4 per cent. of the total farm products.

Natural resources, especially forestry, receive a good deal of attention. It is shown, too, that the agricultural labourer is very efficient; 9,000,000 hands in the United States raise nearly half as much grain as 66,000,000 in Europe, where, however, far fewer horses are employed. Business organisation, book-keeping, costs, cooperation, and credit are next discussed, while a section is given to the amenities of rural life, the church, travelling libraries and travelling pictures, social organisations, the rural landscape, and "the farm beautiful."

Dr. Bailey himself writes on agricultural education. We notice that the American colleges are subjected to criticism just as are our own, because many of their best students do not become farmers. The answer is, of course, obvious; they are needed to provide the enormous staff of experts maintained by the colleges and experiment stations. The American educational system is more complete than ours in that it aims at giving systematic instruction to the men actually farming. The means adopted include courses at the col-

leges, reading circles at home, and farmers' institutes. Full details of the working of these schemes are given.

Legislature relating to agriculture is then dealt with, and the somewhat varying laws of the different States are summarised. Lastly, we have a number of biographies of persons who were prominent in developing "agriculture and wholesome country living, and in starting new movements of national consequence."

The volume can be cordially recommended to all who are interested in the remarkable progress of agriculture in the United States. The story is wonderfully interesting, even when told in the rather disjointed manner that is a necessary consequence of a number of authors and an encyclopædia. Problems are arising in parts of the British Empire not unlike those that have arisen in the United States. The methods by which they were dealt with there, which are so well set out in the present volume, cannot fail to afford valuable and suggestive material to agricultural workers and administrators elsewhere.

E. J. RUSSELL.

SIR JOSEPH BANKS.

Sir Joseph Banks, the "Father of Australia." By J. H. Maiden. Pp. xxiv+244. (Sydney: William Applegate Gullick; London: Kegan Paul and Co., Ltd., 1909.) Price 6s. net.

IN an old gazetteer we read that Botany Bay was discovered in 1770 by Captain Cook, who so named it from the great quantity of herbs which he found on its shores. This statement is true, of course, as to the main fact, but it is otherwise inaccurate and incomplete, for no doubt the name was suggested by Sir Joseph Banks's report on the vegetation of the country around their first landing-place in Australia and the very rich botanical collections obtained. After circumnavigating New Zealand the question arose whether the *Endeavour* should sail in search of the supposed southern continent or make for the coast of New Holland, and the latter course was determined upon because the condition of the ship was not considered equal to encounter the stormy southern seas. The expedition arrived in the bay on April 28 and left on May 6, and an entry in Banks's journal, dated May 3, runs as follows:

"Our collection of plants was now grown so immensely large that it was necessary that some extraordinary care should be taken of them lest they should spoil in the books."

This note referred to the collections previously made in New Zealand, as well as the Australian plants, of which, by the way, only a small proportion were herbs.

In commemoration of this notable and important event an obelisk was erected in 1870, the centenary of the landing of Cook and Banks, but it has long been felt in Sydney that Banks's services in the exploration and colonisation of Australia have not been adequately recognised. As Mr. Maiden states in the book before us:—"His journal of the voyage was made over to Hawkesworth, who so arranged the narrative that Banks did not receive due credit." The recent publication of Banks's journal, edited by the venerable Sir Joseph Hooker, has brought to light the prominent part Banks took in the expedition, and the publication now of a portion of his correspondence shows that he was more or less actively engaged during the remaining fifty years of his life in promoting the interests of the young colony and the exploration of the surrounding country. A committee has been constituted in Sydney to collect a fund for the purpose of providing a memorial to Banks. Mr. Maiden has joined the movement, and the book he now offers the public has been compiled with the double object of disseminating information concerning "Australia's greatest early friend" and of procuring a handsome contribution to the memorial fund. It has been printed at the expense of the State of New South Wales, and the whole of the proceeds of the sale will be devoted to the object in question.

That a botanist should have undertaken this task is appropriate, and a botanist living on the spot where Australia's colonisation began, because Banks himself, though a man of universal sympathies, was essentially a botanist and horticulturist. Mr. Maiden has not written a biography of Banks, though he chronicles the leading events of his whole career. Following this he has strung together a chronological narrative of events connected with the early history of Australia, in which many important personages figure besides Banks. The whole is a highly interesting record of facts, gleaned from a variety of sources and selected for the purpose of establishing, or rather vindicating, Banks's claim to the gratitude of both the old and the new countries for the leading part he took in what has proved a most momentous movement in the population of the Antipodes. The book is fully and suitably illustrated, including portraits, early views, and reproductions of Cook's charts of Botany Bay and the entrance to the Endeavour River, on which the modern Cooktown is situated. It is a book, too, that everybody interested in Australia should read, and thereby derive much pleasure, and directly or indirectly assist the author in his patriotic effort. Short extracts from two of Banks's characteristic letters, dated 1797 and 1799, and addressed to Governor Hunter, may close this notice:—

"The climate and soil are in my opinion superior to most which have yet been settled by Europeans. . . . I see the future prospect of empire and dominion which now cannot be disappointed. Who knows but England may revive in New South Wales when it has sunk in Europe? Your colony is already a most valuable appendage to Great Britain, and I flatter myself we shall before it is long see her Ministers made sensible of its real value." W. B. HEMSLEY.

THE ESSENTIALS OF THE COMPARATIVE ANATOMY OF VERTEBRATES.

Vergleichende Anatomie der Wirbeltiere. By Dr. Robert Wiedersheim. Siebente Auflage. Pp. xx+936; 476 text-figures, and one lithographic plate. (Jena: Gustav Fischer, 1909.) Price 21 marks.

THE seventh edition of this well-known text-book is much more than a mere reprint of the 1906 edition, the work in its present form having experienced both a thorough revision and a considerable

increase in bulk. Additions have been made to the accounts of nearly every system of organs, and the verbal descriptions supplemented by the inclusion of nearly one hundred new text-figures. The new figures illustrating the skulls, so coloured as to distinguish bone from cartilage, are very effective, and those of Petromyzon, Lacerta, Crocodilus, and Chelone will be found especially useful; indeed, it is a pity that a few more laboratory types (such as Hatteria, and some additional birds and mammals) were not included at the same time. The valuable literature-list—a most excellent feature of this book—has also of necessity been much enlarged.

The account of the nervous system shows a marked advance on that of the earlier editions. The description of the internal structure of the brain embodies some of the important results obtained in recent years by Edinger, Sterzi, Elliot Smith, Johnston, and other workers in this branch of anatomy. There is also included a more thorough exposition of the modern component theory of the cranial nerves, though we are of opinion that the sections treating of this subject, and of the primitive segmentation of the head, might with advantage have been still more expanded, both as regards the facts and their theoretical interpretation. The questions, for example, as to the alleged serial homology between ordinary eyes and the paired pineal organs, the primitive sensory nature of the epibranchial placodes (referred to on p. 331) and their possible connection with the eye and the nose, the late origin and consequent non-homology of the acustico-lateral system of nerves with the spinal nerves, the secondary nature of the segmental arrangement of the lateral-line sense-organs, the curious situation of the supposed gustatory organs in the external skin of certain teleosts and their innervation by the visceral sensory lateralis accessorius nerve, are all of intense interest, and worthy of a brief discussion in a book dealing with the fundamentals of vertebrate morphology. The chief results of the large amount of work recently pursued in connection with the gas-bladder of fishes have also been incorporated in the revised account of this subject, though we cannot agree with the unhesitating adoption of the Reis-Nüsbaum idea that the gas contents of the bladder are the product of the chemical decomposition of the substance of the gland-cells; in our opinion Jaeger's view, that the oxygen and other gases are derived directly from the blood and are merely pumped into the bladder cavity by the gland-cells, seems much more feasible. Among other sections of the book which have been considerably altered and extended are those relating to the morphology of the sternal skeleton, the phylogeny of the limb skeleton, the structure of the mammalian lung, the urinogenital apparatus of bony fish, and the male copulatory organs of the chief vertebrate groups.

Concerning what we venture to consider omissions in the book, we must confess that we should like to have seen, among other things, a complete account of the recent work of Osborn, Broom, and others on the Theriodont reptiles, and of the origin of the Mammalia from this ancient group, a subject of intense interest to comparative anatomists and one which has now been worked out in such complete detail that we can trace in these fossil reptilian skeletons the evolution of almost every bone in the mammalian skeleton. Again, the subject of the minute structure of fish-scales, to which Goodrich has recently directed attention, is quite untouched in the present work, though the facts are most striking, both from the standpoints of pure morphology and classification. In saying that these subjects are omissions, and thereby implying that in our opinion they should have been included, we are not unmindful that the size of the book must be kept within reasonable limits; we would only suggest that succinct accounts of the subjects just named and those before referred to are far more suitable for inclusion than descriptions and figures, *e.g.* of the external form of the ear, of the development of the cement organ of Polypterus, of the layers of the retina, and other similar topics which, though also worthy of mention, are of relatively less moment.

We may point out in conclusion that to the best of our belief the common text-book statement (p. 642) that the at-first paired umbilical (allantoic or hypogastric) veins are homologous with the epigastric veins of Amphibia and the lateral veins of Elasmobranchs has been disproved by Beddard: the two sets of veins are quite distinct.

A standard book like the present, and especially this last superb edition, is in no need of recommendation, and our recognition of this is a sufficient apology for the large proportion of criticism contained in the preceding remarks. W. N. F. W.

THREE TEXT-BOOKS OF PRACTICAL CHEMISTRY.

(1) *A Course of Practical Chemistry Suitable for Public Schools.* By A. Beresford Ryley. Pp. viii+156. (London: J. and A. Churchill, 1909.) Price 4*s.* 6*d.* net.

(2) *Introduction to Practical Chemistry, for Medical, Dental, and General Students.* By A. M. Kellas. Pp. viii+262. (London: Henry Frowde, and Hodder and Stoughton, 1909.) Price 3*s.* 6*d.* net.

(3) *First Stage Inorganic Chemistry (Practical).* For the First Stage Examination of the Board of Education (South Kensington). Revised Edition. By H. W. Bausor. Pp. iii+85. (London: W. B. Clive, University Tutorial Press, Ltd., 1909.) Price 1*s.*

As a general rule, the teacher of practical chemistry yields sooner or later to the apparently irresistible temptation of writing a text-book for the use of students attending his classes. The consequent excessive multiplication of elementary treatises is, in the main, deplorable, although the contents of some of these publications afford an interesting indication of the trend of contemporaneous science teaching.

(1) The course of practical chemistry suitable for public schools is of special significance from this point of view, inasmuch as the author refers to his procedure as a retrogression from the heuristic method, a system which he dismisses as "ideal, but quite impracticable in the larger classes of public schools." This course

of instruction begins with a series of introductory exercises on such fundamental principles as the nature of physical and chemical changes, the common elements and some of their typical compounds, and the processes of combustion, oxidation, reduction, &c. Detailed explanations are to be supplied by the demonstrator, who is also supposed to carry out the more difficult experiments, and to devise the simple apparatus required by the student.

Simple volumetric analysis is introduced at an early stage, but, unfortunately, the underlying principle of equivalence is not adequately explained. Two definitions of equivalent weight are given on p. 54, one referring to acids, and the other to bases and salts. In the latter, equivalent weight is stated to be the molecular weight divided by the sum of the valencies of the metallic radicle. This definition is not applicable to potassium permanganate, an important reagent generally introduced into an elementary course of volumetric analysis. The working instructions for the volumetric analysis and for the determination of equivalents and atomic weights are excellent, and make for neatness and accuracy in quantitative exercises. There are a few singular omissions in the general practical course; formic acid is not indicated as a source of pure carbon monoxide, and although the interaction of copper and hot concentrated sulphuric acid is mentioned thrice, on pp. 13, 92, and 98, no reference is made to the cuprous sulphide which is produced as a bye-product together with copper sulphate.

The last chapter is devoted to qualitative analysis, and contains the practical details of the dry and wet tests for the commonly occurring metals and acids, without equations or other theoretical explanations.

Although an experienced teacher could select, from the large number of practical exercises contained in this treatise, a typical set suitable for an elementary course, yet it would certainly be necessary to add a few simple gravimetric processes such as the estimation of iron, copper, chlorine, or sulphate. Otherwise, the student's practical experience would be sadly lacking in balance, for while having had an opportunity of attempting the preparation of comparatively uncommon compounds, such as phosphine and periodic and bromic acids, he might remain ignorant of the methods of elementary gravimetric analysis.

(2) The author of the second volume under review is of opinion that an elementary practical book should contain more complete explanations than are generally given. This course also begins with the practical study of the non-metallic elements and their typical compounds, but some of this introductory work may be omitted by students who have an opportunity of seeing these experiments demonstrated on the lecture table. The work on the non-metals is followed by the preparation of typical compounds of the metals. These exercises are of special interest to medical and dental students, as a knowledge of the preparations given in detail is required by the syllabus of the Conjoint Board. The list of preparations would be considerably improved by the inclusion of a few double salts (such as ferrous ammonium sulphate and the alums), some of which are quite suitable for an elementary course. The qualitative tests for the metals and acids are described in considerable detail, equations being given for the more important chemical changes, together with a summary relating to each metal and its notable compounds. Although this part of the book is fairly comprehensive, the tests for nickel and cobalt and for boric and hydrofluoric acids are omitted. In other respects, the qualitative analysis is quite adequately treated in a systematic manner, and the tables are remarkably free from errors. On p. 94 the interaction of a silver salt and sodium hydroxide gives the oxide Ag_2O, whereas on p. 148 the product is said to be the hydroxide AgOH. The first reaction on p. 112 refers to stannous sulphide.

The last chapter contains a brief introduction to quantitative analysis, dealing chiefly with volumetric processes.

(3) The third of the foregoing books has been re-written to meet the present requirements of the Board of Education as regards the elementary stage of practical inorganic chemistry. A description of the properties of some common substances leads up to elementary experiments consisting of observational work and simple quantitative exercises. Full working details are given as well as theoretical explanations. The book is admirably suited to the work of the elementary stage. G. T. M.

OUR BOOK SHELF.

Bathy-orographical Wall Maps of the Pacific, Atlantic and Indian Oceans. (Edinburgh and London: W. and A. K. Johnston, Ltd.) Price 12*s.* each.

THESE maps of the oceans are on Mollweide's equal-area projection. The elevations and depressions shown are at 6000, 1500, 600 feet, and below sea-level on the land, while 100, 1000, 2000, 3000, and 4000 fathoms are represented over the sea area.

The elevations shown on the land are scarcely sufficient for the purpose for which these maps are undoubtedly intended, the study of the build of continents, but the sea depths should render them useful to teachers.

Many points are admirably illustrated. The oceanic islands are well shown as the culminating summits of ridges, and the use of such maps should help to correct the erroneous notions often prevalent as to the position of island groups.

The complicated series of islands in the Pacific Ocean can only be understood by reference to a clear ocean map. For example, the islands known as Melanesia, which rest on the submarine plateau to the east of Australia, can be seen to have an intimate connection with the mainland, with which they were once connected. On the outer fringe of these islands are the Solomon Islands and New Hebrides, and the Mikronesian group from the Caroline Islands to the Tonga Islands.

Further to the east the South Pacific chain suggests a possible land connection in former ages between South America and Australia, which may account for the migration of marsupial and land tortoises from one coast to the other.

The fringing chains of islands which extend on the north-west of the Pacific from Formosa to Alaska are admirably shown on this map, in contrast to the deep depressions known as the Tuscarora and Aleutian trenches.

The usual classification of the major submarine forms includes the shelf, the depression, and the elevation. The shelf extends to about 100 fathoms below sea-level. As the lowest ground represented in these maps, from 0 to 600 feet, is coloured green, while the sea to the depth of 100 fathoms is tinted a light blue, students will probably find it somewhat difficult to compare these areas. The maps would have gained considerably if both these regions, from 600 feet to the 100-fathom line, had been left white, and if the names, at any rate on the land, had been omitted. It is surely quite unnecessary to print "AFRICA" across the continent in such large letters as to obscure some of the details of the plateau of Abyssinia.

On the oceans the names are fewer in number, and do not interfere with the graphic effect of the deeper blue which marks the depressions and elevations of the ocean floor.

Though, as regards graphic representation, more suited for reference than school use, these maps have one important advantage. The equal-area projection employed is most effective for the oceans, when shown separately, and the comparison of areas possible should be useful in the study of the relative extent of land and sea.

The Practical Management of Sewage Disposal Works. By W. C. Easdale. Pp. 60. (London: The Sanitary Publishing Co., Ltd., 1909.) Price 2*s.* net.

THE author has endeavoured with considerable success to deal, in the space of fifty-four small pages, with the more important points arising in the management of small sewage works and private-house installations, &c.

When considering the question of tanks, the author rather unfortunately states that in all types of tanks, *i.e.* sedimentation, precipitation, and septic tanks, the work to be done is the same, viz. the removal of suspended matter. This expression is somewhat misleading and liable to misinterpretation.

Apparently, in dealing with the removal of sludge from tanks, septic tanks only are considered, as the author's doctrine of "little and often" removal, without emptying the tank, can only in general be properly applied to such tanks, and, it may be added, only when the design of the tank allows of the removal of the more or less thoroughly septicised sludge. In the case of sedimentation and chemical precipitation tanks, it is almost essential that the sludge should be completely removed at each operation in order to avoid fermentation taking place, with its consequent ill-effect on the complete settlement of the suspended solids.

In connection with the design of contact beds, the author rightly directs attention to the extreme importance of the thorough and complete drainage of the bed, and also to the question of the size of the unit.

It is evident that there is a limit to the application of the maxim "little and often" advocated in regard to the removal of accumulated suspended matter from the surface of the contact beds. From the point of view of economy, cleansing operations should not be carried out too frequently, as it is obvious that a certain amount of filtering media must be removed at each operation, incurring additional cost; while so long as the accumulated suspended matter is not sufficient to impede the drainage from the surface and consequent ingress of air, no detrimental results may be anticipated.

The author's remarks with regard to the attention to be given to distributing apparatus in connection with percolating filters are important, and should be carefully noted. In connection with the final chapter on tests and records, Spitta's methylene blue test might with advantage be included, and possibly a colour test for nitrates.

The book can be thoroughly recommended for the objects defined in the author's introductory remarks.

E. A.

Das Reich der Wolken und Niederschläge. By Prof. Dr. Carl Kassner. Pp. 160. (Leipzig: Quelle and Meyer, 1909.) Price 1.25 marks.

THIS work, No. 68 of the popular scientific manuals published by Messrs. Quelle and Meyer, is to some extent the outcome of lectures delivered by the author at technical high schools, modified to meet the requirements of general readers. In addition to sound elementary information on the taking and reduction of observations, it includes the results of the most recent investigations, of the fundamental researches of Hann, Hellmann, and others, and useful references to the historical development of this branch of meteorological science. Chapters i.–v. treat of aqueous vapour, condensation, formation of fog and clouds, sunshine and cloudiness. Chapters vi.–x. deal with rainfall, snow and hail, exposure of gauges, calculation of results, &c. The remaining chapters, xi.–xiii., refer to the rainfall over the globe, the causes of its unequal distribution, to daily, yearly, and secular periods. The whole will repay careful perusal; among some of the many points of special interest we may note references to Goethe's appreciation of Howard's classification of clouds, to various kinds of glazed frost and hail, and to the effect of wind and exposure on rainfall records. Hellmann's classification and reproduction of Neuhauss's photographs of snow crystals are preferred to Glaisher's drawings, which the author hints should now be omitted from text-books. On p. 78 we notice that Chepstow is misprinted as Chepston.

Astronomische Abhandlungen der Hamburg Sternwarte in Bergedorf. Edited by the director, Dr. R. Schorr. Band i. No. 1, pp. 130, and 3 plates; No. 2, pp. 10, and 3 plates; No. 3, pp. 99. (Hamburg, 1909.)

FOUNDED in 1825 by State-aided private means, the Hamburg Observatory was taken over by the State in 1833, and in 1906 was by decree transferred to the new site at Bergedorf. This site and its equipment are briefly described in Dr. Schorr's introduction to the new series of "Abhandlungen" of which that under review is the first volume.

Part i. is by Dr. Dolberg, who describes, and discusses, the latitude determinations made at Hamburg in 1904–6. The observations were made with a Repsold portable transit instrument, and a great part of the time was spent in determining and discussing the instrumental errors. The actual latitude observations were made in 1905, and consisted of 426 complete measures of 90 pairs of stars. These are discussed, with the reductions, at length, and a mean latitude of 53° 33′ 6·05″ ± 0·015″ is found for the position of the circle.

Dr. Graff is responsible for the work described in parts ii. and iii., and in the former he describes his observations, measures and drawings of Saturn during 1907, when the ring system and the earth lay in the same plane. The three plates carry twelve drawings, and form an interesting record of the various appearances of the edges of the rings from July 26 to November 30, 1907.

Part iii. is of less general interest, but is a useful reference work. It contains the places of 580 variable stars, lying between the North Pole and 23° south declination, for the epoch 1900·0. The objects are given under their various constellations first, and are then collected into a general catalogue showing the

number, the name, the maximum magnitude, the co-ordinates for 1900·0, the precession, and the B.D. number for each star.

The volume is in quarto form, neatly and strongly bound, and altogether promises the addition of a valuable series to current astronomical publications.

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.*]

Upper-air Temperatures Registered Outside and Inside Balloons.

ATTENTION has been directed several times in NATURE to the interest attaching to the knowledge of the rate at which the gas inside rubber balloons takes up the temperature of the air outside. In this connection the results of two registering-balloon ascents from Manchester, made at the suggestion of Mr. Gold, are useful as giving some idea of the magnitudes of various possible errors.

The ascents were made on July 2, 1909, at 6.50 a.m. and 10.17 p.m. respectively. Each balloon carried two instruments, of which one was suspended in the usual manner about 4 metres below the balloon, while the other was fixed inside the balloon. The latter instrument was kept approximately in the centre of the balloon by means of rubber stays. The results are given in the following tables :—

TABLE I.—(6.50 a.m. *Ascent.*)

Height (ks.)	Temperature °C. Instrument outside Balloon.	Instrument inside Balloon. Ascent.	Descent.
0	10·8	16	12
1	7·0	16·5	7
2	+ 4·5	15·5	+ 5·5
3	− 0·5	13·5	− 0·5
4	− 6	10	− 4
5	−12·5	4·5	−13
6	−19	+ 1·5	−18
7	−24·5	− 1·5	−23·5
8	−31·5	− 6·5	−31·5
9	−39·5	− 9·5	−38·5
10	−44	−14	−44
11	−45	−15	−47·5
12	−44	−13·5	−49
13	−43	−10	−48·5
14	−41·5	− 6	−47
15	−39·5	− 2·5	−42·5

TABLE II.—(10.17 p.m.)

Height (ks.)	Temperature °C. Instrument inside Balloon. Ascent.	Descent.
0	11·5	10
1	+ 2·5	+ 6
2	− 0·5	− 0·5
3	− 6	− 6
4	−11	−11
5	−17	−17
6	−23	−23
7	−28	−31
8	−34	−38
9	−40·5	−44
10	−48	−50
11	−55·5	−56
12	−55·5	−57·5
13	−56	−58·5
14	−57·5	57·5

The traces of the two instruments sent up at 6.50 a.m. emphasise the large possible error arising from insolation should the vertical velocity of the balloon fall below the value necessary for efficient ventilation. The temperatures recorded during the ascent diverge as the height increases, the maximum difference—nearly 40° C.—occurring at the maximum height attained, *i.e.* 15 km. That the divergence is not due to a systematic difference between the two instruments is shown by their good agreement during the greater part of the descent. In this connection it is of interest to compare the experimental results with the mathematical computations made by Mr. Gold in NATURE, March 18, 1909, p. 68.

Substituting in his equations the values corresponding to the Dines instrument and the small rubber balloons employed in the ascent, and assuming that half the incident solar radiation is absorbed, we find that $(T-\theta)$, the temperature difference between the gas inside and the air outside, may be 20° C. This is considerably less than the actual value found (30° C.), but the discrepancy is easily explained by the fact that the radiation which penetrates the semi-transparent envelope strikes the almost unventilated instrument inside. That this accounts partly for the difference is evidenced by the fact that the temperature ceases to fall near 11 km., where the pressure is about 150 mm., *i.e.* the pressure below which the natural convection has been found to be ineffective.

The night ascent gives more definite information. The trace of the outside instrument in this case was defective, and it was assumed that the descent readings of the inside instrument gave a close approximation to the readings of the outside one. The doubling of the trace at low altitudes is due to the high initial temperature of the gas inside the balloon—that of the laboratory in which it was filled—and to the effect of daily variation of temperature during the time interval between the beginning of the ascent and the end of the descent. From 2 to 6 km., however, the temperature inside the balloon is the same as that of the outside air. At about 6 km., where there is a considerable increase in the temperature gradient, a lag is developed, which increases to about 8·5 km. where the temperature difference reaches 5° C. Subsequently the lag steadily diminishes, and at 10·5 km. the temperatures are again in agreement to within 1° C. Applying Gold's equation to this case, we find, on substituting the values appropriate to the ascent, that the theoretical lag at 11 km. is about 0·7° C., a rather remarkable agreement in consideration of the fact that the equation is admittedly only approximate. It would appear, therefore, that what might be called the "natural" lag of the balloon temperature in night ascents is small, and that the lag indicated between 6 and 11 km. arose from special circumstances possibly connected with the humidity of the air. The difference between the ascent and descent traces above 11 km. may possibly be attributable to the same cause as the divergence from 15 to 10 km. of the descent traces of the two instruments employed earlier in the day. The results demonstrate conclusively the very large effect of solar radiation compared with that of terrestrial radiation, and indicate that errors in temperature due to air which has already been in contact with the balloon and to radiation from the balloon are, in night ascents, negligible.

In the daytime, however, errors arising from these causes may be considerable. This may, in fact, explain why the differences between the upward and downward traces in ascents by day are more frequent and of greater magnitude than those found for night ascents.

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Avogadro's Hypothesis.

I SHOULD like to direct the attention of Mr. Woolhouse (NATURE, January 20) to the little book "Avogadro and Dalton, the Standing in Chemistry of their Hypotheses" (Edinburgh: W. F. Clay, 1904), in which Dr. Meldrum discusses with great force and discrimination the exact position which should be given to Avogadro's hypothesis. Dr. Meldrum also deals faithfully with those who have made light use of the word "law."

A. SMITHELLS.

The University, Leeds, January 24.

SVEN HEDIN'S "TRANS-HIMALAYA."[1]

THE special quest of Dr. Sven Hedin in his last and greatest journey of geographical exploration in Tibet was that hitherto unexplored range of mountains, which was believed to rise within the unsurveyed white patch of desert on the "Roof of the World" to the further side of the Tsangpo or Brahmaputra, behind the Himalayas. Although this immense chain, stretching for about 600 miles, is one of the mighty mountain ranges of the earth, and forms the northern watershed of the great Brahmaputra, as well as of the Upper Indus, yet its very existence, even, was largely the subject of conjecture.

A line of high peaks in this desolate region was first reported about 200 years ago by a party of surveyor-Lamas, who had been trained and sent out into Tibet by the Jesuits of Peking, under the patronage of the emperor, Kang-hsi; and the peaks, as located and named by these Tibetans, and rediscovered by recent travellers, figure on the rough map, published by D'Anville, in A.D. 1733. Brian Hodgson, in 1848, as the result of his inquiries in Nepal, depicted these peaks in his sketch-map as forming portions of a hypothetical range of mountains, stretching continuously from the Karakorum and Pamirs on the west to the Tengri Nor lake near Lhasa on the south-east; and he assigned to it the name of "Nyenchen," after the name of the highest peak near its Lhasa end. In the map attached to Huc's travels, this range is also represented as an unbroken chain; and so, too, in Saunder's map of 1879 in Markham's "Tibet"; whilst Grenard, the companion of the ill-fated de Rhins, in 1899, indicates it conjecturally as a double range, which Colonel Burrard, of the Indian Survey, in his recent book on the geography of Tibet, has called the "Kailas Range," after the famous Mount Olympus of the Hindus, at its northern end. So great, indeed, was the need for the exploration of these mountains deemed to be that the president of the Royal Geographical Society declared a few years ago that: "In the whole length, from the Tengri Nor to the Mariam La, no one has crossed them, so far as we know" (a statement, by the way, not absolutely correct, as the pundits Nain Sing and A-K[illegible] and Littledale had crossed them) " . . . . I believe *nothing in Asia is of greater geographical importance than the exploration of this range of mountains.*"

This, then, is the range to which Dr. Hedin now assigns the appropriate name of "Trans-Himalaya," after having zigzagged across it by eight different passes, and after mapping out its contours in considerable detail.

More than this, the two handsome volumes in which Dr. Hedin tells the story of this great achievement differ from all his previous books on the "Forbidden Land" in possessing greater human and living interest. For the first time, after his many previous years of travel in that country, he has been able to penetrate beyond the desolate deserts and reach a portion of what he truly terms "*Tibet proper*, that is the part chiefly inhabited by a settled population." For this good fortune and for the more friendly treatment generally which he experienced at the hands of the Tibetans he is indebted directly to the amicable relations established with Tibet by the British mission of 1904, none the less real and genuine though cultivated at the point of the bayonet. These relations of friendship and respect, strengthened and cemented by the visit of the Grand Tashi Lama to India in 1905 to meet the Prince of Wales, have enormously increased the prestige of the European throughout Tibet and Central Asia. Thus, a section of Younghusband's mission with four British officers, unaccompanied by any escort of their own, but relying solely on the protection of the Tibetans, was able to pass in a friendly way through those inhabited dis-

Sven Hedin.

FIG. 1.—The members of the last Expedition in Poo. From "Trans-Himalaya."

[1] "Trans-Himalaya, Discoveries and Adventures in Tibet." By Sven Hedin. With 388 illustrations from photographs, watercolour sketches and drawings by the author and 10 maps. In 2 volumes. Vol. i., pp. xxiii+436; Vol. ii., pp. xvii+441. (London: Macmillan and Co., Ltd., 1909.) 30s. net.

tricts of Tibet, two years before Dr. Hedin visited them; and several other Europeans have visited the Tashi Lama's palace and the western capital. In particular, Lord Minto, the Viceroy of India, to whom the author gratefully dedicates his book, "used his influence with the Tashi Lama so that many doors in the forbidden land formerly tightly closed were opened to me."

The start, under such favourable conditions, was made in August, 1906, from Ladak, by way of Kashmir, as the recent treaty with China absolutely prohibited Europeans entering Tibet across the Indian frontier, and could not be relaxed by the Indian Government even in favour of Dr. Hedin, much to his freely expressed vexation. He gave out that he was proceeding to Turkestan, but in the solitudes, a few marches out of Leh, he crossed the lofty Karakorum range and turned southwards into the great elevated Tibetan desert, the Chang-tang. Here he pushed on through the stark solitudes, day after day for two months, surveying the country, without meeting a soul until he crossed the Trans-Himalaya near the capital of Western Tibet. The first nomadic herdsmen he encountered were friendly and acted as guides and supplied provisions and baggage animals. They, as well as their chief, informed him of the friendly passage that way of the British officers saying that "now Europeans seem to be privileged to pass through the country." In a few days more, Tibetan couriers arrived with his European letters, which had been sent on by the British agent through the Tashi Lama, at the request of Lord Minto; and accompanying these letters, were welcome stores of European provisions, newspapers, books, &c., as presents from the British agent at Gyantse; and, most important of all, an official to guide and assist Dr. Hedin through that inhabitated portion of Tibet to the Tashi Lama's capital.

Thereafter, writes our author, "the route was as free to us as the uninhabited Chang-tung had been. We should pass black tents daily, be able to buy all we want. We enjoyed unlimited freedom, and had not a single man with us as escort or watchman." Arrived at the capital, Shigatse, he says, "the priests welcome us with kindly good-tempered smiles," and he was installed as the favoured guest of the Tashi Lama, the second of the "Living Buddhas," who received him cordially several times. This high honour which he procured through Lord Minto, proved so invaluable to Dr. Hedin, that, as he writes, "eighteen months later it came about that chiefs and monks said *Bonpo Chimbo* [great lord!] we know that you are a friend of the Tashi Lama, and we are at your service!" His Holiness, it is interesting to learn, has been a keen photographer since his visit to India, when he was initiated into the mysteries of the art by British officers. In his palace he has had a dark room fitted up, where the developing is done by one of the young priests who accompanied him to India. Whilst halting at the Tashi Lama's capital, our traveller lightened his baggage by sending back to Europe, through the British officer at Gyantse, his survey records, note-books, photographic plates, rock-specimens, &c. Here, also, he witnessed the new-year's carnival and festivities, and was allowed to roam freely over the famous palace of the monastery of the Tashi Lama, a busy hive of four thousand ascetics; but, unfortunately, our author, through want of special knowledge, has not added anything to our information on these interesting subjects.

His stay at Tashilhunpo was brought suddenly to an end by the Chinese officials at Lhasa, who insisted on the Tibetans enforcing the treaty, so that Dr. Hedin was compelled to return forthwith to Ladak under a guard. On the way, he succeeded in eluding his guard and made a detour across the Trans-Himalaya by two fresh passes; he also discovered a new western source of the Brahmaputra, and took a

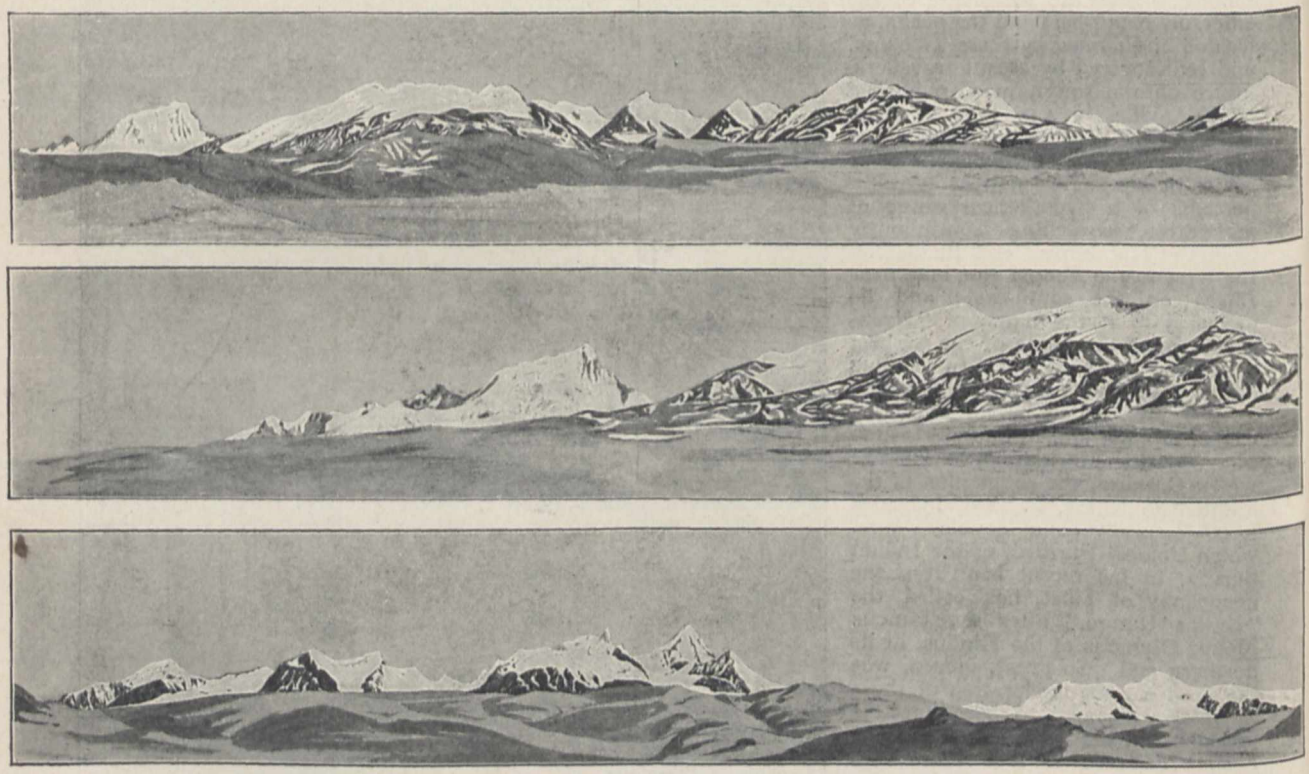


FIG. 2.—The Summits of Lunpo-Gangri from three Camps. From "Trans-Himalaya."

series of soundings over Lake Manasarowar, by means of his portable boat.

On return to Ladak, with characteristic pertinacity, he decided to make a second expedition back again to Tibet, in order to complete his partial exploration of the Trans-Himalaya, as he reflected that, "it was especially irritating to think that others might come here and rob me of these conquests." So with a fresh caravan, got together with the aid of the British officials, he plunged south once more through the terrible Tibetan deserts, and much astonished the discomfited Tibetan chiefs by his reappearance amongst them a year after they had got rid of him with such infinite pains. In this latter traverse, three more passes were surveyed, with the result, to quote the author's own words, that, "When I passed over the Trans-Himalaya for the eighth time at Surnge-la, I had the satisfaction of seeing all the old hypotheses fall down like a house of cards and a new ground plan laid down on the map of Asia, where before the blank patch yawned with its alluring "Unexplored." This mountain-system, it is remarked, cannot be called "a range," because it is a collection of several ranges, more or less parallel or branching off at various angles; Dr. Hedin, however, will find that somewhat similar features are displayed by the Himalayas themselves.

The narrative of the two years' strenuous journeyings for the survey of these formidable mountains, is written in a vigorous, direct, style, which reflects the cheery optimism of this pioneer traveller as he pushed on undaunted, in the face of endless hardships and difficulties. It also shows him animating his men with something of his own abounding enthusiasm, without which, indeed, the exploration could never have been accomplished. The reader feels the swing of the caravan moving through the pages, with the thrill of reality and a pervading sense of danger ahead; though to many readers the repetition from day to day of the details of camp routine, and the reiterated records of the grim struggles of the men and the sufferings and painful deaths of the dwindling baggage animals, will doubtless make somewhat monotonous and unpleasant reading after a time.

Besides the geographical record, so important in itself, and the camp episodes, there is little else that is new. Remarkably few references occur in respect to natural history; scarcely any mention or passing recognition is made of wild animals, or plants, or minerals, such as we expect in the journal of a scientific traveller; and the few remarks which occur in regard to the people and their customs exhibit a lack of familiarity with authentic sources of precise information, and the well-known researches of Rockhill and others. Incidental reference is made to a collection of rock-specimens, the description of which by specialists, is promised along with the detailed maps, which will doubtless be accompanied by an analysis of other objects collected, though no mention is made of them. The young Indian elephant of the Tashi Lama, we are told, "is the only one of his species in the whole country"; but the Talai Lama, we know, has (or had in 1904) a much larger tusker, a present from the Sikhim raja, which had survived the arctic winters of many years at Lhasa, and was housed in a grove near the British mission camp outside that city in 1904. "A *Bod* or Buddhist" is spoken of as if these two terms were equivalent, whereas the former means a Tibetan or inhabitant of *Bod* or Tibet. The "*Bothiyas*" (*sic*) are described as "a mixed people sprung partly from Indian and partly from Tibetan elements," whilst in reality, "Bhotiya" is merely the Indian designation of the Tibetan race or people of *Bod*. A want of precision in the spelling of several of the vernacular place-names is noticeable in a professedly geographical work, thus "Sekiya" invariably occurs in the text for the well-known monastery and sect of Sakya or Saskyas, and "Yere-tsangpo" for the Yaru (or "upper") Tsangpo; and many of the names are spelt phonetically according to no regular system. To say "Hor or Bod-yul" is equivalent to saying "Turkish or Tibet." In regard to the term used for the great Manasarowar Lake by D'Anville in his old map, namely "*Ma-pama Talai*," or Ma-pama Lake, Dr. Hedin gives "Ma-vang" as the correct form, but this latter is merely the vulgar vocalization of the name, which is spelt and properly pronounced as "*Ma-pàm*"; and our author sagely states that "D'Anville might have added that the Chinese and Talai or Dalai means ocean," and that it was used to imply that this particular lake was larger than the other neighbouring lakes mentioned in his text. This, however, is not correct; "Tālai" is *not* Chinese, but a Mongol word, and it is applied to all the lakes in that neighbourhood, as well as throughout the Northern Himalayas, irrespective of their size; and in the abbreviated form of "*Tāl*" it was imported into Northern India by the Moghal section of the Mongols, and is now naturalised there as the current vernacular name for a lake. Deficiencies of this kind, however, can be corrected in another edition, and in no wise belittle the outstanding importance of Dr. Hedin's splendid geographical achievements.

These attractive volumes, with their wealth of sketches and beautiful photographs, deserve nothing but praise, and form a fitting record of Sir Sven Hedin's magnificent pioneer work amongst one of the most forbidding mountain ranges in the world. This work, too, is of such importance to Indian hydrography as to have gained for its author, amongst other well-earned honours, a knighthood of the Indian Empire. It is also pleasing to observe that his men have not been forgotten, for the thirty-seven Asiatics who followed the explorer faithfully through Tibet, and, as the author generously admits, "contributed in no small degree to the successful issue and results of the expedition," have been rewarded with gold and silver medals, bestowed by the King of Sweden.

COLOUR-BLINDNESS.

FOR a considerable time past dissatisfaction has been felt in certain quarters with the methods adopted by the Board of Trade in examining in colour-vision candidates for certificates as master or mate in the mercantile marine. On June 30, 1909, Lord Muskerry directed attention to the matter in the House of Lords, using the cases of Mr. W. H. Glover and Mr. John Trattles as the text of his argument, and moving that a Select Committee be appointed to consider the conditions under which eyesight tests for the mercantile marine certificates were conducted. Lord Hamilton of Dalzell, in reply, stated that during the last four years 25,151 candidates were examined; of these 239 failed in the colour-vision tests; 64 appealed, with the result that 27 passed and 37 were rejected. The tests, based upon the report of a committee of the Royal Society, which sat at the request of the Board of Trade in 1890, were considered to be efficient as at present carried out. He held that no case had been made out for the appointment of a Select Committee. The Marquis of Salisbury said he had, perhaps, a special claim to be heard in this matter, because he was colour-blind himself. He was convinced that colour-blindness was capricious; on some days he was very much more colour-blind than on other

days. But from the point of view of the Board of Trade and of the mercantile marine such caprice must be very dangerous. The motion was by leave withdrawn.

Since this debate in the House of Lords the case of Mr. John Trattles has assumed greater importance, and it will be well to recount briefly its history and the chief features which it presents. In February, 1904, Mr. Trattles was examined for his certificate as second mate; he passed the colour-vision test, and was granted his certificate. In July, 1905, he went up for examination as first mate, and failed in the colour-vision test. He appealed, and was specially examined by Sir William Abney and Captain Harvey, and again failed. In September, 1905, having refused to surrender his certificate as second mate, a Local Marine Board was called to inquire into his competency. The board found that he was not incompetent to hold his certificate by reason of colour-blindness. In May, 1906, he was examined for a certificate of competency as first mate; he passed the examination, including the sight-test. The Board of Trade was not satisfied, and, after some correspondence, he was offered and accepted a special examination by Sir William Abney and Captain Harvey. It took place in May, 1909, when he again failed in the colour-vision test. He declined voluntarily to surrender his second mate's certificate, and the Board of Trade instituted a special court, consisting of Sir Francis Mowatt, president, with Mr. J. Dickinson, stipendiary magistrate, as legal assessor, to decide the issues. Mr. Trattles therefore came before this court after six examinations in colour-vision during the last six years; on three occasions he passed, and on three occasions he failed.

On the occasion of the special examination by Sir William Abney and Captain Harvey in May, 1909, owing, presumably, to the agitation in the medical and lay Press against the methods adopted by the Board of Trade, certain scientific bodies were invited to send representatives to witness the tests. Dr. W. H. R. Rivers, F.R.S., lecturer in the physiology of the senses in the University of Cambridge, and Mr. J. Herbert Parsons were present, representing the Royal Society and the Ophthalmological Society respectively. These gentlemen were not informed that the case was one likely to render desirable their evidence as witnesses in a court of law. Dr. W. Ettles, who had examined Mr. Trattles, and was of opinion that he was not colour-blind, was also present.

The special court commenced its sittings on December 2, 1909, at the Imperial College of Science and Technology, South Kensington. Evidence was given by Sir William Abney, Dr. Rivers, Mr. Herbert Parsons, Captain Harvey, Captain Fulton, and Fleet-Surgeon Prynn, R.N.; they concurred in their opinion that Mr. Trattles was colour-blind. Mr. Trattles's witnesses included himself and several well-qualified captains, who had had extensive experience of his skill and ability in navigating ships under conditions of difficulty in the North Sea, the Baltic, the Channel, the Atlantic, the Mediterranean, the Black Sea, and in the Mersey. We do not notice the name of Dr. Ettles in the reports we have seen; we should have thought that he would have been an important witness for the defence. Mr. Trattles submitted to an examination before the court, conducted by Sir William Abney. The court further allowed a practical test, conducted by Commander Wilson-Barker, R.N.R., who was nominated by the Trinity House Brethren. It took place on the evening of December 30, when it was "calm, with some haze on the horizon." Commander Wilson-Barker reported that "Trattles had no difficulty whatever in picking up the lights. He had vision of a quality equal to that of myself and of the look-out man." He instanced two tests to which he attached special importance. On approaching the Nore light at some distance off, Trattles hesitated, questioning if it was not a reddish light. He was correct, the light being a new white light in which some ruby rays are retained as an experiment in penetrating the fog. Trattles was asked to describe the colour of two planets which the Commander pointed out to him from the deck; he did not recognise them, but he correctly described one of them (Mars) as reddish. Sir Francis Mowatt came to the conclusion that Trattles is not incompetent from colour-blindness to discharge the duties of a mate, and directed that his certificate as second mate be returned to him.

We have quoted this case at considerable length because, in our opinion, it demonstrates beyond dispute the urgent need of reform in the methods of conducting inquiries into the colour-vision of candidates by the Board of Trade. Here is a man, with an unimpeachable record in his profession, whose life must have been made a misery from anxiety as to his future career. On the other hand, the public cannot but feel perturbed at the thought that numberless lives are endangered if mistakes are allowed to occur. There are obviously two explanations of the anomaly that the same man may be rejected by the same tests conducted by different examiners; either the tests themselves are at fault or, if efficient, they are not applied with sufficient care or accuracy. Experts whose opinions cannot be lightly disregarded will be found to support both these contentions. For our own part, for reasons which it would take too long to enter into on the present occasion, we incline to the second alternative. The preliminary examinations are conducted by men who have no knowledge of physiology, whatever their other qualifications may be. Even on appeal there is no physiologist amongst the examiners.

We do not wish to labour this point unduly, but owing to the manner in which it has been neglected in the past it merits serious consideration. Defects of colour-vision are defects of a physiological condition, and belong to the class of conditions which the physiologist is accustomed to deal with. Every physiologist to-day must perforce be a more or less accomplished physicist; every physicist is by no means called upon to be an equally accomplished physiologist. The physiologist is familiar with those tantalising variations which characterise living matter, induced by the lability of the medium and the complexity of the forces brought to bear upon it. Even amongst physiologists and ophthalmologists, only those who have devoted particular attention to this highly specialised branch are fully qualified to deal with it. Normal colour-vision shows a great range of variations under differences of intensity of stimulation, differences of adaptation of the retina, differences of the psychological condition, and in different individuals. To take a simple example, the fields of vision for colours vary according to the intensity of the stimulus. Defects of colour-vision show an equally wide range, and whilst it is possible to group the cases according to certain well-defined types, there is none of that accuracy of definition in the scientific picture which rejoices the heart of the physicist. Whilst comparatively gross tests, such as the ordinary tests with Holmgren's wools, used in preliminary examinations by the Board of Trade, suffice to distinguish the graver forms of defective colour sensation, they cannot, as ordinarily applied, be regarded as infallible in less pronounced cases—cases which may yet involve danger to many lives if they are allowed to pass unrecognised. Hence occurs the necessity for more delicate tests, physical indeed in their nature, but

only to be interpreted accurately in the light of a comprehensive knowledge of the physiology of vision.

We have the profoundest respect for the work which Sir William Abney has done upon the subject, and every competent critic will endorse the opinion of Lord Rayleigh, quoted by Lord Hamilton of Dalzell, that the Board of Trade could not be wrong in following his advice. How is it to be explained, then, that his opinion, endorsed by other competent men of science, is not accepted as final? We think that it is largely due to the difficulty, or rather impossibility, of conveying to laymen any adequate conception of the peculiarities of vision of the colour-blind. The difficulty is enhanced by the terminology and phraseology adopted by the expert, who almost invariably speaks, as it were, in the language of the theory of colour-vision which he personally affects. Thus, Sir William Abney describes a man in terms of the Young-Helmholtz theory as *red-blind*, whilst Dr. Rivers, agreeing entirely with the facts of the colour-vision of the individual, describes him as *red-green-blind*, and would doubtless prefer to avoid all ambiguity by calling him scoterythrous. Every statement which either might make in endeavouring to convey some idea of the visual perceptions of a colour-blind individual to one who has had no training in the physiology of the senses might be implicitly relied on for accuracy when rightly interpreted, but the probabilities of correct interpretation are exceedingly small, if, indeed, the whole statement is not regarded as a meaningless jargon.

Further, the layman fails wholly to understand why recondite tests, such, for example, as that with simultaneous contrast colours, should be imposed upon the examinee. He can comprehend "practical" tests on board ship, such as that to which Mr. Trattles submitted. It would surprise him greatly to be told that under favourable atmospheric conditions the expert would fully expect a colour-blind person to pick up lights with unfailing accuracy.

The Trattles case will have served an invaluable purpose if, as must inevitably be, it focusses public opinion upon the glaring anomalies of the examination in colour-vision of candidates by the Board of Trade. It appears to us to be imperative that all the conditions should be re-investigated by a competent body, either a carefully selected Royal Commission or a committee of the Royal Society upon which physiologists and ophthalmologists who have devoted special attention to the subject are adequately represented. Among the duties of such a committee would be :—

(1) Re-investigation of the tests for colour-blindness with the view of the adoption of methods less open to attack, and, if possible, of a simpler nature.

(2) Re-organisation of the examinations and of the boards of examiners.

We have no doubt that it would be possible so to revise the conditions of the Board of Trade examinations that it would cease to be necessary to have recourse to a court of law for adjudication on the results of a purely scientific question.

NATURE PHOTOGRAPHY.[1]

THE object of Mr. Bedford's book is to encourage the pursuit of nature photography among those who cannot afford either the time or expense to undertake very advanced work in this direction. The author rightly points out that there are great advantages in this method of studying nature over the older method of collecting, and that the study of natural history by means of photography may be taken up by those whose time and means are strictly limited. The first part of the book deals with the apparatus required. A detailed description is left to text-books on photography; some knowledge of cameras and photographic methods is assumed, and the author confines himself to suggestions and to an account of the particular kinds of apparatus which he himself has found serviceable. On the whole, this part of the book should be valuable to a beginner taking up the subject for the first time, but one feels that in some parts space is wasted in describing processes of which a sufficient account is given in every book on photography, and other parts might with advantage be made more full, for in places the reader is left with no clear idea of the nature of the instrument or process recommended. Rough estimates of cost might also have been included; several times we are told that the choice must be decided by the possible outlay, but no actual estimates of expense are given.

The second part of the book deals with the actual photography of living objects. In the chapter on choice of subjects, the author very rightly emphasises the fact that a connected series of photographs of one subject or group of subjects is of much greater interest and value than an indiscriminate collection of pictures of isolated things. This is illustrated in the book by the series of plates (Figs. 69–76) showing the early life of a young cuckoo. We regret that the chapter was not extended somewhat, at least so far as to emphasise the value of photographic records of objects which cannot easily be collected or preserved in their natural condition, such as fungi, insect larvæ, or fruits. As an illustration of the excellent results that may follow from the patient collection of photographs of such things, one may mention Connold's useful book on "British Oak Galls."

Red Admiral Butterfly (wings expanded). From "Nature Photography for Beginners."

The chapters on how to observe and photograph the commoner birds and their nests take the form of a conversation, or rather discourse, to an imaginary novice during a series of birds'-nesting excursions. This style of writing is very irritating, as are the frequent references to the pleasures of tea in the country, and these chapters might lead one who had

[1] "Nature Photography for Beginners." By E. J. Bedford. Pp. xiv+168. (London: J. M. Dent and Sons, Ltd., 1909.) Price 7*s.* 6*d.* net.

never searched for nests to believe that one could be found in every bush in which it was sought. It is to be regretted that the author did not put his evidently considerable knowledge of nesting-habits into different form. The succeeding chapter, on curious nesting-places, where the author's experience is told straightforwardly, is much better. The concluding chapters, on photographing animals and flowers and on protective colouration, are so sketchy as to be of little practical use, and we note some mistakes, *e.g.* the statement on p. 161 about the cause of colour differences in moths probably has no foundation.

The style of the whole book is colloquial, and sometimes marred by not very successful attempts at wit.

The book is illustrated by a number of very pretty photographs, which are distinctly good, but not of the striking character made familiar by some other nature-photography works. Nearly all are stereoscopic, and a stereoscope is supplied with the book which adds considerably to their usefulness. Unfortunately, the stereoscope makes the texture of the process-block unpleasantly conspicuous. Although the photographs are not especially striking, they illustrate well the kind of work which an amateur who is limited in time or means may hope to produce.

THE NEW COMET (1910*a*).

THE comet discovered near Johannesburg on January 16, as announced in last week's NATURE, has justified the opinion then expressed as to its becoming a brilliant object in our evening skies. From many parts of the civilised world we hear of crowds gathering to watch the rare phenomenon, and the daily Press, despite the General Election excitement, has devoted considerable space to the description of the "Daylight Comet."

Apparently the comet was first seen by some miners on January 16, and reported to Mr. Innes, of the Transvaal Observatory, Johannesburg. Messrs. Worssell and Innes made the first measurement of its position at 19h. 29·2m. G.M.T. January 16, that is, at 9.29 a.m. on January 17 local standard time, when the sun would be well above the horizon. The measures were continued until January 17, 0h. 8·6m. (Johannesburg M.T.), that is, midday, and they showed that the comet was rapidly approaching the sun, the apparent movement per hour being +42s. in R.A. and +6′·5′ in declination.

Mr. Innes described the comet as having a head 5′ in diameter, and a well-developed tail; in a later message the latter was stated to be 1° long, fan-shaped, and visible to the naked eye. This observation emphasises the exceptional brilliance of the comet and the purity of the Transvaal atmosphere, for at the time of observation the comet was within 4½° of the sun and west of it.

The apparent motion was so rapid that by the time the discovery was announced here the comet had passed to the east of the sun, and was therefore to be seen at or after sunset instead of before or at sunrise. The Cambridge Observatory appears to have been the most fortunately situated of English observatories, for the sky was clear enough on January 19 to warrant an attack in force, and Mr. Hubrecht was, according to Saturday's *Daily Mail*, fortunate enough to find the comet straight away. Mr. Hinks thereupon secured a measure of the position, and saw a nucleus as bright as Mercury, and a tail 2° long; on Thursday, January 20, the nucleus was seen to be brighter and the tail further developed.

According to a Central News correspondent, the comet was seen, in full daylight, at the Milan Observatory, but no tail was seen. The observations of the tail vary considerably in their estimates of its length, but this is to be expected, for, obviously, the prominence of such a filmy structure in daylight or twilight will vary greatly with the purity of the atmosphere.

At Oxford, Prof. Turner found the comet quite a conspicuous object, in field-glasses, at 5 p.m. on January 20, and could see it quite easily with the naked eye; he made his observations from the Robinson Tower of New College.

On Friday, January 21, the Cambridge observers were again favoured, and, according to the *Times*, Mr. Hinks found the comet to be considerably brighter than on the preceding day, and to have a fine stellar nucleus with the surrounding envelopes well developed. Prof. Dyson, at the Royal Observatory, Edinburgh, also saw the nucleus. The same day, Mr. J. H. Elgie, observing at Leeds, saw the comet at 5 p.m., and describes it as "weirdly magnificent," having a tail 8° long. The nucleus, he estimated, was as bright as Mars at the recent opposition, and the tail was curved, with the concave side towards Venus; the outer edge was then well defined, but further observations, on Saturday, showed it to be much more diffused. The Rev. F. J. Jervis-Smith, writing from Lymington, says that several persons observing there on January 22 thought the tail appeared to flash slightly and continuously, but this phenomenon may have been due to the low position of the object and consequent atmospheric effects.

The lengthy reports in Monday's *Times*, *Daily Mail*, *Chronicle*, &c., show that the comet was well observed during the week-end. On Saturday, January 22, Prof. Turner secured two photographs showing the brighter portions of the tail, and four photographs were taken at the Dunsink Observatory. Dr. Whittaker and his assistants at Dunsink also observed the comet visually, and found that, in addition to the tail, extending upwards to a distance of 8°, where it was lost in a dense cloud, there was a distinct jet, or horn, of light on that side of the head nearest to the horizon. The head of the comet appeared as a dusky-red nucleus surrounded by a nebulous envelope of fainter red, and was as large as, or larger than, Mars. The twin tails were of a bright yellow colour.

Dr. Rambaut observed the comet with the 10-inch and 18-inch telescopes at the Radcliffe Observatory on January 22, and saw it quite well, despite a thick haze. Prof. Dyson also made observations at Edinburgh, and found, at 5.25 p.m., that the head was as bright as Mars and had a nucleus 45″ in diameter, whilst the tail extended to a distance of 7°. At Cambridge it was estimated to be 6° long. The orbit computed by Messrs. Stratton and Hubrecht, at Cambridge, shows that the comet passed through perihelion on January 17, at a distance of two million miles from the sun, and will continue to move northwards with diminishing speed.

At the Solar Physics Observatory, South Kensington, and, we understand, at the Royal Observatory, Greenwich, the careful preparations for observing, and the constant attendance of the staff during the hours available for observations, were, until Tuesday evening, rendered nugatory by clouds, or by the persistent smoky haze which, even on Saturday, rendered Venus a faint object, and made quite hopeless the careful search for the comet. But on Tuesday evening observations were secured by Dr. W. J. S. Lockyer, using the 10-inch refractor, and these showed that, at 5.35 p.m., the Kiel position was in error to a slight extent in R.A. and about 2° in declination, the observed place being further south than that indicated by the ephemeris.

In a telegram transmitted by Prof. Pickering to the

Astronomische Nachrichten (supp. No. 4383) it is announced that Dr. Wright, of the Lick Observatory, has made a daylight observation which shows the spectrum of the comet's nucleus to be continuous, with the sodium, D, lines bright. Similar observations are reported in the *Daily Telegraph* (January 24) from the Glasgow Observatory, with the addition of a "hydrocarbon" band. This occurrence of the D lines recalls the Wells's, and the Great, comets of 1882, in which Copeland and Lohse observed the same lines intensely bright, due, according to Copeland, to the near approach of the comet to the sun. In the present case the rapidity with which the comet appears to have travelled when near perihelion further suggests a similarity.

The publication of a set of elements and an ephemeris by the Kiel Centralstelle (Circular No. 117) provides for observations during the next few days. The elements are based on observations made at Algiers on January 18, 19, and 20, and are as follows:—

Elements.

$T = 1910$, January 17·42 (M.T. Berlin).
$\omega = 263° 5'7$
$\Omega = 8° 56'2$ } 1910·0
$i = 62° 16'1$
$\log q = 8·6169$

The following is an abstract from the ephemeris:—

Ephemeris for 0*h.* (*M.T. Berlin*).

1910	R.A. h. m.	Decl. ° ′
January 26 ...	21 25·3 ...	+0 20
27 ...	21 31·2 ...	+2 30
28 ...	21 36·7 ...	+4 14
29 ...	21 42·1 ...	+6 2
30 ...	21 47·2 ...	+7 45

Observations made by Prof. Turner, Dr. Lockyer, and others, indicate that this ephemeris is incorrect in declination, and that on January 25 the observed position was about 2° south of that given by the ephemeris. Prof. Turner reports that the discordance is increasing.

Observations made on January 24 and 25 indicate that the comet's brightness is decreasing. In the *Times* of January 25, Sir Robert Ball reported that "Prof. Newall finds a remarkable spectrum," and the Rev. T. E. R. Phillips stated that the double tail was not unlike that of the great comet of 1874, but with the gap in the centre much wider than in that case. Further photographs were secured at Dunsink and Oxford on Tuesday. In the *Times* of January 26 Sir Robert Ball reports that the comet was again observed, between 5 and 6 p.m. on Tuesday. It was much fainter than on Saturday, but the tail was quite 10° long, and was slightly curved towards Venus. The bright yellow light was still present, but fainter.

Bright, "daylight," comets are not frequent visitors; the tale for the nineteenth century is practically completed by the comets of 1843, 1847, 1853, 1861, and 1882, and it is a curious coincidence that this present visitor should arrive at the time when we had settled down to the carefully ordered study of the rediscovered Halley. But reference to the notes presented to the Royal Astronomical Society by Messrs. Cowell and Crommelin will show that the coincidence is not unique; quite a number of returns of Halley's comet have been marked by the appearance of exceptionally bright sporadic visitors.

The present object has been introduced to us under a misnomer. The *Astronomische Nachrichten* now tells us that the appellation "Drake" is simply due to a misinterpretation of "great" as the message was being transmitted by telephone; popularly it is the "Daylight Comet." W. E. ROLSTON.

NOTES.

WE regret to see the announcement of the death, at Marburg, of Prof. F. Kohlrausch, the distinguished physicist, at seventy years of age.

THE death is announced, at sixty-two years of age, of Prof. H. Brunner, professor of toxicological chemistry in the University of Lausanne since 1876.

THE Friday evening discourse at the Royal Institution on February 4 will be delivered by Prof. W. Bateson, F.R.S., on "The Heredity of Sex."

PROF. A. LACROIX has been elected president for 1910 of the Geological Society of France. M. Œhlert, Mme. Œhlert, Prof. Vidal, and M. Cossmann have been elected vice-presidents. This is the first time a lady has been elected to office in the society.

TO the *Field* of January 22 Mr. Lydekker contributes an account of an apparently new race of buffalo obtained by Mr. Hilton-Simpson in the extreme south of French Congoland; the race appears to be allied to the red Congo buffalo, but is of much darker colour.

ACCORDING to a statement in the *Times* of January 17, three skeletons of sauropod dinosaurs have recently been discovered in the Jurassic strata of Utah by a collector from the Carnegie Museum, Pittsburg. One of the three is stated to be higher and more massive than that of the type of *Diplodocus carnegiei*, although its length—84 feet—is somewhat less.

THE council of the Royal Geographical Society has decided to award a special gold medal to Commander Peary for his journey to the North Pole, and for having undertaken such scientific investigations as his opportunities permitted; and a silver replica to Captain Bartlett for attaining eighty-eight degrees north latitude.

ACCORDING to the New York correspondent of the *Times*, the U.S. Department of Commerce and Labour has under consideration the dispatch of the Government steamship *Albatross* on an expedition to the Antarctic Ocean. The expedition is the suggestion of Dr. H. F. Osborn, of the American Museum of Natural History, New York. The objects of the proposed expedition are stated to be partly commercial and partly scientific. There appears to be reason to believe that some of the remote southern islands are the homes of herds of the southern fur seal, and it is hoped to discover these, as well as to study south polar fauna generally.

A SERIES of lectures in connection with the Selborne Society has been arranged, and will be held in the theatre of the Civil Service Commission, Burlington Gardens, London, W. The first lecture of the course was delivered by Mr. F. Enoch on January 21, and dealt with insects through the camera. There was a large audience. The lecture, which aroused great enthusiasm, gave the results of many years of patient outdoor research, and was illustrated by a unique series of three-colour photographs. On February 11 Mr. W. Bickerton will lecture on wild birds and their ways; on March 11, Mr. W. M. Webb on clothes a human nature-study; and, on April 8, Miss Gertrude Bacon on wind, wave, and cloud. Fuller particulars may be obtained from the honorary general secretary of the society, 42 Bloomsbury Square, London, W.C.

IT is with regret that we see the announcement of the unexpected death of Dr. W. Page-May, fellow and lecturer of University College, London, which occurred quite suddenly at Brighton on Wednesday, January 19. To

those associated with him at University College, where, during the years since his return from Helwan, he carried out his work on the central nervous system, as well as to a far larger circle of friends, his early death, when he was in the full vigour of his intellect, has been felt as a heavy loss. Dr. Page-May brought a well-trained mind to the study of neurology. He was thoroughly familiar with the literature of this subject, and also with all the special physiological and histological methods which have so largely contributed to those conceptions, which are held at the present time, of the minute structure and modes of action of the brain. Several researches were in actual progress at the time of his death. Among the more important of his papers we may mention the "Investigations into Segmental Representation of Movements in the Lumbar Region of the Mammalian Spinal Cord," published in the Philosophical Transactions of the Royal Society, 1897; and numerous papers in *Brain*, on "The Afferent Path," and, in collaboration with Dr. Gordon Holmes, "On the Exact Origin of the Pyramidal Tracts in Man and other Mammals."

RECORDS of severe earthquake shocks were obtained at many seismological observatories on Saturday, January 22. The following observations of shocks are recorded:—at 7.45 a.m. at Seydisfjord, in Iceland; at Akureyri, in the same island, at about 8 a.m.; at 8.52 a.m. by Prof. Milne at Shide, in the Isle of Wight; at 8.45 a.m. by Prof. Belar at Laibach, in Austria. A disturbance was registered at the Parc Saint-Maur earthquake station, Paris, at 9 a.m., and was most violent from 9.4 to 9.24 a.m. The French observers locate the earthquake as occurring at a distance of about 3000 kilometres from Paris in a south-easterly direction, and it is believed to have visited the Caucasus or Armenia. Prof. Milne is reported to have estimated the distance of the origin of the shock at a little more than a thousand miles. Prof. Belar is said to have given the distance as 2500 miles, and suggests Asia as the seat of the disturbance.

THE council of the Royal Meteorological Society has forwarded a memorial to the Royal Commission which is now inquiring into the work of the University of London urging that the time is fully ripe for placing the study of meteorology on a more satisfactory basis, and for its inclusion among the subjects for degree examinations. The council has arranged for a provincial meeting to be held at Manchester on February 23, and it is hoped that this will be the means of making the work of the society better known in a district in which considerable attention is already being given to meteorology. At the annual meeting of the society the president presented to Dr. W. N. Shaw, F.R.S., the Symons gold medal for 1910, which had been awarded to him in consideration of his distinguished work in connection with meteorological science.

MR. EDWARD T. CONNOLD, whose death is announced, was born at Hastings on June 11, 1862. He is best known from his researches in connection with British plant-galls, upon which he published the following beautifully illustrated works:—"British Vegetable Galls" (1901), "British Oak Galls" (1908), and "Plant Galls of Great Britain" (1909). At the time of his death he had in preparation a work on British wild fruits. His collection of plant-galls is exhibited at the Hastings Museum, in which institution he took great interest. On the formation of the Hastings and St. Leonards Natural History Society in 1893 he became honorary secretary, and at once entered upon his duties with characteristic enthusiasm. He was an excellent lecturer on popular natural history, while his skill as a photographer is attested by the plates with which his published works are embellished.

WE have to acknowledge the receipt of a catalogue of publications relating to "Evertebrata," issued by Mr. W. Junk, of Berlin, and containing more than six thousand items.

DR. C. HOSSEUS, of Berlin, communicates to the January issue of *Urania* a brief *résumé* of two collecting trips in Siam, in the course of which much valuable material was obtained. Special attention is directed to the important *rôle* played in Siam by elephants, which, unlike their cousins in India, breed more or less freely in captivity.

Naturen for January opens with a long and well-illustrated article, by Dr. D. Damas, on the oceanography of Greenland, based on the observations made by the *Belgica* expedition of 1905. Maps show the extent of the ice at different seasons, while the bathymetrical variation in salinity is illustrated by diagrams.

IN the January number of *Knowledge* the question is raised, under the heading "Zoological Notes," whether there were ever English species-names for many of the better known kinds of animals, the two sexes of which have distinctive designations of their own. As examples may be cited mallard and duck, bull and cow, dog and bitch, and horse and mare. In the opinion of the writer of the note, no species-name originally existed in these and many other cases.

IN the Journal of the Quekett Microscopical Club for November, 1909, Mr. W. Wesché states that, having discovered a few years ago the viviparous propagation of the tachinid fly known as *Phorodera serriventris*, he was at a loss to understand why the female required an ovipositor, more especially one of unusual form. The problem was solved by observations made at Mersea Island, off the Essex coast, last summer. From these it appears that, after birth, the living larvæ are introduced by means of a very sharp hook on the under surface of the body of the female into the bodies of caterpillars, the fly making an aperture for their entrance by forcing the hook into its victims. The necessary purchase on the body of the caterpillar is obtained by the grip of the two serrated abdominal plates in advance of the hook, this giving a hold in an opposite direction to the force expended on the penetrating hook. When not in use, the hook is folded in the median line under the abdomen. The larvæ have strong chitinous jaws, which are visible through the integuments of the gravid female, and in one instance the author counted no fewer than ninety-eight jaws, although such a number appears to be unusual.

THE greater portion of the contents of vol. xxxi., Nos. 3 and 4, of Notes from the Leyden Museum, is devoted to entomological subjects, among which reference may be made to a paper, by Dr. A. Forel, on ants obtained on Krakatau and in Java by Mr. E. Jacobson, with biological notes by the collector. The latter gives copious notes on the habits of the species known as *Polyrhachis dives*, of which a colony was in the habit of invading the bath-room of his residence. The ants effected an entrance through a chink in the wall, so that the nest could not be discovered. They made their appearance in the evening, but were in no wise disconcerted by gaslight, and so freely did they drink that their abdomens became greatly distended. The author, who kept many of these ants in captivity, gives figures of three of their nests. In July, 1905, he found that many of the ants were badly infested with nematode worms, the stomach of one in

dividual containing no fewer than fifteen parasites. A nematode taken by Mr. Jacobson from *Camponotus maculatus* was described by Dr. von Linstow as a new species, under the name of *Ochetocephalus javanicus*, in vol. xxix. of the "Notes."

PROF. G. HABERLANDT has arranged with the publishers of his "Physiologische Pflanzenanatomie" to issue separately the chapters from the latest edition of his book dealing with the perceptive organs of plants. This gives botanists the opportunity of obtaining in a small brochure, at a price of two marks, the essence of the experiments and arguments put forward by the author and other physiologists in connection with the statolith theory of gravity-perception, and in favour of regarding such anatomical peculiarities as papillæ, hairs, &c., in certain plants as mechanisms for the perception of light and contact.

INDIVIDUAL variation in the development of plants is the subject of a paper, by Dr. K. Koriba, forming vol. xxiii., art. 3, of the Journal of the College of Science, Tokyo. Horse beans and peas were germinated and afterwards grown, some as water-cultures in tap-water, others in solutions containing zinc or copper sulphate, and others again in soil. Their development was estimated chiefly by the increase of length in stem and root. It is noted that these organs respond differently to changes in external conditions. Thus growth of the root continues at a lower temperature than growth of the stem, while at a higher temperature the reverse holds good; also a poisonous solution affects the root more readily. According to the observations quoted, heavy seeds do not always germinate most quickly, so that individual quality is considered to be more potent than weight.

THE report for the year 1908 of the director of the botanic gardens and Government domains in Sydney has been received. There is special reference among native plants to a new variety of the shrub *Acacia salina* and the monocotyledonous plant *Aneilema gramineum*, related to Tradescantia. A number of the latest successful introductions come from South Africa, notably species of Aloe; these and species of Agave from Mexico appear to find the climatic conditions they require. Among the grasses, *Festuca arundinacea* and *Panicum muticum* are regarded as valuable species alike for fodder purposes and for decoration. A list of troublesome weeds includes *Allium fragrans, Cyperus rotundus, Hypochaeris radicata, Medicago denticulata*, and *Portulaca oleracea*.

A SKETCH of the flora of Siam is contributed by Dr. C. C. Hosseus to *Globus* (vol. xcvi., Nos. 10 and 11), where he describes the chief types of vegetation studied by him during several journeys into the interior. The country is rich in forests. An extension of the Indian sub-Himalayan pine forests, where *Pinus Khasya* is dominant, is found in the extreme north. There are luxurious evergreen forests containing oaks, laurels, species of Cinnamomum, Cephalotaxus, and Podocarpus at different altitudes, where lianes, ferns, and orchids grow in profusion. The teak forests seldom rise above 900 feet; the predominating teak is accompanied by *Albizzia procera, Butea frondosa*, and Xylia. The Dipterocarp forests growing on laterite also show a great wealth of vegetation. Below these formations occur the forests and grass lands of the Savannahs, while near the coasts the swamps provide habitats for Pistia, Salvinia, Azolla, Nymphæa, and Nelumbium. Finally, a mangrove belt lines the islands and coasts.

THE North Carolina Department of Agriculture has issued an illustrated bulletin on some common birds of the farm, including the *bob-white* (*Colinus virginianus*), night-hawk or "bullbat" (*Chordeiles virginianus*), meadow-lark (*Sturnella magna*), and the various wood-peckers. Particular attention is directed to the food they take.

THE first of the new series of scientific bulletins issued by the University of Wisconsin Experiment Station deals with the function of phosphates in the nutrition of animals. At least 3 grams of phosphorus were found to be necessary for a growing pig of 50 lb. weight, otherwise the animal withdrew from its skeleton both calcium and phosphorus in the proportions found in tri-calcic phosphate. In another bulletin, dealing with the phosphate contents of soils, we find the remarkable result that heavy manuring such as is practised in tobacco culture led to a great loss of phosphates from the soil. N/5 nitric acid proved a useful solvent in determining whether or not soils are deficient in phosphates.

THE Proceedings of the Indiana Academy of Science contain reports of the papers read at the twenty-fourth annual meeting at Purdue University, Lafayette, Indiana. The president, Mr. Glen Culbertson, dealt with deforestation and its effects among the hills of southern Indiana. A report was also presented on the work of the pathological laboratory of the Central Indiana Hospital for the Insane, Indianopolis. Other papers dealt with local mycological problems, heteroecious plant rusts of Indiana, the rust of timothy, dissemination of disease by means of the seed of the host plant, and so on. There is an anthropological paper on the "shake" dance of the Quilente Indians, and a number of chemical and biological papers.

ATTEMPTS have been made to introduce into the West Indies from the United States new varieties of ground nuts, noted for the large size of the nuts and their heavy yield. The results have been somewhat disappointing, partly on account of the severe attacks of fungi. A description is given in a recent issue of the *Agricultural News* of the fungi already observed, but there are others still to be identified. One of the Uromyces has done a good deal of damage, and could not be kept in check by the ordinary remedies. Another fungus, not yet identified, attacks the roots. The diseased portions exhibit a fine web-like mycelium, covered in its older portions with straight, rod-like crystals. These form small white tufts, which grow somewhat, become yellow, and finally brown. They are about a quarter of an inch in diameter when fully grown, and roughly spherical in shape. In fruiting they show two or three layers of firm, brown hyphæ forming an outer covering which encloses a mass of swollen colourless hyphæ, complete but undifferentiated. They are probably of the nature of sclerotia. No other fruiting bodies have yet been found.

THE Journal of the College of Agriculture, Tohoku Imperial University, Sapporo, Japan, contains a paper by S. Ito (in English) on the Uredineæ parasitic on the Japanese Gramineæ. Some 800 specimens were examined, collected from different parts of Japan, from Saghalien and the Kurile Islands in the north to Formosa in the south. They fall into six genera. Seventy-three species and two varieties are recorded for the first time in Japan, while no fewer than twenty-one are altogether new to science. The other paper, by Y. Niisima, contains a detailed description (in German) of the Scolytidæ injurious to forest trees. There is an enormous mass of detail in these papers, and the illustrations are very beautifully done; indeed, the publications of the Japanese agricultural

colleges are beyond question the most beautifully illustrated of the agricultural journals.

THE current West Indian Bulletin (vol. x., No. 2) contains, as usual, a number of interesting articles on West Indian products. Among them is a statement of the present position of the cotton industry, showing a rapid increase in spite of one or two set-backs in a few unsuitable districts. The estimated value of the lint in 1902 was 7366*l.*; in 1907 it was 172,294*l.* A pamphlet is also issued summarising the experiments on sugar-cane at Barbadoes with seedling canes and with various manures. The striking result was brought out that potash and nitrogen manures increased the amount of sugar while phosphates diminished it. The Bulletin of the Jamaica Department of Agriculture, the second of the new series, is quite up to the standard set by the first, and contains an interesting article, by Mr. Ashby, describing the bacterial production of sulphuretted hydrogen from certain obnoxious ponds near Jamaica. There are also some well illustrated and interesting articles on the Indian cattle of the island and the Hereford herd of Knockalva.

AN interesting preliminary notice, by Mr. P. A. Curry, of the results obtained in the research of the upper air above the Blue Hill area during the rainy season of 1909 is published in the *Cairo Scientific Journal* for October last. The main object was to find the direction and velocity of the wind at different heights above Roseires by the use of small pilot balloons, of which seventy-nine were released. The surface wind, which was slightly west of south, veered to south-west at 1500 metres; at 3000 m. north-east winds were somewhat predominant, veering to slightly north of east at 3500 m. From that altitude to 6000 m. it was very constant in direction, at which point it backed slightly to north-east at 9000 m., then veering again to east at 12,000 m. One balloon which rose above this showed a due east wind at 13,000 m. and 14,000 m., veering to east-south-east at 18,000 m. Up to 3000 m. the velocity averaged little more than 5 metres per second, increasing to 10 m.p.s. at 6000 m.; it then decreased to 8 m.p.s. at 7000 m., and remained fairly steady up to 10,000 m. Above this altitude the velocity increased rapidly. The results show a fairly steady circulation whether rain falls or not, and the limiting height of the upper easterly drift does not decrease on dry days, as was found to be the case in Abyssinia.

DR. G. H. SAVAGE has sent us a reprint of the Harveian oration delivered by him before the Royal College of Physicians of London on October 18, 1909. Dr. Savage selects for the themes of his lecture experimental psychology and hypnotism, and emphasises the importance of taking into consideration the teaching and methods of these subjects with regard to neurological and mental pathology.

MR. B. A. GUPTE, assistant director of ethnography for India, has issued the preliminary draft of a collection of passages from the sacred books of the Hindus, Jains, Buddhists, and Mohammedans, dealing with women in India, their life, morals, character, rites, and ceremonies, which is of considerable interest. In a subsequent edition the compiler would do well to give definite references to his authorities, which would add considerably to the interest of the collection.

IN an article entitled "Mental Processes and Concomitant Galvanometric Changes" (*Psychological Review*, January), Dr. Daniel Starch investigates the changes in resistance of the body to a weak electric current during varying mental conditions. He concludes that all kinds of mental states are accompanied by galvanometric changes, and that emotional states and muscular activity produce the widest deflections, habitual activity and the process of visual attention producing the least. He finds that quiet mental activity, even when considerable effect is involved, produces only small galvanometric effects.

IN a note published in the Bulletin of the Imperial Earthquake Investigation Committee (vol. iii., No. 2, Tokyo) Prof. Omori considers briefly a subject already touched on by Mr. Oldham, namely, the dependence of the velocity of seismic waves on the nature of the path traversed by them. He calculates the mean surface velocity of the first preliminary tremors by the "difference method" for three earthquakes, and finds it to be 16·02 km. per second for the Guatemala earthquake of 1902, 11·36 km. per second for the Indian (Kangra) earthquake of 1905, and 13·97 km. per second for the San Francisco earthquake of 1906. In the first case the wave-paths were mainly submarine, in the second mainly continental, in the third partly continental and partly submarine. The differences in velocity may thus be due to a deficiency in rigidity in the continental portions of the crust (especially in the centre of Asia) and to an excess of rigidity beneath the Pacific and Atlantic Oceans.

THE Mines Department of South Australia has issued an interesting report, dealing with the mineral output of the State for the half-year ending June 13, 1909 ("A Review of Mining Operations in the State of South Australia during the Half-year ending June 30, 1909," No. 10, Adelaide, 1909). The chief mineral in South Australia is copper, produced from a large number of small scattered mines, but they were less active than usual owing to the low price of copper. There are many small gold mines, of which Arltunga is the most important field, but, owing to its inaccessible position, only very high-grade ores can be worked there. The average grade of the ore in the thirty small mines reported is 102*s.* per ton. The total quantity of ore treated from this field has been only 10,000 tons. Steady progress is being made with the phosphate mines, and a company is working one of the numerous deposits of high-quality china-clay found in South Australia.

IN the *Electrician* for January 7 Mr. Fournier D'Albe commences a series of articles on recent advances in electrical theory. The first instalment deals with the doubts which have been recently cast on the necessity for assuming an æther, with the principle of relativity, the Fitzgerald-Lorentz theory of the change of length of a body moving through space, and with the problem of aberration. The articles should prove a useful introduction to a subject which is one of the most interesting before the scientific world at the present time. There is a slight error in the statement of the amount of expansion of a rod which observers would postulate if the observed times of to and fro motion of light were the same with the rod at rest and in motion through the æther parallel to its length respectively. The amount of change stated by the author is that which would be postulated if the times were found the same when the rod moved with the same velocity with respect to the æther parallel and perpendicular to itself respectively, as in Michelson and Morley's experiments.

IN the December (1909) number of *Le Radium* M. Jean Perrin gives an account of his measurements of the Brownian movements in emulsions of gamboge and of mastic, and of the calculations of a number of molecular

constants he has based on those observations. If it is assumed that the movements of the granules in such emulsions can be classed with those of the molecules of a gas, the theory of the equal partition of the energy amongst the molecules of mixed gases leads to the conclusion that the mean kinetic energy of translation of these granules is identical with that of gas molecules. If, then, the kinetic energy of the granules can be determined, the number of gas molecules in a cubic centimetre of gas under normal conditions may be calculated. M. Perrin determines the kinetic energy of the granules in two independent ways:—first, from measurements of the distribution of the granules at different heights in the emulsion, which he finds follows the same law as in gases; second, from measurements of the displacements of the granules in a given time, and the law which Einstein has deduced for the connection between displacement and mean kinetic energy. Both lead to the conclusion that the number of molecules in a gram molecule is $70{\cdot}5 \times 10^{22}$.

COMMENTING on the death of M. Delagrange, *Engineering* for January 14 points out two special features of technical interest in this aëroplane accident. In the first place it is the first fatal accident with a machine of the monoplane type, and, in the second, it is the first which appears to be distinctly owing to a failure in the main structure of the machine used. It seems to have been generally assumed that the biplane is a safer machine than the monoplane, yet the fact remains that the greater number of accidents have happened to the biplane. There seems to be good reason to suppose that the death of M. Delagrange was caused by the main framing forming one of the wings giving way altogether, followed by the fall of the machine. The general construction of the framing is that of a trussed girder constructed of wood and steel wire. The wires are very numerous in the biplane as compared with those required in the monoplane frame. Usually the wire stays are of solid steel wire or ribbon, which gives little indication of readiness to break. Stranded wire rope is better from this point of view, as ample warning is always given by some of the strands breaking before the rope finally gives way. The broken strands are very easily detected. Further, many machines of both types have the spars insufficiently stayed or not stayed at all against the longitudinal pressure due to the air resistance, which pressure in such cases will be taken up entirely by the spars. To make the aëroplane of practical use, trustworthiness and safety are required, and more attention should be given to these rather than to cutting down structural weights for the purpose of striving after "records."

THE December (1909) number of the *Journal of Physical Chemistry* contains a series of determinations, by Messrs. O. C. Schaefer and H. Schlundt, of the dielectric constants of the anhydrous halogen acids, which gave the following values:—

HI	... ...	21·7°, 2·90; −50°, 2·88; −70° (solid), 3·95.
HBr	... ...	24·7°, 3·82; −80°, 6·29.
HCl	... ...	27·7°, 4·60; −90°, 8·85.
HCN	...	−25° (solid), 2·4; −70° (solid), 3·05.

Attention may also be directed to a paper, by Mr. M. M. Garver, on a kinetic interpretation of osmotic pressure, in which the fundamental assumption is made that, whilst the average velocity of water-molecules in a sugar solution is the same as in pure water at the same temperature, the *range of variation* on either side of the mean is greatly reduced, so that vaporisation and freezing are alike rendered more difficult.

THE volume of the Journal of the American Chemical Society, which has just been completed, is remarkable, not only for the importance of the researches that are described in it, but also for the excellent conciseness with which the results are presented. Two papers by Mr. F. F. Rupert, on the properties of aqueous ammonia and aqueous hydrochloric acid, might be cited as models, not only of accurate and thorough investigation, but of successful resistance to the temptation to expand the bulk of the paper in proportion (or out of proportion, as the case may be) to the importance of the subject. The isolation of ammonium hydroxide, $(NH_4)OH$, and of ammonium oxide, $(NH_4)_2O$, is recorded, for instance, in a paper which covers less than three pages, and congratulations are due from the reader to authors and editor alike on the excellent results that have followed from their cooperation in this respect. The contents of the volume are of such a character as to give much support to the invitation that has recently been extended to English chemists to become members of the American society.

THE Institute of Chemistry has issued a third edition, revised and enlarged, of the "List of Official Chemical Appointments." The list has been compiled by Mr. R. B. Pilcher, registrar and secretary of the institute, and is sold at 2*s*. net. It is arranged in three main divisions:—appointments in Great Britain and Ireland, under the various departments of State, county and borough councils, and other authorities, together with professorial and teaching appointments in schools and colleges in this country; appointments in India and the colonies; and an appendix giving information regarding chemical societies and institutions. A register of fellows and associates of the institute who are seeking appointments is kept at the office of the institute, so that authorities may obtain the services of qualified professional chemists as vacancies arise. In many instances particulars are given in the list as to the Acts of Parliament under which appointments are made, and the regulations and conditions governing the selection of candidates for them. Intended primarily for the use of professional chemists, the publication should be found useful by authorities and persons interested in the applications of chemistry to purposes of State and in the promotion of higher chemical instruction.

A SECOND edition of Mr. G. M. Norman's "Systematic Practical Organic Chemistry" has been published by Mr. W. B. Clive at the University Tutorial Press, Ltd. Various alterations and additions have been made to the book in order to meet the new requirements of the Board of Education syllabus in the subject.

THE popular lectures to be given at the Royal Victoria Hall, Waterloo Bridge Road, S.E., on Tuesdays during February, include the following:—Mr. H. S. Rowell, on "Aëronautics"; Mr. Horace W. Monckton, on "Berkshire, Geological, Geographical, and Historical"; and Mr. E. Cuthbertson, on "The Constitution of Atoms."

COTTERILL AND SLADE'S well-known text-book, "Lessons in Applied Mechanics," has now been published by Messrs. Macmillan and Co., Ltd., in two parts. The first volume includes the sections dealing with the principle of work and hydraulics, and the second those concerned with the strength of materials and structures. The separate volumes meet the needs of students preparing for the various examinations in applied mechanics held by the Board of Education.

OUR ASTRONOMICAL COLUMN.

HALLEY'S COMET, 1909c.—A further extract from Mr. Crommelin's corrected ephemeris (*Astronomische Nachrichten*, No. 4379, p. 170) for Halley's comet is given below :—

Ephemeris for Greenwich Noon.

1910	R.A. h. m. s.	Decl. ° ′	log r	log Δ
Jan. 30	1 6·4	+ 8 27	—	0·2284
Feb. 4	0 59·1	+ 8 14	0·1916	0·2410
9	0 52·8	+ 8 4	—	0·2522
14	0 47·6	+ 7 58	0·1473	0·2617
19	0 42·6	+ 7 55	—	0·2688
24	0 38·1	+ 7 54	0·0971	0·2743
Mar. 1	0 34·0	+ 7 55	—	0·2774

These positions will be found plotted on the chart which we gave in our issue for January 13, p. 320, and it will be seen that the comet is now apparently travelling slowly westwards through the constellation Pisces; on February 5 it will be nearly 1° north of the 4·5 magnitude star ϵ Piscium. During February the comet's distance from the sun will decrease from about 151 to 108·7 million miles, whilst the distance from the earth will increase from about 157 to 176 million miles. According to the ephemeris given by Prof. Searle in No. 607 of the *Astronomical Journal*, the brightness should, during February, increase from 20 to 30, the unit taken being the brightness on September 11 when re-discovered. In the same journal Prof. Barnard gives some further observations, and states that on December 7 the comet was an easy object, appearing to have a small nucleus, in the 4-inch finder of the 40-inch telescope. In the latter it appeared much larger, and its magnitude was about 10·5.

In No. 4383 of the *Astronomische Nachrichten* (p. 238) Herr Archenhold describes the occultation of a twelfth-magnitude star by the nucleus of the comet on December 5, and, among other things, records that no appreciable change of the colour of the star was caused by the superposition of the comet; the nucleus was sharply defined, and by Argelander's method Herr Archenhold found that its magnitude was 11·8.

OTHER PERIODIC COMETS DUE TO RETURN THIS YEAR.—In addition to Tempel's second, and D'Arrest's comets, five other periodic comets may be picked up during 1910, and notes concerning them are given in No. 1, vol. xviii., of *Popular Astronomy* (January, p. 47).

Giacobini's comet, 1896 v., passed perihelion in December, 1909, according to the latest calculations, and its detection now is unlikely. Swift's comet, 1895 ii., is due at perihelion during the present month, but is unfavourably placed. Spitaler's comet, 1890 vii., is, according to the recent calculations of Dr. Hopfer (*Astronomische Nachrichten*, No. 4371), likely to pass perihelion early in October, and might, had a search been made, have been recovered in 1903; between 1807 and 1903 this comet suffered considerable perturbations by Jupiter, which lengthened its period from 6·42 to 6·82 years. Faye's comet is due at perihelion, in very favourable circumstances, in the latter part of October, and Brooks's comet, 1889 v., is more likely to be seen during the summer of 1910 than when near perihelion in January, 1911.

WINNECKE'S COMET.—In No. 4383 of the *Astronomische Nachrichten* Dr. Perrine states that Winnecke's comet will soon be too faint for him to follow with the 12-inch refractor at Cordoba. As it is moving northwards rapidly, he suggests that further observations may be secured with the larger instruments of the northern hemisphere. Dr. Hillebrand's ephemeris for this object appeared in No. 4374 of the *Astronomische Nachrichten*, and Dr. Perrine states that observations made on 1909 December 10 gave a correction (Obs.-Eph.) of R.A., −55s.; dec., 0′.

THE EPOCH OF THE LAST SUN-SPOT MAXIMUM.—In No. 12, vol. xxxviii., of the *Memorie della Società degli Spettroscopisti Italiani*, Dr. Wolfer discusses the epoch of the most recent sun-spot maximum. The observations show that the spot activity was maintained from 1905 to 1908, but, as there was a marked diminution in the latter year, continued in 1909, he concludes that the maximum is passed, and proceeds to determine its epoch. This is not a simple matter, because there were three marked waves, reaching their maxima in November, 1905, July, 1906, and February, 1907, respectively, and three smaller ones; in this respect the maximum strongly resembles that of 1829 and, less so, that of 1804. However, from the relative numbers Dr. Wolfer obtains 1906·1 as the principal maximum, and from the same data, compensated, 1906·4. This gives the interval from the preceding maximum as 12·3 years, 1·2 years in excess of the mean period 11·1 years. With regard to the intensity of the maximum, Dr. Wolfer finds that 1906·4 follows those of 1884 and 1894, making the third maximum of feeble intensity, and he discusses the observations made since 1750, showing that periods of great and small maxima follow alternately.

"ANNUARIO" FOR 1910 OF THE MADRID OBSERVATORY.—The annual publication of the Madrid Observatory is a substantial volume of 560 cap. octavo pages, and contains, *inter alia*, the usual calendars and astronomical tables, a dissertation on the nature, distances, motions, &c., of stars, and a *résumé* of the solar observations made at the observatory during 1908. The prominence observations are tabulated in detail, and then summarised in the form employed by Prof. Ricco. Meteorological results are also given.

A STUDY OF BARK-BEETLES.

THE entomological publications of the United States Department of Agriculture have for long past been the admiration of European naturalists. Exceptionally valuable, even among that Department's series of excellent memoirs, are two recent papers on Scolytid beetles

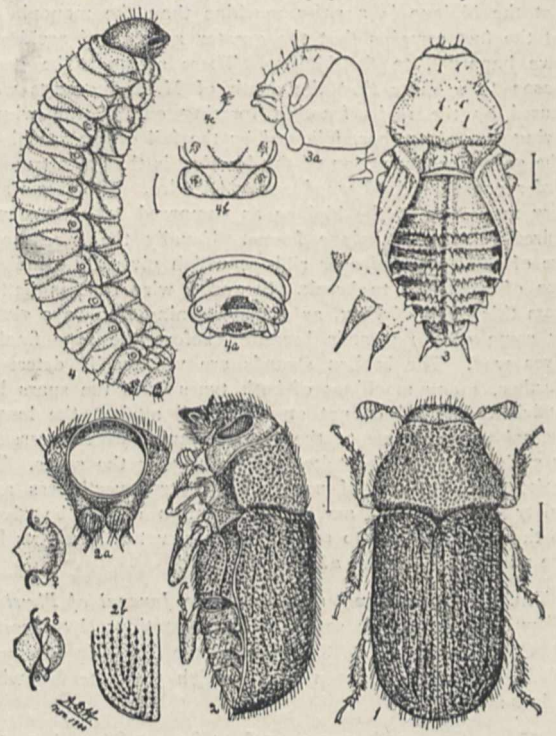


FIG. 1.—Eastern Spruce Beetle (*Dendroctonus piceaperda*). 1, Dorsal aspect; 2, lateral aspect; 2*a*, prothorax; 2*b*, end of elytron, showing sculpture; ♀, ♂, seventh abdominal terga of female and male (the clear oval spaces are stridulating areas; 3, pupa, dorsal aspect with spines more highly magnified; 3*a*, head and prothorax of pupa, lateral aspect; 4, larva, lateral aspect; 4*a*, terminal abdominal segments of larva, dorsal view; 4*b*, abdominal segments of larva, ventral view.

of the genus Dendroctonus by Dr. A. D. Hopkins, one (Technical Series, No. 17, part i.) being in the main systematic and descriptive, the other (Bulletin No. 83, part i.) dealing for the most part with the bionomics of the beetles and the *rôle* played by the various species as depredators in North American forests. These papers contain some of the results of seventeen years' original research; probably no such descriptions and figures of the

imaginal and larval anatomy of Scolytid beetles as those in the technical memoir have ever been issued before, while in the systematic portion are to be found, not only full structural accounts of the various species, but figures showing the characteristic form of the brood and larval galleries in each case. The accompanying figures, slightly reduced from the original, give some idea of Dr. Hopkins's excellent illustrations.

Most Scolytid beetles—the well-known *Hylurgus* (or *Myelophilus*) *piniperda*, for example—lay their eggs in dying or unhealthy trees or in felled trunks, the vigorous flow of sap and secretion of resin in healthy growing trees being unfavourable for the development of the larvæ. Members of the genus Dendroctonus, however, prefer, as a rule, healthy trees for breeding purposes; hence the destruction wrought by the insects may become exceedingly serious (see the photograph reproduced), and it is not possible to exterminate large numbers of the beetles and larvæ by "trap-trunks" or "trap-logs," according to the practice of German foresters with Hylurgus and similar bark-beetles. As is usual in American economic work, attention has been paid to the natural enemies of the destructive beetles, and experiments have been made

FIG. 2.—Yellow Pines killed by the Western Pine Beetle (*Dendroctonus brevicornis*), Yosemite National Park.

with imported specimens of the handsome European beetle *Clerus formicarius*, which drags bark-beetles and larvæ from their burrows and ruthlessly devours them.

The genus Dendroctonus has a remarkable distribution. Twenty-three species are found in North America, the genus spreading northwards to Labrador and Alaska and southwards through the Mexican highlands into Guatemala. In the "Old World" a single species only is known—*D. micans*, which inhabits Russia, Germany, Denmark, and southern Scandinavia. While "the species of this genus of beetles are the most destructive enemies of the coniferous forest trees of North America," they are hardly known in Europe except to special students of the Scolytidæ. The absence of Dendroctonus from northern Scandinavia, from our own islands, and from western Europe generally, suggests that the former geographical connection between the outlying European *D. micans* and the numerous American members of the genus was by way of Siberia and Alaska. G. H. C.

ATMOSPHERIC ELECTRICITY IN EGYPT.

IN Paper No. 10 of the Survey Department of Egypt Mr. H. E. Hurst discusses two years' results of atmospheric electric potential obtained from a Kelvin water-dropper electrograph at Helwan from March, 1906, to February, 1908. From observations made with a Kelvin portable electrometer, and experiments on the disturbing effect due to the presence of instrument and observer, a factor was obtained, multiplication by which transfers curve readings to potential gradient in the open (volts per metre of height). The mean value found for the potential gradient from the two years was 113, a value lower than is usually encountered in Europe. In the second year, however, owing to the more open scale employed, there was at times considerable loss of trace, and an allowance which Mr. Hurst makes for this would bring up the value of the potential gradient for that year from 119 to 129, and the mean for the two years from 113 to 118. The curves were not smoothed, and were measured only at the even hours, and there is rather excessive irregularity in the diurnal inequality curves which are given for individual months of the year. All show a prominent minimum in the early morning from 4 a.m. to 6 a.m., and some a secondary minimum in the early afternoon, but successive months differ in this respect rather widely. In the mean diurnal inequality for the year there is little variation in the potential from 10 a.m. to 10 p.m.; the value at 8 p.m. is the absolutely largest in both years. One very exceptional phenomenon is that the potential is decidedly highest in summer. The mean potential gradient from the four months June to September was 136, while that from the four months November to February was only 98, no allowance being made in either case for loss of trace. Curiously, however, the mean range of the diurnal inequality was 81 for the four mid-winter months as compared to 50 for the four months June to September.

The mean diurnal inequality for the year was analysed in a Fourier series. The amplitude of the 24-hour term was nearly double that of the 12-hour term. The latter term was found, as at Kew, to be almost exactly in phase with the 12-hour Fourier "wave" for barometric pressure. No connection could be found between potential gradient and temperature, sunshine, or any other meteorological element except wind direction and possibly vapour pressure. Other observers have associated sudden changes of potential with sunrise and sunset, but no such connection seems to exist at Helwan. During sandstorms negative potentials are sometimes encountered, but not always.

The present publication is welcome evidence of the scientific activity of the Helwan Observatory, and contains several results of much interest. It is to be hoped, however, that a more complete analysis will be made some years hence, when sufficient data have accumulated to give fairly smooth results for individual months of the year, and that the curves will then be measured at all hours of the day, and not merely at the even hours.

C. CHREE.

AMERICAN HYDROLOGY.[1]

NEGLECTING the quantity disappearing through evaporation as relatively insignificant, the rainfall over any area either finds its way on or near the surface into streams or percolates into the ground to form subterranean reservoirs, which are tapped in many cases, naturally by springs and artificially by wells. Each of these processes has a distinct and valuable bearing upon the industrial and hygienic resources of a country, and in countries where there is no separate hydrological service the scientific investigation of the national water supply comes within the purview of the geological department, as is the case in the United States. The two papers which form the subject of this brief notice illustrate in a very

[1] Surface Water Supply of the United States, 1907–8. Part ii., South Atlantic Coast and Eastern Gulf of Mexico. Prepared under the direction of M. O. Leighton by M. R. Hall and R. H. Bolster. Water Supply Paper No. 242. Pp. 226.

Underground Water Resources of Connecticut. By Herbert E. Gregory, with a Study of the Occurrence of Water in Crystalline Rocks, by E. E. Ellis. Water Supply Paper No. 232. Pp. 200. (Washington: Government Printing Office, 1909.)

striking manner the varied and comprehensive character of the work carried on by the U.S. Geological Survey. The first volume constitutes a general review of the surface water supply over a very considerable tract of country, comprising the drainage basins of the rivers James, Roanoke, Yadkin or Pedee, Santee, Savannah, Ogeechee, Altamaha, Satello, St. John, Peace, Withlacoochee, Suwanee, Ocklockonee, Apalachicola, Choctawhatchee, Escamba, Mobile, Pascagoula, and Pearl; while the second is a comparatively local and complete investigation into the wells and springs of Connecticut.

An introduction to the former volume gives a brief *résumé* of the scope of investigations and the purposes of the work, with a description of the field methods employed for measuring stream flow, from which it appears that the system most generally in use is that of gauging by means of sectional areas and velocity readings. These last are taken by the Price current meter. Fig. 1 illustrates in a typical manner the plan of operations. At the selected station the river bed is divided transversely into any convenient number of points, at which records are taken both of the depth and the velocity. The latter is determined by two observations in each case, at one-fifth and four-fifths of the total depth respectively. The average of these two readings gives the mean velocity of the current very closely for open-water conditions. The discharge is obtained by a simple computation of the cross-sectional area of the strips multiplied by the average of the mean velocities at their ends.

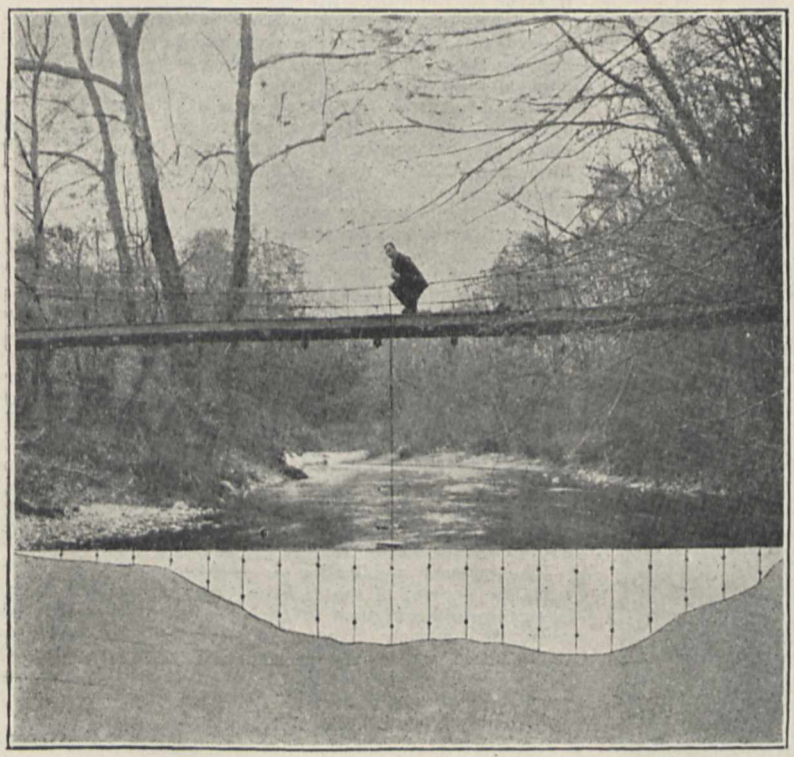


FIG. 1.—Bridge Station and Cross-section of Stream.

The second volume contains interesting chapters on the physiography, meteorology, and geology of the State of Connecticut, and not the least valuable feature is the study by Mr. Ellis of the conditions affecting the occurrence of water in crystalline rocks. The term crystalline is taken as covering both igneous (granite, diabase, gabbro, &c.) and metamorphic (schists and gneisses) varieties. More than two-thirds of the area of the State is underlain by rocks of this type, and a large number of wells have been driven into them. It is pointed out that the porosity of crystalline rock is very slight (averaging 0·5 per cent. or less), and that the only circulation of water which has sufficient rapidity of movement to be of value as a source of well supply must be through joints and fractures. A study of the occurrence of these joints, accordingly, is of great utility and value, and the data collected cannot fail to prove of more than local interest on account of the scarcity of information on the subject. B. C.

RECENT WORK OF GEOLOGICAL SURVEYS.

I.

GREAT BRITAIN AND INDIA.

THE wide range of work done by the Geological Survey of Great Britain is again seen in the "Summary of Progress for 1908" (1909, price 1*s*.). The numerous notes made on observations in England, Wales, and Scotland are, of course, only preliminary to their development in future memoirs; but we may here direct attention to the careful re-examination of two marine Devonian intercalations in the Upper Old Red Sandstone near Milford Haven (p. 35), and to the description of the Achanarras beds (Middle Old Red Sandstone) of Caithness, by Mr. R. G. Carruthers (p. 87). Caithness has also yielded a mass of sandstone with Lower Cretaceous fossils (p. 62). Even if this proves to be transported, like the blocks of chalk in Aberdeenshire, it will remain a remarkable addition to our knowledge of the extent of the early Cretaceous sea. The Petrographical Department has shown the presence of nepheline in several rocks of the Midland Valley of Scotland (p. 44).

The memoirs published recently include one of economic importance on the water-supply of Bedfordshire and Northamptonshire, with rainfall-maps supplied by Dr. H. R. Mill (1909, price 4*s*. 6*d*.). Dr. Strahan has written a second edition of the memoir on the country around Newport, in the South Wales coalfield (1909, price 1*s*. 6*d*.), which shows how knowledge advances, even during a decade. An interesting break near the top of the Carboniferous Limestone is pointed out, and the Old Red Sandstone is now divided into an upper and a lower series. It is probably not generally known that the characteristic Upper Old Red Sandstone mollusc, *Archanodon jukesii*, was found near Talgarth in 1895, the specimens being now in the British Museum. A terse and effective account is given on p. 89 of the passage from the continental beds of the Trias in this district through the Rhætic shales to the marine Jurassic system, and a comparison is made between this complete sequence and that observable where the Cretaceous sea spread across the Weald.

The description of the geology of the country around Basingstoke (1909, price 2*s*.), accompanying the colour-printed Sheet 284 (1*s*. 6*d*.), has been entrusted to Mr. H. J. Osborne White. The area is a familiar one, at the junction of the London Basin and the great swelling rolls of Salisbury Plain. The chalk district was formerly strewn with sarsens, which have been traced to a sandstone in the Reading beds. The Plateau Gravels raise interesting questions of former river-courses, and it appears that the Wey basin (p. 90) has now captured waters that once brought Lower Greensand débris westward into the valley of the Loddon. The soft Eocene strata are responsible for considerable "mutability of the lines of drainage."

The memoir on the country around Bodmin and St. Austell, by Messrs. Ussher, Barrow, and MacAlister (1909,

price 4s.), accompanies the colour-printed map, Sheet 347 (price 1s. 6d.). The tin and copper mines are described, with sections. Considerable interest attaches to the origin of china-stone and china-clay (p. 105); the former is an altered granite, in which kaolinisation is not an essential feature. It must not contain tourmaline, or minerals liable to discolour it. China-clay, on the other hand, must be a kaolinised product, and tourmaline can be washed out of it during its preparation for commercial use. Mr. MacAlister (p. 115) attributes the main kaolinisation to "moisture with fluorides emanating from the granite," while Dr. Flett (p. 118) believes in the greater potency of carbonic acid. Hence we are by no means at the end of this much-discussed question. The metamorphism of the Devonian rocks by a granite associated with the Hercynian folding furnishes interesting material. We wish that Mr. Barrow could have been restrained from promulgating the Anglo-Swedish word "calc-flinta" (p. 99), which can hardly be taken as a serious term. It appears, however, on the index to the map, where it has become classed, with associated altered sediments, as of igneous origin.

The Scottish branch of the Survey recalls the ancient state of things, when romance and argument by flood and field were to be sought northward of the Tyne. The memoir on Sheet 45, including Oban and Dalmally (1908, price 2s. 6d.), has for its frontispiece the Pass of Brander, through which the Atlantic always seems to call, across the rain-swept moorland under Cruachan. Mr. H. Kynaston, before his departure for the Transvaal, surveyed this region with Mr. J. B. Hill, and several other authors have joined in the present memoir. Much of the interest of the area is petrographical, but nowhere is the petrographer more dependent on the relations of the rocks as determined in the field. Take, for instance, the marginal features of the Cruachan granite (p. 83), or the pitchstone with cordierite, augite, magnetite, and spinel (p. 129), which results from the fusion of a phyllite by a Cainozoic dyke. Bibliographers should be warned that one of the authors of this memoir, Mr. H. B. Muff, changes his name henceforward to the ancestral form of Maufe. Under this guise he appears as joint author with his colleagues, Messrs. Clough and Bailey, of a very striking paper on the Cruachan and Glen Coe cauldron-subsidence, in the Quarterly Journal of the Geological Society for November, 1909. It is not too much to say that the researches of the Geological Survey have added to our appreciation of one of the grandest regions of the Highlands.

The memoir on Sheet 36, covering the seaboard of Mid-Argyll, is mainly by Messrs. Peach, Kynaston, and Muff (1909, price 2s. 3d.). Effective illustrations are given of the remarkable boulder-beds traceable above the limestone-zone of the metamorphic series. The reality of the break marked by this conglomerate is shown by its frequent inclusion of local rocks, such as the limestone blocks in the Garvellachs. Rocks from unknown sources also occur. The chapter (p. 43) on the epidiorites of the area, and on their origin as "pillowy" basic lavas, will be of value to geologists in many countries who have to deal with this group of modified rocks, in which a similarity of character has been thrust on materials of very various modes of upbringing. The slate quarries of Easdale have been studied in their economic aspect, and Mr. Muff contributes (p. 16) a valuable exposition of the relations of the various parting-planes to the folding of the rocks, which is applicable to many other cases difficult of interpretation, even in the field.

The Records of the Geological Survey of India contain evidence of a great variety of observations, ranging from economic materials to fossil remains. In the mineral field Dr. Bleeck deals with jadeite, which is extensively worked in a dyke or in detrital boulders by Chinese enterprise in Upper Burma (vol. xxxvi., p. 254). He concludes that pure jadeite consists of the (metasilicate) $NaAlSi_2O_6$, and that the dyke in the Kachin Hills originally consisted of nepheline, $NaAlSiO_4$, and albite, $NaAlSi_3O_8$. One molecule of each of these would produce paragenetically two molecules of jadeite. Albite occurs in both margins of the dyke, as is shown in the interesting section on p. 276, and these marginal zones contain blocks picked off from an adjacent amphibolite. It is presumed that the original magma was unusually rich in soda. Mr. Fermor (vol. xxxvi., p. 295) verifies by new analyses the view of Laspeyres, that psilomelane is a definite manganate of manganese, barium, iron, potassium, and hydrogen, based on the acid H_4MnO_5. Hollandite is crystallised psilomelane, while coronadite of Arizona is held to be a form in which barium is replaced by lead. Mr. P. N. Bose's account of the mineral resources of Rájiplá (vol. xxxvii., p. 167) describes the carnelian mines of Ratanpur, which have been worked for 400 years. The stones are coloured by heating on the spot. The date of Mr. Copland's report is not given, but we judge it to be about 1830. At that time the miners walked seven miles to the mines and seven miles back every day, "on account of the tigers with which the country abounds." In the same volume (p. 199) Mr. Fermor describes three new manganese minerals from India, vredenburgite, probably $3Mn_3O_4.2Fe_2O_3$, and highly magnetic; sitapárite, $9Mn_2O_3.4Fe_2O_3.MnO_2.3CaO$, with a bronzy colour distinguishing it from braunite; and juddite, a manganese amphibole. Specimens of all these may now be seen in the British Museum collections.

In physical geology we note Mr. J. C. Brown's description of the mud-volcanoes of the Arakan coast, Burma (vol. xxxvii., 1909, p. 264), which are produced by the bursting up of petroleum vapours, and which occasionally build up temporary islands in the sea. Sir T. H. Holland and Mr. W. Christie furnish an important paper on the origin of the salt-deposits of Rajputana (vol. xxxviii., 1909, p. 154). They show, in the first place, that the rivers flowing into the basins in which the salt accumulates in dry seasons contain an unusual amount of sodium chloride; secondly, that this is not likely to be washed out of older salt-beds; and thirdly, by actual experiments at Pachbadra, that the amount of salt passing a front 300 km. broad and 100 m. high during the four hot-weather months is some 130,000 tons. Mr. T. D. La Touche suggested in 1902 that the salt in the great plains might be added to by wind-borne drift, but the present writers conclude that this is the essential method of supply. The Rann of Cutch becomes actually crusted over with salt in the dry season; magnesium and potassium salts, being more soluble, are left behind in the unevaporated water (p. 168), and the sodium chloride, probably with gypsum, is carried inland. Small Foraminifera have been blown inland from the Cutch coast for 500 miles. The rains follow on the hot months, and the salt is washed into temporary lakes before it can be blown back by the return monsoon. The application of this striking instance to the Triassic lake-basins, formed under desert conditions (p. 183), makes it of wide importance. Judging from the immense stretches of pebble-beds in the European Trias, and from the signs of extension and recession of the lakes, flood-waters arising under monsoon influences may have prevailed in a region that was dry during a large part of the year. Gypsum beds like those of our Trias are found deposited from the seasonal lakes of north-west India.

Stratigraphy is represented by Mr. G. E. Pilgrim's investigation of Tertiary fresh-water deposits in Baluchistan and Sind (vol. xxxvii., p. 139), in which he divides up beds previously grouped as Siwalik into an Oligocene series with Anthracotherium and the allied Brachyodus, an Upper Miocene series with Deinotherium and Tetrabelodon, and an unfossiliferous series, which is probably Upper Pliocene. Unconformities occur between these series. Mr. C. S. Middlemiss, writing on the Gondwanas of Kashmir (vol. xxxvii., p. 286), suggests a re-arrangement of beds previously studied. He has found a new Lower Carboniferous horizon in the Lidar valley (p. 319), lower than the Panjal volcanic series. Above the Panjal series on the Golabgarh Pass he traces a section where Lower Gondwana plants (Gangamopteris, Glossopteris, &c.) lie beneath marine beds with a Middle Carboniferous fauna. This establishes (p. 296) the position of the Lower Gondwana beds in peninsular India, including the Talchir glacial series. No signs of glacial conditions, however, were observed in their representatives in the north. Mr. E. W. Vredenburg, in a paper on a hippurite-limestone in Seistan (vol. xxxviii., p. 189), points out that Seistan occupies a tectonic depression, the floor of which has been covered by the lacustrine Pliocene Gobi formation, the

equivalent of the Siwaliks of India. This has been covered by later alluvium, but appears, highly inclined, on the margin of the basin, and earth-movements have probably continued into Pleistocene times.

Following on Mr. Yabe's recent review of the genus Fusulina, particularly in its Asiatic bearings, which was noticed in a previous article in NATURE, Mr. H. H. Hayden adds a critical and microscopic investigation in a paper on Fusulinidæ from Afghanistan (vol. xxxviii., p. 230). He shows good reason for the view that Fusulina is perforate, but urges that the appearance of its shell, and its minutely granular character under the microscope, should place it among the porcellanea. It does not appear, however, that the fossil porcellanea selected for comparison are in their original condition, seeing how quickly a granular calcitic structure arises in shells that were once composed of aragonite. Mr. Hayden regards the shell of a modern Biloculina as also similar, and as composed of calcite (p. 233). In the face of other determinations it will be well to suspend judgment before Fusulina becomes placed in a unique position.

In Palæontologia Indica, also published by the Indian Geological Survey, Dr. A. S. Woodward (vol. iii., Memoir 3) has described fish-remains from the Lameta beds of the Central Provinces, which fix the age of these beds between Danian times and the close of the Eocene period.

The Mysore Geological Department (Bulletin No. 4) has assisted the gravity observations of the Survey of India by the determination of the densities of a large number of specimens of hornblende schists obtained from mine-shafts nearly 3000 feet in depth. The unaltered rock, where it is below the zone of saturation by water, has a density of 3·00. The effect on the superficial zone of alternate wetting and drying in a tropical atmosphere is shown by its being regarded as "weathered" down to 100 feet, the density in the first 10 feet being 1·65, inclusive of air-spaces, and rising to 2·66 at 30 feet and 2·90 at 100 feet. The determinations give what are styled "apparent specific gravities" in soil-analysis, and the method of collection of the loose material in its field-condition in a measured box might have proved simpler than that actually adopted (p. 9). In vol. viii. of the Department's Records (for July, 1906, to June, 1907, received in November, 1909), Mr. B. Jayaram makes the now customary complaint (p. 84) that his oldest rocks in Mysore are hornblende-schists, into which gneiss, and subsequently pegmatite, have intruded. He presumes below this "an hypothetical archæan basement rock, say gneiss," but this is probably suggested out of deference to the text-books. His notes on rocks and minerals express a large amount of original observation, and he claims a secondary origin for his pyroxene-hornblende granulites (p. 90), without realising that he is thereby bringing them into line with those of Saxony, the nature of which was so long misunderstood. According to Dr. Smeeth, the State geologist (p. 15), there is a good deal to be yet learned about the origin of the Mysore laterites; but Mr. H. K. Slater's report on the Sorab Taluk (p. 31) has suggestive remarks on the relation of laterite to lithomarge, and of lithomarge to an original highly felspathic granulite, elsewhere referred to as a banded felsite or rhyolite. He believes that the same granulite (p. 49) passes, by impregnation with silica and iron oxide, into a brecciated chalcedony-hæmatite rock, which has been described, somewhat misleadingly, as a quartzite. This paper needs some press-correction.

The Reports of the Mineral Survey of Ceylon for 1907 and 1908 include the last work of Mr. James Parsons, whose tragic loss is recorded in that for 1908. Considerable attention is given to thorianite, and the monazite of Ceylon has yielded 10 per cent. of thoria. "Reconstructed" rubies, as well as beautifully cut gems of a glass rich in lead and thallium, are now being sold in Ceylon markets. Western science has much to answer for in the east. The useful relations between the Survey and the Imperial Institute in London are clearly seen in these reports, and the same feature is apparent in the Geologists' Annual Report of the Federated Malay States for 1908, in which tin-deposits are naturally of foremost interest.

G. A. J. C.

EDUCATION ABROAD AND IN ENGLAND.[1]

IN education, as in other matters, each nation must solve its own problems for itself. Every system of education should be the expression of national characteristics and adapted to national idiosyncrasies. Still, lessons which we can ill afford to neglect may be learnt from the study of developments in other countries, and in some respects it is much easier to ascertain what is being done abroad than at home. Thanks to the admirable series of special reports inaugurated by Prof. Sadler, we can make ourselves more or less familiar with the details of foreign education. With regard to England, we are not so fortunately situated; the Board of Education gives little or no information as to new and successful experiments, and its reports have mainly a statistical value. This lack of information as to the progress within recent years renders a comparison between English and foreign systems difficult and misleading.

Attention is commonly concentrated upon Germany and the United States. This is natural, having regard to their extraordinary industrial development during the past generation and the extent to which it may be attributable to their systems of education. With regard to Germany, it would be remarkable if a nation forced to repair the ravages of war by intellectual effort—you remember Humboldt's famous expression in 1807, "Der Staat mus durch geistige kräfte ersetzen was er an physischen verloren hat"—had not in the course of a century become pre-eminent in one or more departments; but when you test the value of the system you will find, I think, that the general balance is in our favour. The facilities for technical and scientific instruction are as great here as there, but where the German has the advantage is in the better quality of the pupils who attend those colleges and schools. This is entirely due to the excellence of their secondary education, and until we can make the Board of Education and the public realise that prolonged and sound general education is the essential antecedent to successful technical and scientific training, the quality of the material supplied to our technical and scientific institutions will remain inferior. By their regulations, the Board of Education seem hardly to appreciate the supreme importance of this. A course of four years compares most unfavourably with the courses at the Gymnasia and Realschulen, and it is a fatal mistake to allow that course to be shortened in any circumstances, or to permit individual pupils or special classes to follow a curriculum varying from the curriculum approved for the rest of the school. To remedy the glaring defects in our system of secondary education, and to place our pupils upon terms of equality with those in Germany, it is imperative to fix a higher standard and strictly to adhere to it.

Of the United States as a whole it is difficult to speak. Each State has its own system, and the only common characteristic is the lavish expenditure upon buildings and equipment. No one is more conscious than the American himself that the results are far from satisfactory.

In spite of this, however, valuable lessons may be learnt from America. We are indebted to them for the promotion of international congresses, which will be of universal benefit if they only succeed in the standardising of university education, which at present leads to endless misapprehension and confusion. We might, too, with advantage imitate their custom of holding frequent local inquiries with a view to the re-adjustment of existing methods so as to satisfy modern requirements. At the same time, they have done much to solve the problem of the connection between instruction and apprenticeship, the workshop and the school. The fundamental principle there is based upon the rational assumption that the proper and only way for a young man to learn the practical side of his profession, together with business details, is by working as a regular employee, and that the only place where he can learn properly the scientific and the cultural subjects is at a school under trained teachers. We need also a bureau of education as well organised and endowed as that at Washington to act as an imperial centre for information and advice.

[1] From a paper read at the North of England Education Conference, Leeds, on January 8, by John C. Medd.

For purposes of effective comparison, it may be well briefly to indicate the acknowledged gaps and apparent defects in our system, and the possibility of remedying them by the adoption of particular types of school and methods of instruction from other countries. It is by such an eclectic process that the Japanese are transforming themselves, and have gradually built up a system of education which, upon paper at least, leaves little to be desired. Notwithstanding the constant criticism levelled against the ancient universities and great public schools, I do not consider that they fail to realise their respective functions.

It is with reference to the ordinary secondary schools that the position is so unsatisfactory, and for their improvement we must, as I have already intimated, learn from Germany, or Holland, the burgher schools of which furnished the Germans with their models. Simultaneously, the facilities for promoting the easy passage of suitable pupils of all ranks from one type of school to another ought to be increased.

In elementary education as a whole we stand unrivalled, with the possible exception of Holland, where the methods of instruction are still as Cuvier described them, "au-dessus de tout éloge." It would be folly to expect the same standard of excellence in all schools, having regard to the infinite variety of conditions under which each school is conducted. The great need, commonly, is for more practical instruction, some relaxation of the regulations as to building and equipment for manual instruction and domestic science, and the introduction of a system of supplementary courses. We require, as Prof. Sadler has pointed out, a new type of school in which less attention is paid to purely literary subjects and more to the practical side.

The teacher is the most important factor. Upon his character, capacity, and sympathy the quality of each school depends far more than upon the public spirit of the local authorities and managers. His training is still too limited and hampered by the exigencies of the certificate examination. The normal schools of both France and Holland are conducted on far more enlightened principles. It is recognised that there are certain subjects, such as the theoretical and practical study of natural and physical science, which every teacher, whether destined for an urban or a rural district, ought to know. We do not want to create two distinct classes of teachers or to establish separate institutions for those who will have charge of country schools, but we do want the student during his period of training to become qualified to discharge all those duties which are involved in the modern conception of an elementary school. In Holland, for instance, every student has a systematic course of instruction in horticulture and the elementary principles of agriculture. In woodwork every student makes a complete set of the models of the Swedish Slöyd system and of objects required for other lessons, such as chisels, rulers, levers, and scales; models of tools or engines to assist in explaining different trades and industries; implements for the manufacture of linen and lace, &c. In addition, each student constructs an aquarium, terrarium, and a case for insects to be collected and attended to by himself. Beyond acquiring a mass of information invaluable to him in his profession, he learns how to make the apparatus necessary for object-lessons in the primary school.

The outstanding blot upon English education is the absence of any adequate provision for those who have completed the elementary-school course but do not proceed to a secondary school. To expend millions upon these children until the age of thirteen or fourteen, and then to turn them over to the education of the streets, is disastrous from every point of view. It is during the period of adolescence that the habits are formed which will determine the boy's or girl's whole future career. Cast adrift as they are in the vast majority of cases to rely upon their own resources, they constitute a grave social danger, swell the ranks of the unemployed, and gravitate to the workhouse or the gaol. It is computed that only one in six between the ages of fourteen and twenty-one are receiving any systematic instruction. Taking those between fourteen and eighteen, 2,000,000 out of 2,800,000 have done with education altogether. Minister after Minister of Education deplores this, but no practical steps have ever yet been taken by any Minister to remedy the evil.

Continuation schools, however, are not alone sufficient. A few trade schools have been established, but they should be the rule, and not the exception. The Ambachts or trade schools of Holland furnish a good example. Those admirable institutions owed their origin to private or local initiative, but are subsidised and inspected by the Government. The course usually lasts for three years, and the instruction is continuous throughout the year. The subjects naturally depend to some extent upon local circumstances, but generally include drawing, geometrical drawing, physics, mathematics, mechanics, wood and metal work, all taught technically and with the view of particular industries. In some cases instruction is also given in masonry, furniture and instrument making, painting and house decoration. The results are undoubtedly excellent. For some time artisans were a little jealous of this trade instruction, but now there is an increasing demand by them for lads who have completed the school course. It is intended that pupils should proceed direct from the primary school at the age of twelve or thirteen, and this is the usual custom. A few boys occasionally attend after leaving the intermediate schools or the gymnasia.

Now that the Board of Education has substantiated its claim to be the responsible authority for agricultural education, it would be wrong to ignore that question altogether. We are as far behind other nations in that respect as in the training and instruction of children when they leave the elementary school. In proportion to the agricultural population we have a greater number of advanced colleges than are to be found in any country, but for the rank and file of young farmers and smallholders facilities for acquiring that knowledge which today is essential to the successful cultivation of the soil can hardly be said to exist. We are constantly reminded of the agricultural prosperity of Denmark, but it is generally forgotten that that prosperity is due to the excellence of the people's high schools, which impart a sound secondary education, and which are free from any agricultural bias. The attempt to combine agricultural teaching with general education was quickly discarded by the Danes. What we require are winter schools and classes corresponding to those in Ireland and Holland, a few practical schools of agriculture of the type of those in France, and farm institutes of the character recommended by Lord Reay's Departmental Committee.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

BIRMINGHAM.—Dr. Robert Simon has been elected to the chair of therapeutics rendered vacant by the death of Prof. Foxwell.

Prof. J. W. Taylor has resigned the chair of gynæcology.

Mr. E. E. Fournier d'Albe has been appointed assistant lecturer and demonstrator in experimental physics to fill the vacancy caused by the resignation of Mr. F. W. Aston, who has accepted a post as assistant to Sir J. J. Thomson at the Cavendish Laboratory.

Mr. George Heaton has been appointed lecturer in operative surgery, and Dr. Edgar P. Hedley has been elected to a demonstratorship in chemistry.

Prof. Bostock Hill has been asked to act as a delegate to represent the University at the Congress of the Royal Sanitary Institute to be held in Brighton in September, and also at the International Congress on School Hygiene which meets in Paris in March next.

Prof. F. W. Gamble, F.R.S., has been appointed to represent the University at the eighth International Zoological Congress at Graz (Austria) in August.

CAMBRIDGE.—The Public Orator, Dr. Sandys, spoke as follows in presenting Dr. Mark Aurel Stein for the degree of Doctor of Science *honoris causa* on January 20:—

Adest vir scientiarum non minus quam litterarum de finibus proferendis bene meritus, qui Hungariae in urbe maxima natus, et inter Tubingenses Oxoniensesque linguis orientalibus eruditus, in imperio nostro inter Indos iam per annos plurimos scholis et collegiis nostris admini-

strandis non sine laude praefuit. Ibi, tot laboribus occupatus, tempora tamen subsiciva (ut aiunt) fluminis Indi regionis montanae annalibus antiquis diligenter edendis et luculenter illustrandis non sine fructu dedicavit. Ibi, tot laborum per intervalla, itinera illa magna, Indiae proconsulis magni auspicio, est aggressus, unde gloriam maximam merito est adeptus. Olim, ultra Indiae terminos in regiones propiores prospere peregrinatus (ut alia praeteream), petram Aornon accuratius investigandam esse duxit, rupem illam praecipitem et abruptam "ab Hercule frustra obsessam," ab Alexandro post pericula plurima captam et Minervae Victoriae consecratam.[1] Idem viatoris antiquissimi vestigiis sacris ingressus,[2] Asiae in ipsa penetralia plus quam semel peregrinatus est. Illic, itinere longinquo in uno, regionis desertae ex arenis, quot "oppidum cadavera"[3] diu sepulta, quot tabellarum litteris priscis inscriptarum reliquias, per saecula longa quam tuto conservatas, eruit! In altero autem, regionem quam immensam minutissime permensus, quot tabulis pictis domi delineandam tradidit! Quot turres diu desolatas, quot imperii Sinensis olim latius porrecti propugnacula, dinumeravit! Quam ingentem librorum in quanta linguarum varietate scriptorum multitudinem, quam multa denique artium Graecarum, artium Asiaticarum monumenta, aut pictoris aut sculptoris manu antiquitus exornata, Britanniae in Museum maximum victor reportavit! Herculis praesertim et Minervae et Amoris imagines, olim gemmis insculptis in creta impressas, ab eodem inventas recordati, confitemur inventori tam strenuo, tam sagaci, tam amabili, neque Herculis fortitudinem virtutemque, neque Minervae prudentiam, neque Amorem ipsum, scientiarum et veritatis amorem incorruptum, defuisse.

Duco ad vos Asiae exploratorem impigrum, prudentem, perdoctum, virtutis antiquae exemplar bene nominatum, Marcum Aurelium Stein.

Mr. R. C. Punnett, superintendent of the Museum of Zoology, has been elected to the professorship of biology recently vacated by Prof. W. Bateson. Mr. Punnett took his degree in 1898, obtaining a first class in part ii. of the natural sciences tripos. He was awarded the Walsingham medal in 1900. He has also received the Thruston medal. For some time he held the Balfour studentship, to which he was elected in 1904. He succeeded Dr. Harmer as superintendent of the Museum of Zoology at the beginning of last year.

Prof. W. Bateson, who vacated an ordinary fellowship at St. John's College on resigning the professorship of biology, has been elected to an honorary fellowship.

The chairman of the special board for anthropology gives notice that Mr. Roscoe will give a course of lectures during the present term on the natives of Uganda. The lectures will be given on Fridays (commencing on Friday, January 28), at 5 p.m., in the lecture theatre of the Archæological Museum.

THERE is about to be introduced into Congress a Bill "to promote health and efficiency by the establishment in the United States Bureau of Education of a division for the collection of scientific data on physical education and for the dissemination thereof." The proposal originated at a recent convention of the National Education Association, which appointed a committee to direct the attention of Congress to the need of governmental action on the subject. The association emphasises especially the growing importance of physical culture in view of the increased tendency to the congestion of the population of America in cities.

THE first meeting of the newly formed London branch of the Mathematical Association will be held at the Polytechnic, Regent Street, on Saturday, January 29, at 2.45 p.m. Mr. A. W. Siddons (Harrow) will read a paper on the Board of Education circular on the teaching of geometry, and amongst those who will contribute to the discussion are Miss Home, Miss Gwatkin, Mr. G. St. L. Carson, Dr. T. P. Nunn, Mr. J. G. Hamilton, Mr. F. J. G. Whipple, and Mr. T. J. Garstang. There will be an exhibition of books and models. Those desiring to attend are requested to communicate with the honorary secretary, Mr. P. Abbott, 5 West View, Highgate Hill, N.

[1] Curtius, viii. 11, 2–24.

[2] A reference to Hiuen-Tsiang, the great Chinese pilgrim of 649 A.D. whom Dr. Stein claimed as his "guide and patron-saint" ("Sand-buried Ruins of Khotan," ed. 1904, p. xxi., &c.).

[3] Ap. Cic. *ad Fam.*, iv. 5, 4.

ACCORDING to the *Madras Educational Review*, Sir F. D. Lugard, the Governor of Hong Kong, has reported to the Government that Mr. H. N. Mody has offered to present the colony with the building necessary to start a university. A committee has been formed, with the Governor as chairman, to promote the undertaking. Mr. Mody's original offer was to give a sum of 30,000*l.* for this purpose, and a further 6000*l.* towards the endowment. Plans of the necessary buildings were prepared, and as the Director of Public Works estimated that the cost would not be less than 58,000*l.*, Mr. Mody undertook to provide them in accordance with the plans which he had approved, no matter what the cost might be, stipulating, however, that he should use on the buildings the 6000*l.* originally given for endowment if it should be required.

A COPY of the report of the principal of the Huddersfield Technical College for the session 1908–9 has reached us. The number of students in attendance during the session amounted to 1593, an increase of 106 over the previous year. The principal directs attention to the urgent national and civic importance of an early attempt to remedy by legislation the defects in our present system of public education. He points out that, after passing through the standards in the primary schools, most of the nation's children are cast adrift upon the world untouched by any educational influence, the great majority before they reach the age of fourteen, and many thousands before they are thirteen. There are in England and Wales more than 1,500,000 boys and girls below the age of seventeen who are not in attendance at any school, whether day or evening, primary, secondary, or technical. It is to be hoped that the need for the continued educational oversight and care of this army of adolescents will be recognised by our legislators speedily. Half-time labour below the age of fourteen, he insists, must be abolished, and the school-leaving age raised to fourteen at least, while some beginning should be made in the work of providing for the continued instruction of those children who at present escape from all educational supervision on leaving the day school.

THE *Builder* for January 15 has an illustrated article on the accepted design for the City of Leeds Training College. The portion of the estate of Kirkstall Grange, Far Headingley, near Leeds, which is to be utilised measures seventy acres in extent. The major portion has been purchased from Lord Grimthorpe, and about thirty acres have been leased for seven years. The existing house, a fine example of eighteenth-century work, is very wisely to be retained in the scheme. A finer site could hardly have been obtained. The scheme of buildings comprises educational block; five hostels for women and two for men, in addition to the existing mansion, which is to be utilised as a hostel for men; baths and laundry; sanatorium; principal's and vice-principal's houses; women's and men's games pavilions, together with the requisite lodges. Sir Aston Webb, as assessor appointed by the committee, placed the design of Mr. G. W. Atkinson first. The front elevation of the educational block in this design consists of a centre and two end pavilions connected by wings; crowning the centre, where a recessed portico of the Corinthian order standing on a basement is employed, is a low dome. The whole composition has an air of Georgian refinement which accords well with Kirkstall Grange, and the scheme, when translated from paper to reality, will make the educational apparatus of Leeds Education Committee as nearly perfect as is possible in the present state of our knowledge.

THE Maharaja of Durbhanga, presiding at the end of December last at the Lahore Industrial Conference, spoke of the industrial activities of India. The *Pioneer Mail* reports him to have said that the first and foremost of all Indian industries is agriculture. Agriculture is receiving the serious attention of the Government. Agricultural colleges and Government farms planted here and there have been doing fruitful work so far as they are able, but

there are not enough of them yet to do more than touch the fringe of the subject. Scientific agriculture must begin to be taught and learned at all the primary schools in India, every pupil being practically instructed by means of gardens attached to each school. The agricultural education of the people must be put in the foreground of the endeavours of the Government and of all the educational authorities. Experiments at the Government farms have shown that with selected seed and proper treatment an acre can be made to yield, on an average, from 50 to 100 per cent. more than it does at present. To take an instance, the average output of wheat in India is only from nine to ten bushels per acre. In Great Britain it is more than thirty. To raise the average in India even to fifteen bushels is surely not beyond the reach of science. The same remarks might be made in regard to all the food crops. An attainable 50 per cent. more, when realised, would go far to banish scarcity and famine from the land.

PROF. RUDOLF TOMBO, jun., of Columbia University, contributed to *Science* of December 24 last an article dealing with university registration statistics in the United States. The returns are given for twenty-eight of the leading universities, three institutions having been added to the list this year, viz. Texas, Tulane, and Washington (St. Louis). In 1909 four universities—Iowa, Minnesota, New York, and Yale—showed a loss in enrolment compared with the previous year, as against two universities in 1908 and five in 1907. On the whole, there were considerable gains, the increase in several instances being quite marked. The greatest gains were made during the year by Columbia, Chicago, Wisconsin, California, Cornell, Ohio, and Pennsylvania, in the order named, each one of these having gained more than 300 students. Columbia was the only university to register an increase of above 400 students in 1909, whereas there were no fewer than eight in 1908. For the second time in the history of American universities the 6000 mark was exceeded, Columbia having a total enrolment in 1909 of 6132 students, Harvard having registered 6013 in 1903. Harvard continues to lead in the number of male academic students, being followed by Yale, Princeton, Michigan, Chicago, Wisconsin, Columbia, and Minnesota. A general depression occurred in the case of the engineering schools, Stanford being the only institution to exhibit a noteworthy gain. The important schools of agriculture showed an increase, the single exception being Minnesota. The article concludes with an individual examination of the statistics of the more important of the universities.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, January 20.—Sir Archibald Geikie, K.C.B., president, in the chair.—Dr. C. **Bolton**: Further observations on the pathology of gastric ulcer (progress report). In four previous papers the production and properties of gastro-toxic serum, obtained by immunising the rabbit with guinea-pig's gastric cells, were described, and it was demonstrated that the ulcers produced by the serum healed within three or four weeks if the animal were in its normal condition and fed on a normal diet. Since chronic gastric ulcer in the human subject is a common malady, and gastric ulceration is initially acute, it was considered that some unknown condition or conditions must be present which delay the healing of these ulcers. It was, however, found on experiment that so long as the stomach emptied itself in the normal time it was impossible to delay the healing of gastric ulcer by increased or diminished acidity of the gastric contents or by feeding on infected food; the position of the ulcer in the stomach did not materially affect the result. The present communication deals with the effects of interference with the motor function of the stomach upon the healing of ulcer, the food and acidity of the stomach contents being normal. The gastric ulcers were produced in the cat by the local injection of gastro-toxic serum into the stomach wall, the serum being prepared by immunising the goat with the gastric cells of the cat. Motor insufficiency of the stomach, leading to retention of its contents, which is one of the commonest forms of indigestion of food in man, was produced by constricting the pylorus of the cat by means of rubber tubing, the ulcer then being formed on the anterior wall of the stomach. It was found that in these circumstances the healing of the ulcers was delayed for at least twice the normal time. The ulcers, however, eventually healed up, but the regenerated mucous membrane was of a lower type than normal. Thus it may consist on the forty-first day of a single layer of cubical cells such as should be found on the tenth day of normal healing, or of glands formed entirely of duct epithelium. It was further found that the more sclerotic the base of the scar the more badly developed was the mucous membrane. In certain cases the *normal* healing of the ulcers was occasionally delayed by necrosis of the granulation tissue forming their bases, or by excessive formation of fibrous tissue, and in these cases the mucous membrane was of the lower type. It was therefore considered that the delay in healing in motor insufficiency was an exaggeration of the condition occasionally seen in the normal state. Both conditions are due to digestion or irritation of the base of the ulcer, leading to necrosis or increased formation of fibrous tissue, so that the regenerated mucous membrane is either unable to grow over it at all or only consists of a single layer of cells or of glands of a lower type than normal. When the base is excessively fibrous the glands have not a sufficiently vascular and cellular stroma in which to proliferate.—Dr. G. **Dreyer** and J. Sholto C. **Douglas**: The velocity of reaction in the "absorption" of specific agglutinins by bacteria, and in the "adsorption" of agglutinins, trypsin, and sulphuric acid by animal charcoal. Though a fair number of observations exist as to the influence of time on the so-called adsorption processes, *e.g.* the adsorption of a dye by a fibre (Bordet, Bayliss, &c.) proving that it takes a very considerable time before equilibrium is reached, the study of the time reaction in the taking up of agglutinins by bacteria has been confined to the observations of Eisenberg and Volk. These authors maintain that the velocity of reaction is extremely fast, and that equilibrium is reached in five minutes, even at a temperature of 0° C., and that no appreciable difference is to be found in the absorption velocity, whether the reaction takes place at 0° C. or 37° C. The present authors' results, which are contradictory to those of Eisenberg and Volk, may be summarised as follows:—(1) the establishment of equilibrium in the absorption of agglutinins by their specific bacteria is not attained, as stated by Eisenberg and Volk, in less than five minutes at 0° C., but takes a considerable time, since equilibrium is not reached at room temperature even in four hours; (2) the adsorption of agglutinin or trypsin by charcoal does not reach an equilibrium within four hours at room temperature, nor the adsorption of sulphuric acid by charcoal in twenty-four hours, or possibly even in forty-eight hours; (3) there is no justification for judging as to the nature of the interaction between an absorbing substance and a material absorbed from the rapidity or slowness with which equilibrium is attained, as has been done by Arrhenius.—Dr. G. **Dreyer** and J. Sholto C. **Douglas**: The absorption of agglutinin by bacteria, and the application of physico-chemical laws thereto. Eisenberg and Volk, in 1902, were the first to make more or less exact quantitative measurements of the absorption of agglutinins by bacteria. They showed that if agglutinating serum were treated in varying dilutions with a constant amount of homologous bacteria, the amount of agglutinin taken away was not constant, but that in a concentrated serum the absolute amount removed was greater than in a diluted serum, whilst, on the other hand, the relative amount taken away in a dilute serum was much the greater. By taking the experiments of Eisenberg and Volk, Arrhenius showed the existence of a relation between the quantity of absorbed agglutinin, C, and of the agglutinin left in the fluid, B, and expressed this relationship in the simple formula $C = kB^n$. The result of the present experiments may be summarised as follows:—(1) when an agglutinating serum in different concentrations is treated with constant amounts of bacteria, the quantity absorbed, C, may not only increase to a limit value, but may, when this point is passed, even decrease to zero when the concentration of the serum is further increased, which is quite different to

the statement of Eisenberg and Volk; (2) it is impossible, from the greater or smaller size of the exponent "n" in the formula $C=kB^n$, to determine whether, in the case of agglutinin, we have to deal with an absorption or an adsorption process, as done by Arrhenius, as in both cases "n" may vary within nearly the same ranges; (3) the formula $C=kB^n$, proposed by Arrhenius to express the absorption of agglutinin by bacteria, as being a special example of the Guldberg and Waage law of chemical mass action, does not hold good either in the case of the absorption of agglutinin by bacteria or of the neutralisation of agglutinin by homologous bacterial filtrate; (4) the combination of agglutinin and bacteria is therefore not such a simple process as anticipated by Arrhenius, but is very possibly complex, and not improbably of the same nature as the interaction of bacterial toxins and anti-toxins.—V. H. **Veley** and A. D. **Waller**: Observations on the rate of action of drugs upon muscle as a function of temperature. The authors tested the problem by observations on the rate of action on muscle of alcohol, chloroform, quinine, and aconitine, at temperatures between 7° and 25°. They used Esson's formula, modified for their purpose, for the calculation of results,

$$\log L_0 - \log L_1 = m(\log T_1 - \log T_0)$$

(where L_0 and L_1 are the lengths of time between application of the drug and cessation of contraction, and T_0 and T_1 the absolute temperatures at which the action took place; m is the experimental constant). The values of m came out as follows:—alcohol = 20·5; chloroform = 14·3; quinine = 26·7. (The values of m in the case of hydrogen peroxide and hydrogen iodide = 20·38, and in that of chloric acid and ferrous sulphate = 26·5.) The corresponding temperature-coefficients per 10° are:—alcohol = 2·02; chloroform = 1·63; quinine = 2·52. (In a previous rough determination the authors found ether = 2.) The data from which the value of m was calculated in the case of chloroform are as follows:—

Temp.	Lengths of time.	$\log T_1/T_0$	$\log L_0/L_1$	m
7° ...	24·5′ ...	0000 ...	0000 ...	
10° ...	21′ ...	0017 ...	0670 ...	14·3
19° ...	13′ ...	0182 ...	2753 ...	15·1
24° ...	10·5′ ...	0257 ...	3673 ...	14·3
24° ...	11′ ...	0257 ...	3478 ...	13·5
			Mean =	14·3

The action of aconitine is completely arrested at 7°, and manifests itself as soon as the temperature is raised to 17°.—V. H. **Veley**: An examination of the physical and physiological properties of tetrachlorethane and trichlorethylene. Symmetrical tetrachlorethane, $CHCl_2CHCl_2$, was originally prepared about forty years ago from acetylene and chlorine gas in presence of antimony chloride. It is now prepared on a large scale by the same reaction, aluminium chloride being used instead of the antimony salt. Trichlorethylene, $CHClCCl_2$, is obtained from tetrachlorethane by heating with alkalies. Certain determinations of the densities and refractive index μ_α of tetrachlorethane have been published, but those of trichlorethylene have been curiously overlooked. Values are given of densities at certain temperatures and refractive index μ_D at 17° in the paper. The effects of both substances on isolated muscle are compared with that of chloroform. It is shown that toxicities of chloroform, trichlorethylene, and tetrachlorethane are in the ratio 1/1·5/4. It is further noted that the action of trichlorethylene is more regular than that of any other drug or anæsthetic examined by this method. Preliminary experiments with living animals have shown that anæsthesia produced by this compound is also of a very regular type.—J. D. **Thomson** and Prof. A. R. **Cushny**: The action of antimony compounds in trypanosomiasis in rats.—Sir David **Bruce**, Captains A. E. **Hamerton** and H. R. **Bateman**, and Captain F. P. **Mackie**: "Amakebe" (a disease of calves in Uganda).—Sir W. **Crookes**: Scandium. This is a continuation of the paper read in April, 1908 (Phil. Trans., A, vol. ccix., pp. 15–46), in which, after describing the mode of extracting scandia from the mineral wiikite, the principal salts, twenty-three in number, were described, their formulæ and analytical results being given in detail.

In the present paper the following salts are described, their preparation, analyses, and formulæ being given:—

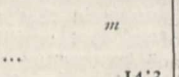
Scandium Aurochloride, $3ScCl_3,2AuCl_3,21H_2O$.

Scandium aurochloride is prepared by mixing strong solutions of the component chlorides, and allowing the mixture to evaporate slowly over sulphuric acid in a vacuum desiccator. The double salts separate out in a felt-like mass of needle-shaped crystals of a yellow colour and very deliquescent. The water of crystallisation gradually goes off when the salt is kept in a desiccator over sulphuric acid, definite hydrates being formed. In this manner the following hydrates have been formed:—

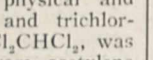
8-Hydrate Scandium Aurochloride, $3ScCl_3,2AuCl_3,8H_2O$, and the

2-Hydrate Scandium Aurochloride, $3ScCl_3,2AuCl_3,2H_2O$.

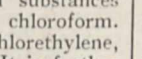
By long-continued drying at 100° all the water is driven off, and the aurochloride melts to a clear orange-coloured liquid, solidifying to a crystalline mass on cooling. After keeping the salt for several days at 100° the liquid gradually becomes solid and crystalline, and in this state it is anhydrous, and has the composition $3ScCl_3,2AuCl_3$. Scandium platinocyanide, $Sc_2[Pt(CN)_4]_3+21H_2O$, is formed by the metathesis in the cold of scandium sulphate and barium platinocyanide. It crystallises out in large monoclinic prisms on a rhombic base, the angles of which are 81° 20′ and 98° 40′. They are very soluble in water, and are insoluble, or nearly so, in absolute alcohol, and frequently group themselves in rosettes. They are dichroic, crimson by transmitted light, and a rich metallic green by reflected light. The reflected and transmitted rays are oppositely polarised. Scandium iodate, $Sc(IO_3)_3+18H_2O$, is prepared by the metathesis of a soluble scandium salt with ammonium iodate. It forms a white crystalline powder almost insoluble in water. Scandium sulphite, Sc_23SO_3, is a white insoluble powder formed by mixing a soluble scandium salt with sodium sulphide. It is anhydrous, and gradually decomposes on exposure to dry air.

Scandium Malate, 

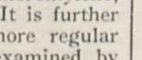
Malic acid and scandium hydroxide react when rubbed together with a little water, and the liquid becomes clear on being heated. When gradually cooled a precipitate appears, and at the ordinary temperature of the laboratory the solution is opaque and almost solid. Scandium malate is a granular white powder, soluble in hot and difficultly soluble in cold water. It is easily soluble in ammonia, and is not precipitated from the ammoniacal solution by dilute acetic or malic acid.

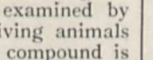
Scandium Malonate, 

Scandium hydroxide dissolves readily in a cold aqueous solution of malonic acid, and on being heated the solution deposits a semi-transparent granular precipitate, having no crystalline appearance under the microscope. This precipitate partially dissolves on cooling. If this solution is boiled for some time a dense precipitate is formed, which does not re-dissolve on cooling. According to the mode of preparation scandium malonate contains either one or two molecules of water:—

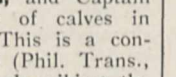
Mono-hydrated Scandium Malonate, 

and

Di-hydrated Scandium Malonate, 

Basic Scandium Malonate, 

When a large excess of scandium hydroxide is gently warmed with an insufficient amount of malonic acid to dissolve it, and the filtered solution is well boiled, a basic salt is precipitated having the above composition.

Scandium Tartrate, 

Scandium hydroxide is added to a strong solution of tartaric acid with slight warming until the greater part of the scandium hydroxide is dissolved, care being taken to keep the base in slight excess. The turbid solution is filtered and boiled. A granular precipitate comes down.

This is well washed with boiling water and dried in a desiccator over sulphuric acid. Formed in this way, scandium tartrate forms a white crystalline powder, insoluble in hot and slightly soluble in cold water, and insoluble in alcohol.

Scandium Racemate, $\left.\begin{matrix}CH(OH)COO\\ |\\ CH(OH)COO\end{matrix}\right\rangle Sc(OH),4H_2O,$

is prepared in a similar manner to the tartrate. The two salts are, however, not quite similar, as the racemate comes down less plentifully on boiling, and it is not anhydrous as is the tartrate, but contains four molecules of water, one of which is driven off at 115°.

Scandium Lævo-tartrate, $\left.\begin{matrix}CH(OH)COO\\ |\\ CH(OH)COO\end{matrix}\right\rangle Sc(OH),2H_2O,$

is prepared in a similar way to the tartrate. When dried in a desiccator over sulphuric acid it contains one molecule of water. Dried in the air it contains two molecules of water.

Scandium Meso-tartrate, $\left.\begin{matrix}CH(OH)COO\\ |\\ CH(OH)COO\end{matrix}\right\rangle Sc(OH),H_2O,$

is prepared by gently warming a slight excess of scandium hydroxide with aqueous meso-tartaric acid, and then boiling the filtered solution. The meso-tartrate comes down as a white granular precipitate. The analysis of the compounds of scandium with tartaric acid and its isomers has been complicated by the tendency to form basic salts admitting of no simple formulæ. Thus both the tartrate and lævo-tartrates occasionally form salts containing percentages of scandium ranging near to 23·5, with a deviation of two- or three-tenths of a unit one side or the other. The nearest basic salt which contains such an amount of scandium has the composition

$$5\left\{\begin{matrix}CH(OH)COO\\ |\\ CH(OH)COO\end{matrix}\right\rangle Sc\ OH + \begin{matrix}CH(OH)COO\cdot Sc:O\\ |\\ CH(OH)COO\cdot Sc:O\end{matrix}$$

and contains 23·49 per cent. of scandium.

Linnean Society, December 16, 1909.—Prof. E. B. Poulton, F.R.S., vice-president, in the chair.—Rev. T. R. R. **Stebbing**: (1) Report on the Crustacea Isopoda and Tanaidacea collected by Mr. Crossland in the Sudanese Red Sea; (2) Isopoda from the Indian Ocean and British East Africa. Among the Red Sea species the most interesting novelty is one named *Lanocira latifrons*, in allusion to the peculiar widening of the frontal process. In British East Africa, Wasin has yielded a new genus and species meriting the significant appellation *Kalliapseudes makrothrix*, which may be rendered in the vulgar tongue as the "long-haired beauty of the Apseudidæ." The species is remarkable for the extensive fringes of feathered setæ on the mandibles, maxillipeds, and first gnathopods, as well as for the short round-ended finger of its second gnathopods. In the Stanley Gardiner collection the new species *Apanthura xenocheir* is unique within its own family in the structure of the hand and finger of the first gnathopods. The new genus and species *Pontógelos aselgókeros*, of the family Eurydicidæ, from Mauritius, displays a prolongation of the first antennæ hitherto unexampled in that family. Several new species and a new genus of Epicaridea, isopods parasitic on other crustaceans, are described from specimens transmitted by Miss M. J. Rathbun, who had extracted them with great care from the crabs of the Stanley Gardiner Expedition. In one instance it proved that the maternal pouch of the parasite was occupied, not by the usual enormous mass of eggs, but by another parasite, probably itself an epicaridean, though strangely metamorphosed. The discussion of this difficult tribe was opportune for offering a tribute of respect to the memory of the late Prof. Alfred Giard, one of whose latest writings was a luminous essay on Lamarck and Darwin.—Prof. G. H. **Carpenter**: Pycnogonida from the Red Sea and Indian Ocean, collected by Mr. Cyril Crossland.—R. **Shelford**: A collection of Blattidæ preserved in amber, from Prussia.—A. W. **Waters**: The Bryozoa from collections made by Mr. C. Crossland, part ii., Cyclostomata, Ctenostomata, and Endoprocta. The collections dealt with only contain sixteen species, and these are nearly all known from the Mediterranean, while nine are British. In this and the previous paper ninety-nine Red Sea species and varieties are referred to; of these, 34 are known from the Atlantic, 26 from British seas, 39 from the Mediterranean, 34 from Indian and neighbouring seas, 17 from Crossland's Zanzibar collection, 8 from Japan, 35 from Australia. The classification of the Ctenostomata is examined, and it is considered that the group Stolonifera of Ehlers must be divided into Vesicularina and Stolonifera. In the first there is usually a moderately thick erect stem from which the zoœcia arise directly, and they all have gizzards, an organ not general in the Ctenostomata, and probably confined to this group. In the Stolonifera as now reduced there is a delicate creeping rhizome expanding at intervals, and from these places the zoœcia arise, usually in pairs. There is no gizzard. The gizzards of the Vesicularina usually have a large number of sharp and irregular teeth surrounded by a band of strong muscles, but in Cryptopolyzoon the gizzard has but two teeth with nearly flat edges.

Geological Society, January 12.—Prof. W. J. Sollas, F.R.S., president, in the chair.—C. I. **Gardiner** and Prof. S. H. **Reynolds**; with a palæontological appendix by F. R. C. **Reed**: The igneous and associated sedimentary rocks of the Glensaul district (County Galway). The general succession of the rocks of the Glensaul district is given, in descending order, in tabular form. The graptolitic beds occurring in the Mount Partry beds have yielded nineteen species, which indicate the upper part of the zone of *Didymograptus extensus*. The commonest species met with are *D. extensus*, Hall, and *D. bifidus*, Hall. In a previous description of the rocks of the Tourmakeady district, the term Shangort beds was applied to a series of grits and tuffs, and the term Tourmakeady beds to an associated series of calcareous strata which generally take the form of limestone-breccias. In the Glensaul district it is not possible to draw a sharp line of distinction between the two rock-types. The fossils from the Shangort and Tourmakeady beds show a close resemblance to those of the Tourmakeady district, but the finding of certain additional forms, especially *Nileus armadillo* and Niobe sp., has impressed the close connection between this fauna and that of the Orthoceras Limestone of Sweden, and it is rather of Arenig than of Llandeilo age. The conclusion is in conformity with the field evidence. The relegation of the Shangort and Tourmakeady beds of Glensaul to the Arenig would imply a similar age for those of the Tourmakeady district. The Glensaul district contrasts strongly with that of Tourmakeady as regards the character of the crystalline igneous rocks, which are all quartz-felsites. One species of Illænus, one of Niobe, one of Nileus, two of Bathyurus, three of Cheirurus, one of Pliomera, one of Encrinurus, one of Phacops, and a new species of Bathyurellus are described; also three species of Orthis, one of Hyolithes, one of Rafinesquina, one of Camerella, and one of Porambonites.—Prof. E. W. **Skeats**: The gneisses and altered dacites of the Dandenong district (Victoria), and their relations to the dacites and to the granodiorites of the area. The area described lies about twenty-five miles south-south-east of Melbourne. The early geological surveyors regarded the dacites as Palæozoic "traps" passing into the granodiorites. Prof. J. W. Gregory described the rocks as dacites, probably of Lower Tertiary age, resting upon the denuded surface of the granodiorites and of the adjoining Lower Palæozoic sediments. The field-relations of the rocks are described, and gneiss is shown to occur between the dacite and the granodiorite. The contact with the plutonic rock is abrupt. No foliation or banding occurs in the granodiorites, but acid veins pass from the junction into the altered dacite and also cut across the foliations of the gneiss. The field-evidence shows that the dacites are older than the granodiorites, and also that the gneiss was formed before the intrusion of the acid veins. The chemical evidence indicates that differentiation of a magma took place; the dacite was first erupted, and, following on that, the granodiorite (of more acid composition) was intruded into the dacite. In the altered dacites a schistosity occurs near the contact, ilmenite is changed to biotite by reaction with the felspar in the ground-mass, biotite is corroded by the

ground-mass, and hypersthene is altered at its margin to biotite and quartz. Finally, granules of blue tourmaline occur in the contact-rocks. In the gneiss, hypersthene is not found, ilmenite is rare, and the rock is foliated. The gneiss is probably a modification of the dacite, but evidence as to its origin is incomplete. It may be the result of extreme contact-metamorphism of a dacite of peculiar character, such as a tuff. Possibly it was produced by differential movement in the dacite before complete consolidation, and certainly before the intrusion of the granodiorite.—H. J. **Grayson**: Recent improvements in rock-section cutting apparatus. The apparatus comprises a slitting disc of mild steel and two bronze grinding laps mounted on a substantial wooden table. The discs and laps are each 10 inches in diameter, and revolve at about 900 revolutions a minute. The discs and laps are connected with endless belts, which in turn are connected with wheels driven by a 1-horse-power electric motor. Special clamps are used to attach the rock-specimen and to cut the slice. A goniometric crystal-holder, permitting of slicing in any desired direction, is described, and can be fitted to one of the clamps. Clamps swinging radially across the grinding laps permit the parallel grinding of the slice to any thinness. A polishing lap can be placed in the position of one of the grinding laps. The finishing of the slice is done by hand on a slate disc.

Zoological Society, January 18.—Prof. J. Rose Bradford, F.R.S., vice-president, in the chair.—S. A. **Neave**: Collections of butterflies made during four years spent in northern Rhodesia and adjacent territories. The collection comprised 450 species, of which thirty were new to science, besides several rare and little-known species, including the rare *Acraea mirifica*, Lathy, and the hitherto unknown female.—J. T. **Cunningham**: Marine fishes and invertebrates of St. Helena. The scientific results of a visit to the island in February and March, 1909, for the purpose of investigating the condition and prospects of the fisheries of the island. The author's report on the results of the investigation from the economic point of view has been presented to the Colonial Office. The invertebrates collected have been examined and identified by specialists of the Natural History Museum, namely, Dr. Calman, Mr. Edgar Smith, Prof. Jeffrey Bell, and Mr. Kirkpatrick, the last-named having described a new species of sponge and a new hydroid. The fishes have been worked out by the author himself, and include two new species, one belonging to the Stromateidæ and one to the Cyphosidæ. The three kinds of Albacore occurring at St. Helena are shown to be identical with the three species diagnosed at Madeira by the Rev. R. T. Lowe in 1839, namely, *Thynnus alalonga*, *T. albacora*, and *T. obesus*, species which have been confused or rejected by recent ichthyologists; the synonymy and distribution of these are for the first time correctly elucidated.—Dr. W. T. **Calman**: Second and concluding part of a report on new or rare Crustacea of the order Cumacea, from the collection of the Copenhagen Museum. This portion of the report deals with the families Nannastacidæ and Diastylidæ, and twenty-seven species are described, all of which are regarded as new, and three new genera are established.—Prof. W. M. **Smallwood**: Hydroids and nudibranchs of Bermuda.

Institute of Metals, January 19.—Sir Gerard A. Muntz, Bart., president, in the chair.—O. F. **Hudson** and E. F. **Law**: A contribution to the study of phosphor-bronze. This paper was intended to amplify the conclusions arrived at by A. Philip, who presented a contribution on phosphor-bronze to the Institute of Metals at the Birmingham meeting of the institute in 1908. The authors endeavoured to indicate the relation between the mechanical and other properties of the copper-tin-phosphorus alloys and their constitution and structure. A useful diagram was included in the paper showing the constitution of all the alloys containing up to 25 per cent. of tin. The paper included notes on the examination and analysis of the phosphor-bronzes, and was illustrated by a remarkably clear and numerous collection of photomicrographs illustrating the structure of the alloys. Many of these photographs were originally of 1000 diameters, and these were further enlarged by being projected on a screen from lantern-slides made from autochrome plates, the marvellous blue-green and red colourings of the various constituents thereby being brought before the notice of the audience in a very novel and effective manner.—T. Vaughan **Hughes**: The failure in practice of non-ferrous metals and alloys, with particular reference to brass loco-tubes. This was essentially a practical, as distinct from an academic, paper, and dealt especially with an investigation into the cause of a breakdown of brass loco-tubes which had led to serious casualties and a Government inquiry. The failure was found to be due to the formation of a "scale," only 0·05 mm. thick, which offered a resistance of 20 megohms to an E.M.F. of 250 volts when dry and 150,000 ohms when wet. This electrical measurement showed the heat conductivity of the scale, and explained the over-heating of the tube at the point where the breakdown had occurred.—C. O. **Bannister**: The use of carbonaceous filters in the smelting of zinc. The paper was a corollary of that entitled "Notes on the Production of Pure Spelter," by J. S. G. Primrose, read at the Manchester meeting of the institute in October, 1909. Mr. Bannister described particularly the filters used in the Hopkins fumeless zinc process. The process was stated to have begun with the object of producing lead-free zinc only, but it now embraced three objects—the manufacture of pure spelter, the prevention or reduction of zinc fume, and the obtaining of higher yields.

Royal Meteorological Society, January 19.—H. **Mellish**: Presidential address, on some relations of meteorology with agriculture. The close dependence of agriculture upon climate and upon the periodical variations of the weather has been recognised from the earliest times, but the relations are of such a complicated character, and the difficulty of separating the effects of the different factors is so considerable, that as much progress as might have been expected has perhaps not been made in applying the data of meteorology to the purposes of agriculture. The president first referred to the writings of various authors on the subject of temperature and rainfall, as affecting the wheat and other crops, and then proceeded to deal with such questions as the liability of some crops, and especially of fruit, to injury from frosts; the influence exercised by forests upon climate, and especially upon rainfall; and the study of phenology. He next considered what steps meteorologists could take to further the application of the data of their science to the various problems of agriculture. It is doubtful whether farmers make as much use of the forecasts and weather reports as they might. Possibly this may arise because they are not familiar with the technical terms in which the reports are necessarily couched. This might be remedied in the course of time if instruction on the subject could be worked into the courses at the agricultural schools and colleges. The Royal Meteorological Society has lost no opportunity of urging the importance of the subject to farmers, and also the inclusion of meteorology under the head of nature-study in the schools, and there are reasons to think that this is having some effect.

MANCHESTER.

Literary and Philosophical Society, December 14, 1909.—Mr. Francis Jones, president, in the chair.—Dr. S. **Russ**: A note on radio-active recoil. When radium emanation is condensed at the bottom of a glass tube from which the air has been removed, active deposit particles are radiated up the tube. This phenomenon has been attributed to the recoil of the atom when an α particle is ejected from it. A disc suspended above the emanation may be the recipient of the active deposit particles. An analysis has been made of the decay curves exhibited by such a disc when exposed for different times. The conclusions arrived at are that the numbers of Radium A and radium B particles projected from the emanation are about equal, and that in comparison with them the quantity of radium C projected is insignificant. This latter result has recently been shown experimentally by Dr. Makower and the author.—D. M. S. **Watson**: A preliminary account of the bibliography of the post-Triassic Sauropterygia.

January 11.—Mr. Francis Jones, president, in the chair. —Prof. F. E. **Weiss**: Variability in the flowers of Tropæolum hybrids. A year ago a Tropæolum was observed by Prof. Weiss which showed at the same period three types of flowers, some yellow, some yellow with red markings, and some completely claret coloured. There seemed no marked periodicity in the occurrence of these flowers in 1908, though sometimes the yellow and sometimes the parti-coloured flowers predominated; but in an offspring of this plant it was noticeable that the parti-coloured and red flowers occurred only during the fine, hot weather in the second week in August, while during the cold and wet periods of July, September, and October all the flowers were yellow. This indicated a determining influence of temperature and light, and it is borne out by experiments in self-fertilising the variously coloured flowers. In the second (f_2) generation a variety of different plants arose by segregation, and the colour of the parental flower had no determining effect, yellow flowers yielding red offspring and *vice versa*. Incidentally, the segregation of characters in the second (f_2) generation showed that in Tropæola, dwarfness is recessive to tallness, as is the case in sweet-peas, and that red sap is a dominant character, though sometimes not apparent owing to unpropitious external conditions. This potential redness is, of course, different from the latent condition of a recessive character, which cannot be called into evidence by external conditions.

DUBLIN.

Royal Irish Academy, January 10.—Dr. F. A. Tarleton, president, in the chair.—Sir Robert S. **Ball**: Contributions to the theory of screws, viz.:—(1) on the expression for the virtual coefficient of two vector-screws; (2) on the composition of twists or wrenches on vector-screws; (3) on the pitch operator,

$$\Delta=\frac{d}{dp_1}+\frac{d}{dp_2}+\ \ldots\ +\frac{d}{dp_n}.$$

(4) applications of quaternions to the theory of screws; (5) use of quaternions in the theory of reflected screws; (6) quaternion investigation of the screw reciprocal to five given screws; (7) representation of screw systems of the third order by linear vector functions. The virtual coefficient of two screws α and β is

$$\tfrac{1}{2}\{(p_\alpha+p_\beta)\cos\theta-d\sin\theta\},$$

where p_α p_β are the pitches of the two screws, and d is the length of their common perpendicular. It is here explained how θ can be measured without any ambiguity when α and β are regarded as *vector-screws*. The pitch operator Δ can be applied to any general formula connecting n screws belonging to an $(n-1)$ system, and by successive application a group of new formulæ can sometimes be derived. The application of quaternions to the theory of screws is founded on Hamilton's theorem as developed by Joly, that if μ be a vector moment and λ a vector force, then $S\mu/\lambda$ is the pitch of the screw on which the wrench lies, and $V\mu/\lambda$ is the vector perpendicular from the origin on the screw. One of the most fundamental theorems in the theory of screws asserts the existence of one screw and, in general, only one screw reciprocal to five given screws. The expression is here given of the vector coordinates of the screw reciprocal to the five screws

$$(\mu_1, \lambda_1);\ (\mu_2, \lambda_2);\ (\mu_3, \lambda_3);\ (\mu_4, \lambda_4);\ (\mu_5, \lambda_5).$$

This is, as might be expected, a symmetrical form with regard to the five screws, and leads, among many other results, to a concise expression for the sexiant which when equated to zero gives the condition that six screws shall belong to a five-system. Joly showed that Hamilton's beautiful theory of linear vector functions receives its geometrical representation by the system of screws of the third order. The fundamental properties of linear vector functions can be explained as immediate consequences of the theory of screws.

PARIS.

Academy of Sciences, January 17.—M. Émile Picard in the chair.—E. **Bouty**: The electric cohesion of neon. Although the molecular weight of neon is intermediate between argon, the molecular weights, and helium, its dielectric cohesion is much lower than that of the latter. The dielectric cohesion of neon is lower than that of any known gas; from the point of view of the obstacle opposed to the electric discharge, 57 cm. of neon are equivalent to a layer of 1 cm. of air.—W. **Kilian**: A new example of phenomena of convergence in ammonites: the origins of the group *Ammonites bicurvatus*.—A. **de Gramont**: The distribution of the ultimate lines in stellar spectra.—A. **Demoulin**: The K systems and congruences.—M. **Cisotti**: An application of the method of Jacobi.—Ludovic **Zoretti**: Ensembles of points.—L. **Décombe**: The elimination of directing electric couples, and effects due to asymmetry, to the absence of regulation and to contact electromotive forces in quadrant electrometers.—Edmond **Bauer** and Marcel **Moulin**: The constant in Stefan's law and the radiation of platinum. In a recent paper the authors described a method of determining the constant σ in Stefan's equation $E=\sigma T^4$ by the comparison of the radiation of a black body at 1064° C. with the radiation of a platinum sheet, known, in absolute measure, by experiments in a vacuum. It was assumed that the radiation of platinum followed Lambert's law up to large angles of emission; the latter assumption has now been proved by experiment to be inaccurate, and the introduction of the resulting correction reduces the original value of σ from $6{\cdot}0\times10^{-12}$ to $5{\cdot}3\times10^{-12}$, a figure in good agreement with the $5{\cdot}32\times10^{-12}$ of Kurlbaum.—A. **Colson**: The difficulties of chemical bibliography. A reply to some criticisms of M. Baubigny.—E. **Kohn-Abrest**: The action of heat upon aluminium in a vacuum. Aluminium is volatilised appreciably at 1100° C. in a vacuum, setting free silicon from the walls of the tube if the latter contains a silicate.—G. **Charpy** and S. **Bonnerot**: The cementation of iron by solid carbon. In these experiments both the iron and the carbon were submitted separately to a prolonged heating in a vacuum until no trace of gas was given off. The iron and carbon were then heated in contact at 1000° C., in a high vacuum, for several hours. No trace of carbon was absorbed by the metal under these conditions, although cementation was produced if traces of air were present.—Pierre **Camboulines**: The action of the vapours of carbon tetrachloride on anhydrides and oxides. The action of carbon tetrachloride vapour upon thirty-three oxides was studied. Silica and boric anhydride were not attacked; in the other cases a reaction took place at temperatures between 215° C. (niobic anhydride) and 580° C. (chromium oxide), the pure chloride of the metal being formed, excepting with niobic anhydride, thorium, and uranium oxides. With these a mixture of chloride and oxychloride was formed. This reaction furnishes a good general method for the preparation of anhydrous metallic chlorides.—R. **Fosse**: The transformation of some aromatic alcohols into phosphinic acids by hypophosphorous acid.—Gabriel **Bertrand** and G. **Weisweiller**: Vicianose, a new reducing C_{11} sugar. By the action of a diastatic preparation extracted from *Vicia angustifolia* upon the cyanhydric glucoside vicianine described in a previous paper, a new reducing sugar has been isolated. It has the composition $C_{11}H_{20}O_{10}$, and is the first definite biose prepared by the diastatic hydrolysis of a glucoside.—Marcel **Guerbet**: The condensation of secondary butyl alcohol with its sodium derivative; 3-methyl-5-heptanol and an alcohol, $C_{12}H_{26}O$, result from this condensation.—A. **Verneuil**: The synthetic reproduction of the sapphire by the method of fusion. Blue sapphires, possessing the colour and optical properties of the natural stone, have been prepared by heating alumina containing 1·5 per cent. of magnetic oxide of iron and 0·5 per cent. of titanic acid in the oxyhydrogen blowpipe.—A. **Conte**: Anomalies and spontaneous variations in the domestic birds.—Louis **Masson**: The tolerance of bacteria to antiseptics. Three species, *B. pyocyaneus*, *B. subtilis*, and *B. anthracis*, were grown in cultures containing small amounts of antiseptics (resorcinol, salicylic acid, copper sulphate, and mercuric chloride), and the

proportion of the antiseptic was increased in successive cultures. The bacteria adapted themselves to increasing amounts of the poison, and attained a maximum resisting power, followed by a rapid fall, losing the whole of the acquired resistance. The tolerance was thus shown to be a temporary phenomenon, an example of the resistance of the species to variation.

CALCUTTA.

Asiatic Society of Bengal, January 5.—Hem Chandra **Das-Gupta**: A probable identity between *Clypeaster complanatus*, Duncan and Sladen, and *C. duncanensis*, Noetling. The author gives reasons for thinking that *C. duncanensis*, Noetl., was founded on large specimens of *C. complanatus*, Duncan and Sladen.—I. H. **Burkill**: Fashion in iron styles. A paper to show that the iron styles used in India for writing on palm leaves are of different types in different parts of the country. The iron styles of the extreme south-west are heavy; those of the centre of the Coromandel coast are peculiarly long and generally light; those of Orissa are quite characteristic; the type which is like a clasp-knife is confined to the south. The paper is a supplement to the account of Indian pens published recently in the Agricultural Ledger, No. 6, of 1908–9.

DIARY OF SOCIETIES.

THURSDAY, JANUARY 27.

ROYAL SOCIETY, at 4.30.—Long Period Determination of the Rate of Production of Helium from Radium: Sir James Dewar, F.R.S.—Note on Carbon Mono-sulphide: Sir James Dewar, F.R.S., and Dr. H. O. Jones.—On the Extinction of Colour by Reduction of Luminosity: Sir William de W. Abney, K.C.B., F.R.S.—The Initial Accelerated Motion of Electrified Systems of Finite Extent, and the Reaction produced by the Resulting Radiation: G. W. Walker.—On the Nature of the Magnetokathodic Rays: H. Thirkill.—On the Velocity of Steady Fall of Spherical Particles through a Fluid Medium: E. Cunningham.—The Photo-chemical Formation of Formaldehyde in Green Plants:—Dr. S. B. Schryver.

ROYAL INSTITUTION, at 3.—Assyriology: Rev. C. H. W. Johns.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Equitable Charges for Tramway Supply: H. E. Yerbury.

FRIDAY, JANUARY 28.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Some Uses of Mechanical Power in Engineering Construction: H. F. Donaldson.

SATURDAY, JANUARY 29.

ESSEX FIELD CLUB (at Essex Museum of Natural History, Stratford), at 6.—Trawl Fishing in the North Sea: S. H. Goodchild.

MONDAY, JANUARY 31.

ROYAL SOCIETY OF ARTS, at 8.—Textile Ornamentation: Alan S. Cole, C.B.

INSTITUTE OF ACTUARIES, at 5.—Some Points of Interest in the Operations of Friendly Societies, Railway Benefit Societies, and Collecting Societies: A. W. Watson.

TUESDAY, FEBRUARY 1.

ROYAL INSTITUTION, at 3.—The Cultivation of the Sea: Prof. W. A. Herdman, F.R.S.

ROYAL SOCIETY OF ARTS, at 4.30.—Imperial Colonial Development: C. Reginald Enock.

ZOOLOGICAL SOCIETY, at 8.30.—On a Collection of Freshwater Crustacea from the Transvaal: Hon. Paul A. Methuen.—(1) Littoral Marine Fauna: Kerimba Archipelago, Portuguese East Africa, collected by J. J. Simpson. Sept., 1907, to May, 1908. Holothurioidea; (2) Marine Fauna: Mergui Archipelago, Lower Burma, collected by J. J. Simpson and R. N. Rudmose-Brown. Holothurioidea: Dr. Joseph Pearson.—A Revision of the British Species of Ostracoda belonging to the Subfamilies Candoninæ and Herpetocyphridinæ: Dr. G. Stewardson Brady.

INSTITUTION OF CIVIL ENGINEERS, at 8.—*Further discussion*: The Reconstruction of the Tyne North Pier: I. C. Barling.—*Probable Papers*: Notes on the Sheffield Water-supply and Statistics relating thereto: L. S. M. Marsh.—Statistical and Experimental Data on Filtration: W. R. Baldwin-Wiseman.

WEDNESDAY, FEBRUARY 2.

ROYAL SOCIETY OF ARTS, at 8.—An Improved Method of Electro-plating: A. Rosenberg.

SOCIETY OF PUBLIC ANALYSTS, at 8.—Annual Meeting, Presidents' Address.—The Composition and Analysis of Tea: R. R. Tatlock and R. T. Thomson.—The Examination of Turpentine Substitutes, and the Determination in Turpentine of Hydro-carbons other than Terpenes: J. H. Coste.—The Determination of the Acid Radical, and its Relation to the Constitution of Commercial Bismuth Subnitrate: J. Bristowe P. Harrison.—On Sheep Dips: J. S. Remington.

ENTOMOLOGICAL SOCIETY, at 8.—A Revision of the Labiduridæ, a Family of the Dermaptera: Dr. Malcolm Burr.

THURSDAY FEBRUARY 3.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: On the Relative Sizes of the Organs of Rats and Mice bearing Malignant New Growths: Dr. F. Medigreceanu.—The Thyroid and Parathyroid Glands throughout Vertebrates: F. D. Thompson.—The Transmission of *Trypanosoma lewisi* by the Rat-flea (*Ceratophyllus fasciatus*): Prof. E. A. Minchin and J. D. Thomson.—Further Evidence of the Homogeneity of the Resistance to the Implantation of Malignant New Growths: Dr. E. F. Bashford and Dr. B. R. G. Russell; The Contrast in the Reaction to the Implantation of Cancer after the Inoculation of Living and Mechanically Disintegrated Cells: Dr. M. Haaland.

RÖNTGEN SOCIETY, at 8.15.—The Essential Ambiguity of X-ray Representation, and some Methods of Solution: Dr. W. Cotton.

LINNEAN SOCIETY, at 8.—Further Discussion of the Origin of Vertebrates: Dr. A. Smith Woodward, F.R.S., Prof. A. Dendy, F.R.S., and other speakers, with Dr. Gaskell's reply.

FRIDAY, FEBRUARY 4.

ROYAL INSTITUTION, at 9.—The Heredity of Sex: Prof. W. Bateson, F.R.S.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Construction and Setting-out of a Low-level Sewer: L. T. Wilson.

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