THURSDAY, NOVEMBER 14, 1907.

A NEW HANDBOOK OF INORGANIC CHEMISTRY.

Handbuch der anorganischen Chemie. Herausgegeben von Dr. R. Abegg. Band ii., Abt. ii. Pp. ix+700. Price 24 marks. Band iii., Abt. i. Pp. x+466. Price 17 marks. Abt. iii. Pp. xiv+876. Price 24 marks. (Leipzig: R. Hirzel, 1905-7.)

A HEARTY welcome may be extended to this valuable work of reference, which does for inorganic chemistry much more than Beilstein's famous handbook has done for organic chemistry. It is no mere guide to the recognition and characterisation of the compounds with which it deals. Its aim is beyond this, and its scope is more general. In a word, the editor endeavours to make use of the vast accumulation of physico-chemical data of the past twenty years, and to incorporate them in the descriptive portion of the work, exercising a critical selection of the material employed and giving at the same time due consideration to theoretical connections and outstanding problems. The periodic system has been adopted as the basis of classification, and the portions of the work already issued deal with the elements of the second, third, and fifth periodic groups respectively. Here it may not be out of place to protest against an aggravating instance of the Teutonic passion for subdivision. The work is to be issued in eight separately paged and indexed volumes, dealing with the eight periodic groups, together with a ninth volume of a general character. One might, therefore, reasonably expect that the numbers of the volumes would correspond to the group numbers of the elements described. Instead of this, we find the elements of the fifth group described in vol. iii., section iii., those of the fourth group presumably in vol. iii., section ii., and so on. Whether the elements of group 6 will be found in vol. iii., section iv., or in vol. iv., section i., remains for the present a subject of agreeable speculation.

Prof. Abegg, in carrying out his scheme, has secured the collaboration of many eminent workers in the domains of inorganic and physical chemistry. Amongst those who contribute to the volumes before us we may mention Marckwald (radium), R. J. Meyer (rare earths), Schenck (phosphorus subgroup), Brauner (atomic weights), and Rohland (technological subjects, *e.g.* mortar, ultramarine).

The account of the metals of the rare earths and their compounds deserves special mention. The subject is introduced by a general section of nearly fifty pages, in which we are presented with a historical survey, an account of the mode of occurrence and general chemical characteristics of the group, an outline of the methods of extraction and separation of the earths, and a discussion of the valency and atomic weights of the elements. Then follows in detail the subgroup of the cerite earths, with a special account of the separation and purification of lanthanum, praseodymium, neodymium, and samarium. The second subgroup is that of the terbium elements, and the third deals with those of the erbium and yttrium families.

Another noteworthy feature of the work is the treatment of the atomic weights of all the elements by the same hand. Prof. Brauner has accomplished his task admirably. He takes Clarke's "Recalculation of the Atomic Weights" as the source of data up to 1896, and thereafter refers to the original papers, using the reports of the International Commission as a guide. Little is said of the older and less exact determinations, but the more modern work is given in considerable detail, and critically discussed in its relationship, not only to the atomic weight of the element directly concerned, but to that of other elements which may be involved in the actual experiments. To give an idea of the scale on which Prof. Brauner has written, it may be stated that the atomic weight of beryllium occupies five and a half pages, and that of nitrogen no less than thirty-two pages. The author freely criticises the tables of the International Commission in the course of his articles, pointing out, for example, that if N=14·01 is correct, which he believes to be the case, then Ag cannot be 107·93 as given in the international table, but must lie between 107·88 and 107·89.

Prof. Abegg's "Handbuch" is admirably printed and got up, and must in future form an indispensable item in every properly equipped chemical library.

ITALIAN BIRDS AND NEOGENESIS.

Avifauna Italica. By Enrico Hillyer Giglioli. Secondo resoconto. Pp. xxiv+784. (Firenze: Coi. Tipi dello Stab. Tipografico s. Giuseppe, 1907.)

ITALIAN ornithologists in particular, and students of palæarctic birds in general, will be grateful to Prof. Giglioli for this revised edition of his most valuable work. Herein he now recognises 496 species as entitled to the rank of Italian birds; but this includes species which have only once been obtained within this area, and at least two which many ornithologists will refuse to regard as species at all.

These two exceptions are of more than passing interest, inasmuch as Prof. Giglioli contends that they furnish good examples of "neogenesis": of the birth of new species *per saltum*.

The first of these two cases is that of a redstart obtained by Prof. Giglioli from Sardinia. On data which can only be described as unsatisfactory, the author elects to create a new species—*Ruticilla nigra*—though most of us, on the same evidence, would agree that the examples on which this new species was based were but melanistic specimens of *Ruticilla titys*, the common black redstart. This view he rejects, contending that his own hypothesis is the more reasonable.

Far more importance is to be attached to the second case, which Prof. Giglioli describes at some length, not only in the pages of this work, but also in the

Ibis, 1903. Briefly, this concerns an owl which the author then described as a new species—*Athene chiaradia*; in the volume now before us it is accorded still the rank of a species. Though it is scarcely to be expected that ornithologists will recognise this bird as entitled to specific rank, the history which Prof. Giglioli gives of its discovery will never lose its interest.

Within the space at our disposal, it would be impossible to tell the whole story of this most remarkable case. Suffice it to say that the bird upon which Prof. Giglioli founded his new species was a nestling taken from a nest at Pizzocco, in the province of Udine. Though obviously nearly related to the little owl (*Athene noctua*), it differed therefrom, among other things, in having a dark brown instead of a golden-yellow iris—a rather remarkable fact. Naturally, the author at once instituted a search for further examples from this neighbourhood, and two years later this search was rewarded by the discovery of a nest—in close proximity to that from which the original specimen was obtained—containing four nestlings. One of these, be it noted, was a typical *Athene chiaradiae*, while the remaining nestlings were as typically examples of the little owl (*Athene noctua*)! Two other nests containing both dark and yellow-eyed young were later found, and finally a nest with both types of young, together with the parents, was taken. Though these parents were undoubtedly "little owls," they were both somewhat abnormal specimens, both in the matter of size and coloration.

It is to be deplored that no attempt whatever was made to induce any of these birds to breed in confinement; or that the parents were not allowed their freedom in the hope that they might at least go on perpetuating these strange aberrations. Instead, every single bird was killed to furnish specimens for the natural history museum at Florence. Thereby some extremely valuable facts were lost to science for ever! Had Prof. Giglioli endeavoured to breed these birds in confinement, he might have succeeded in establishing his hypothesis of "neogenesis." As it is, both this and the two new species which he founds thereon must be put back to await further evidence.

Though in some matters we may not agree with Prof. Giglioli, we have said enough, perhaps, to show that his book is by no means a dull catalogue of the birds of Italy. W. P. P.

PHYSIOLOGY OF ALIMENTATION.

The Physiology of Alimentation. By Prof. Martin H. Fischer. Pp. viii+348. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1907.) Price 8*s*. 6*d*. net.

THIS is a small but comprehensive account of modern physiological ideas concerning the important subjects of digestion and absorption. The work of physiologists on these questions has of recent years been both laborious and fruitful. Pawlow has devised new methods of examining the secretions and the course of their action on the food-stuffs. The epoch-making work of Emil Fischer has thrown new light on their composition, especially in the case of the proteins. The doctrine that enzymes are catalytic agents has taken firm root. The importance of the chemical stimuli to secretion (secretin and other hormones) has been demonstrated by Starling and Bayliss. The sequence of events in the journey along the alimentary tube has been accurately followed by Cannon's shadow photographs. All these points, and many others, are clearly treated by Prof. Martin Fischer in the very useful little book he has published.

The introduction of new names for the enzymes so long familiar as pepsin, trypsin, rennet, and the like, will, it is to be feared, introduce confusion to the student's mind, although the new nomenclature aims at uniformity. It is interesting, no doubt, to see the actual shadow photographs which Cannon took, but they do not lend themselves well to reproduction, and more diagrammatic pictures would have been instructive.

In a few cases the information given is not up-to-date, or is open to question. For instance, Pawlow's results on the stimulation of the nerves of the pancreas require revision in the light of the discovery of secretin. These results are given in full, and a few pages later Starling's discovery of the pancreatic hormone is described, but no attempt is made to correlate the two, nor is any guidance given to the reader in estimating their relative value.

Again, Weinland's ideas on the "adaptation" of the pancreas are quoted with apparent approval, and the confirmation of his views is wrongly attributed to Vernon. No mention, however, is made of the important work of Plimmer, who has conclusively shown that Weinland's results rest on imperfect methods, and that in the cases investigated no adaptation is discoverable.

The distinction between casein and caseinogen is mentioned, but the former is stated to be produced from the latter by the addition of acid, as well as by the action of caseinase or rennet. This view is justifiable if, as some have recently asserted, the difference between the two proteins is one of state of aggregation only, and not a true chemical difference. But before adopting such a view it is necessary to dispose of all the work which tends in the opposite direction, and to explain how it is the two substances differ in elementary composition.

Prof. Fischer assigns the place of protein synthesis in the body mainly to the absorptive epithelium of the intestine, and quotes Abderhalden as holding the same view. No mention, however, is made of the work of others (*e.g.* Leathes, Howell, and Schryver), which appears to prove that there is no such special seat of synthesis in the wall of the alimentary tract. There are just a few points where adverse criticism appears to be necessary; there always will be differences of opinion between those who interpret the facts of life. Taken as a whole, the book is not only lucid, but correct and instructive.

W. D. H.

SCHOOL ARITHMETIC.

(1) *Arithmetic for Schools.* By the Rev. J. B. Lock. New edition, revised and enlarged with the assistance of V. M. Turnbull. Pp. vii+480. (London: Macmillan and Co., Ltd., 1907.) Price 4*s.* 6*d.*

(2) *Arithmetic, chiefly Examples.* By G. W. Palmer. Pp. x+339+xlii. (London: Macmillan and Co., Ltd., 1907.) Price 3*s.* 6*d.*

(3) *A Modern Arithmetic, with Graphic and Practical Exercises.* By H. Sydney Jones. Part i. Pp. xii+361. (London: Macmillan and Co., Ltd., 1907.) Price 3*s.*

WE are generally accustomed to consider that the teaching of arithmetic has gained its prominent place in all modern educational systems for two reasons, viz., on account of (1) its utilitarian value, and (2) its culture value. The writer of a general text-book on arithmetic, as well as the teacher of arithmetic, should have both these ideas prominently before him, and so far as either of them fails to consider the subject from these two points of view, so far does he fail in its presentation. A little consideration shows that at different points in the study of the subject the relative importance of the two reasons for teaching it varies considerably; but generally, its utility must give way to the culture training.

Until within the last twenty years the tendency of all works on arithmetic was to build up a system which paid no attention to either reason, but treated the subject more as a series of detached methods—the more mechanical the better—of solving problems set by the author, by the teacher, or by the examiner. We had, in fact, a period which reminds us of the paid problem-solvers of the fifteenth century. Since then we have had two parallel movements of reform in arithmetical teaching. The first was chiefly confined to the public elementary schools, where the culture value was considered as the only value. Arithmetic was to be treated as a "series of problems," and inspectors, examiners and teachers went problem-mad. The other movement was found at its height in the evening continuation schools and in the technical schools. In that case, all teaching of arithmetic was considered of importance as it bore on the daily life of the pupils. Fortunately, we now see signs of a combination of these two movements, and provided their relative importance is correctly gauged, the results from the teaching of arithmetic will show a corresponding improvement.

It is interesting to note that each of the three books under review claims to have treated the subject from both points of view, and they all show traces of the two movements referred to above. At the same time they all reveal and will help to promote a weakness in the teaching of arithmetic in the preparatory schools and in the secondary schools. In the public elementary schools of the country the arithmetical education of the pupils until about the age of seven consists of a thorough knowledge of the numbers 1 to 10. This includes the complete analysis and synthesis of each number. Succeeding years are taken up with the extension of these principles to 20, and to 100, and this is followed by the four rules. Such work is also taken up in certain preparatory schools. These books seem to be intended for secondary schools, *i.e.* for pupils from the age of 12 and upwards, and yet they take up the four simple rules. The only satisfactory reason for doing so would be a more rigid and scientific treatment of the subject, with full details as to the development of the processes used. None of the books can be considered satisfactory in this respect, though both Mr. Jones's and Messrs. Lock and Turnbull's books show an advance on previous text-books. It would seem, therefore, that the authors, while recognising that pupils of twelve ought to be ready to take up a more scientific study of arithmetic, are not prepared to look for that improvement in the earlier work which would permit of this step being taken.

All three books show signs of the former school of arithmetic. This is specially seen in the multiplication of money. There is no justification for the retention of the old method of tens which is simply a disguised form of practice. The objection to the direct method usually is that the working has to be roughly done with no definite place in the setting down. That can be easily overcome by setting down the working of each unit directly below that unit. The direct method corresponds closely to the method always used in division. Again, in multiplication and division by decimals, we find one of the many mechanical rules given in each book. These should only be necessary in the case of beginners, and a pupil who thoroughly understands "place values" should not require any of these mechanical aids.

(1) Mr. Lock's arithmetic has now reached its fifth edition, and we can congratulate the author on the improvement of that edition. The omissions from and re-arrangement of the text are all for the benefit of the teaching of elementary mathematics. There are still some traces of the older methods to be found. On p. 67 the old extended method of finding the H.C.F. is given, and alongside is a contracted method (the quotients are not necessary) with the remark, "The work is best arranged thus." On the succeeding page, however, the authors give the working of two examples in the old style. On pp. 96 and 97 we find a series of examples of continued and complex fractions which we hope the authors will remove from the next edition The importance given to vulgar fractions generally takes away from the value of the book as a modern text-book of arithmetic.

(2) Mr. Palmer's book is an example of a type of text-book which has become common during the last few years.

"It is chiefly made up of examples. The explanatory matter consists almost entirely of worked-out examples, except in certain parts of the book where explanation seemed necessary in consequence of some departure having been made from the ordinary method of treatment."

There is no doubt that such a book is the best that one can put in the hands of pupils, but it requires a teacher who is an expert in his subject. We can

therefore recommend Mr. Palmer's book with confidence to those teachers who take a special interest in and make a special study of the teaching of arithmetic. They will probably find rules and methods which they do not approve of, but these can be neglected without any loss. The method of dealing with the multiplication of decimals is open to the objection that without any gain a much more difficult method than the direct one is given. The author makes use of rough approximations before and rough checks after working out an example. These are very good, and should be used in all working, but they should not be made the means of finding the decimal point in approximations. The placing of the point should give no difficulty if a logical method has been adopted throughout the study of decimals.

(3) Mr. Jones's book is a laudable attempt to remove the study of arithmetic from its commercial trammels and widen its scope. We are afraid that, in the attempt, he has overburdened his book. Practical work is introduced at all stages of the work, and the numerous explanatory diagrams will be a useful addition to the teaching of the subject. There are one or two things which strike us as being out of place in a book which is intended for a general course in arithmetic. Thus the tables of weights and measures include some units which are not in general use. The introduction of these tends to specialise the work, a thing which Mr. Jones claims, in his preface, that he desires to avoid. We are sorry to see in an arithmetic of this type the instruction to "move the point." It is always difficult for a teacher to keep before young pupils the reason for the step, and he is not aided when the text-book adopts the mechanical method. Mr. Jones has added an index, an example that ought to be followed by all writers of school text-books.

F. L. G.

OUR BOOK SHELF.

Die typischen Geometrien und das Unendliche. By B. Petronievics. Pp. viii+88. (Heidelberg: C. Winter, 1907.) Price 3 marks.

THE author of this curious work asserts (p. 86) that it is impossible to make a one-one correspondence between the points of a linear segment and the elements of the arithmetical continuum (0, 1); in other words, he not only declines to accept the Dedekind-Cantor axiom, but asserts that it is illogical. His attempted proof (p. 85) involves the assumption of actual infinitesimal segments; thus he says "so entspricht dem ersten Punkte, der sich mit dem o-Punkte berührt, gar keine Zahl in der Zahlmenge o . . . 1, da das entsprechende Segment unendlich klein ist, und dasselbe wird auch für den zweiten, dritten usw. Punkt gelten."

This idea of immediately adjacent yet different points pervades the whole tract, and leads to wonderful paradoxes; an attempt is made to remove the most obvious difficulties by a distinction between real and unreal points (pp. 9, 10), but this is not satisfactory. There is a continual confusion between the idea of space consisting of points and that of points forming "parts" of space. You cannot eat your cake and then look at it; if in one context "point" means something with extension, it should not be treated elsewhere as having position only. Moreover, no intuition, logic, or metaphysic can get a geometrical thing having extension from two points devoid of it.

Unless something better than this can be said for it, the assumption of actual infinitesimals of different orders in geometry is not likely to be accepted, and the Dedekind-Cantor axiom will probably be retained as the simplest way of connecting geometry with analysis. From the metaphysical side we want something better than a puerile criticism of Cantor's transfinite number-system, vitiated by misunderstandings. Extensional quantities (lengths, volumes, &c.) can be arithmetically defined for figures in an arithmetical space; but no one with an active geometrical imagination can enjoy this way of treating the subject, although he may admire it as a logical feat. Again, take the connectivity of Riemann surfaces, or the classification of knots; here are things with characteristics easily recognised by inspection, but difficult to specify by the arithmetical method; cannot we find some means for testing our intuitions without putting them into this newly invented arithmetical machine? To give a satisfactory answer to the questions arising from the modern aspects of mathematics is a task sufficient to strain the highest philosophical powers; and although Dr. Petronievics has the temerity to declare that Hilbert's "Grundlagen der Geometrie" is logically defective (p. 24, end), he has added little, if anything, which is of value or interest to the discussion.

G. B. M.

Engineering Workshop Practice. By Charles C. Allen. Pp. vii+254. (London: Methuen and Co., n.d.) Price 3*s.* 6*d.*

A BOOK for students on engineering workshop practice is, in many ways, more difficult to write than one addressed to those who, from years of actual practice, have gained an intimate knowledge of the elaborate processes by which engines and other machines are produced. The beginner requires ample explanations of processes, which he has probably never seen carried out, but which to the workman are as familiar as his daily paper.

This book, good as it is, would have been much more useful if no attempt had been made to write for the information of both the beginner and the skilled workman; their needs are so different that the result cannot be satisfactory to either class. A typical instance of the consequences of such an attempt occurs on p. 159, with reference to the cutting of vee threads in a lathe. In a short paragraph the author points out, quite properly, that, in taking a cut over the whole form, there is a great tendency to rip the thread, and then goes on to state that the diagrams indicate the proper method, but offers no further explanation of them. To a skilled workman these diagrams are quite unnecessary; to a student they are merely perplexing. He is left to discover, if he can, that one diagram is intended to indicate that the roughing cut is to be taken on one side of the vee, while in a second diagram a tool, apparently floating in mid-air, lies between two objects, which he may or may not recognise as rake gauges. In other cases where explanations of the diagrams are given they are far from being clear; thus on p. 191, in the instructions for cutting helical gears, we are told that "The cutter used must be selected for the number of teeth there would be in a gear with outside diameter equal to the diameter of a circle determined by the curvature of the gauge in this way." But the author gives no intelligible explanation of what "this way" is.

While it is proper to direct attention to blemishes

of this kind, there is no doubt that the author has produced a book of considerable merit, the value of which would be considerably enhanced in future editions if the attempt to deal with the wants of the skilled workman were frankly abandoned.

The text covers most of the elementary operations of the fitting and machine shops, and the graduated exercises are well thought out, and in a well-equipped college workshop under the supervision of a skilled instructor a beginner would no doubt make remarkable progress in the use of tools, and be of real value in a works at the end of the course of instruction.

Steam and other Engines. By J. Duncan. Pp. ix+471. (London : Macmillan and Co., Ltd., 1907.) Price 5*s*.

THE development of municipal technical schools during the last few years has given a great impetus to the production of books written especially for elementary students. Mr. Duncan's book, on steam and other engines, is an admirable little work of this class, which students in the early part of a course on mechanical engineering will greatly appreciate, for it is well and clearly written, and covers a wide range of modern practice.

There is nothing more attractive to young engineering students than the purely mechanical details of engines, and the wealth of illustrations accompanying the descriptive matter will no doubt prove of great interest.

While the illustrations are a prominent feature of this book, the more important elementary principles of heat-engine theory and applied mechanics are also presented in a very skilful manner. Students working through the course of instruction prescribed, especially if they are able to carry out the experiments and take part in the engine and boiler trials, as the author recommends, will obtain quite a considerable knowledge of steam and other heat engines.

There appear to be very few errors or mistakes of any importance, but occasionally the author is not an accurate guide, as, for instance, when dealing with the flow of steam in an expanding nozzle he incidentally says that "In the case of a liquid the problem is simple as the property of expansibility is absent," a statement in direct contradiction to the actual facts, as students of hydraulics are well aware.

The Elements of Mechanics. A Text-Book for Colleges and Technical Schools. By W. S. Franklin and B. Macnutt. Pp. xi+283. (New York : The Macmillan Co. ; London : Macmillan and Co., Ltd., 1907.) Price 6*s*. 6*d*. net.

A BOOK on elementary mechanics, which commences by addressing the reader as my young friend, and immediately after, in a lengthy paragraph, draws a comparison between the student and the axolotl, does not seem very promising as a scientific work. This feeling is strengthened when a little further on, in speaking of the laws of motion, one of the authors writes :—

"You, my young friend, must have in some measure my own youthful view, which, to tell the truth, I have never wholly lost, that there is something absurd in the idea of reducing the more complicated phenomena of nature to any orderly system of mechanical law. For to speak of motion is no doubt to call to your mind first of all the phenomena that are associated with the excessively complicated, incessantly changing, turbulent and tumbling motion of wind and water. These phenomena have always had the most insistent appeal to us; they have confronted us everywhere and always, and life is an unending contest with their fortuitous diversity, which rises only too often to irresistible sweeps of destruction in fire and flood, and in calamitous crash of collision and collapse where all things commingle in one dread fluid confusion."

The book does not, happily, continue in this style after the opening chapter, but commences a systematic treatment of elementary mechanics on familiar lines, which, however, does not present any new features worthy of notice, except that inaccuracies and lack of precision in the statement of scientific principles are numerous. A new text-book on mechanics may be justifiable, if the authors can present the subject in a better way than has been presented before, or in a form more adapted to the wants of its readers, but a comparison of this work with any good elementary treatise on the subject cannot fail to show its inferior character. E. G. C.

Die Lösung des Problems der Urzeugung (Archigonia, Generatio spontanea). By Martin Kuckuck. Pp. vii+83 ; with 34 figs. and one table. (Leipzig : Barth, 1907.) Price 3 marks.

DR. KUCKUCK made a mixture of gelatine, peptone, asparagin, glycerine, and sea-water, boiled it for an hour, put it in a sterilised vessel, and added a little chloride of barium, which brought about ionisation. The outcome was the formation of minute bodies like protozoa, which show "nutrition, growth, reproduction (segmentation), inheritance, movement (rotation), and form cell-groups (cœnobia of Haeckel), which resemble animal morulæ." Barium chloride produces similar morulæ in fresh white of egg and in yolk of egg. Drops of natrium nucleinecum (Merck), allowed to fall on the surface of the gelatine-peptone-asparagin-glycerine-sea-salt mixture, produce rotating corpuscles, which form loose colonies. The author gives very interesting and striking figures, some drawn, some from photographs, of his artificial cells and cell-colonies. The figures drawn from the artificial morulæ would pass muster in a text-book of embryology; the cell-outlines are sharply defined, and each cell has a beautiful nucleus. It seems to us that these and similar experiments would be more interesting, if less were proved.

On this experimental basis, Dr. Kuckuck rears a theoretical superstructure. Mixtures of inorganic and organic substances pass by ionisation into protoplasm. Salts of barium, radium, and nuclein effect this ionisation. The process of organisation is a process of ionisation. It is so now, and it was so in the beginning. The first organisms arose in the sea and were non-nucleated Monera. The nucleated cell arose by the symbiosis of two aniso-electrical non-nucleated cytodes, as is proved by the fertilisation-process, for is not ontogeny a recapitulation of phylogeny? "Everything living has sex (negative and positive ions), and everything is living because it has sex (negative and positive ions) : ohne Geschlecht kein Leben." A sort of genealogical tree is given showing the origin of organisms from inorganic substances, so that the Stammbaum is now quite complete, even as to its roots. J. A. T.

The Flora of Columbia, Missouri, and Vicinity. By F. P. Daniels. The University of Missouri Studies. Science Series, vol. i., No. 2. Pp. x+319. (The University of Missouri, 1907.)

As a study of a local flora, this memoir, furnishing a list of the plants and an ecological survey, forms a suitable volume for the science series of the Missouri University publications.

The flora is characterised by a predominance of genera belonging to the orders Compositæ, Gramineæ, and Leguminosæ. The sedges are numerous, since the species of Carex exceed fifty. Desmodium, Mes-

pilus, and Aster are large genera, and Vernonia provides eight new species. The genus Quercus is important both for the number of species and also on account of their dominance in the forests of the area. *Q. alba*, the white oak, *Q. rubra* and *Q. Schneckii*, red oaks, are widely distributed; *Q. macrocarpa*, *Q. platanoides*, and *Q. palustris* occur on the coal measures; *Q. acuminata* and *Q. tinctoria* are also common.

The ecological survey is detailed, almost too detailed, as it loses conciseness owing to the multifarious subdivisions. The forests, as the prevailing features of the district, receive the most attention; the cliff and marsh associations are also important. The characters of the various formations are carefully delineated, and the text furnishes an estimable addition to the literature of plant distribution, but the area has apparently not been surveyed with the view of plotting on a map, nor are any illustrations provided.

The Evolution of Matter, Life, and Mind. By W. Stewart Duncan. Pp. 250. (Philadelphia: Index Publishing Company, 1907.)

THIS is a *vade mecum* of evolutionism, a sequel to a previous volume in which the author sought to show that feeling and energy are alternate states of matter everywhere. Feeling is given out as energy, and energy is experienced as feeling. Both are spiritual or non-substantial, sister properties or manifestations capable of inhering and co-inhering in one universal substance, the ether. The progress of investigation has enabled the author to make his monism even more definite. Matter is being refined away into a mode of motion in the ether. This ether is "the fountain of all being," "the hitherto unknown God." Prof. Larmor and others are theologians in spite of themselves. Helped by abundant quotations, Mr. Duncan gives a sketch of recent investigations as to the nature of matter, and he points out that he anticipated some of them. In 1893, for instance, he contended that an ordinary ray is a succession of such motions of the ether as beget waves with *longitudinal* as well as transverse elements of vibration, and it was only last year that Prof. J. H. Poynting showed that rays of light do exert energy in the direction of propagation. In the present volume he develops some original speculations, *e.g.* a theory of radiation and gravitation.

The author tells us that we must believe in the spirituality of matter and of the ether. Physical processes are *never* complete chains of sequence. Feeling and energising arise alternately in all matter. Animal matter has sprung from vegetable matter, and the latter from inorganic matter (in the Arctic regions). All that we call "matter" is at least sensitive and capable of feeling. It is so because of what it produces, and it is so because the ether is the fountain of all being, physical and mental. Every receiver of energy passes through two states, which correspond to those of every living personality, a subjective state of feeling which results from influence from without, and an ejective state of energising which results from influence from within. We trust that this is all quite clear.

Mr. Duncan gives an account of the origin of everything—including evil—except the ether, which is a scientific name for God. He traces the evolution of all living creatures and of the human mind, showing that the difficulty of thinking out the long genetic process may be in great measure overcome if we start from a broad enough basis—the psychosis of "matter." In the course of his exposition he quotes the story of a delightful orchid, discovered by Mr. E. A. Suverkrop, of Philadelphia, which sends down a tubular stem into the water when it is thirsty, fills the tip, and coils it up again. "As the last coil is made the water trickles down upon the roots at the other end." When the discoverer touched the leaves, he was "astonished to see the centre stem convulsively coil itself into a spiral like the spring of a watch." Wonders will never cease. Nor is pathos wanting, for on dry ground "it was almost pitiable to see how the tube would work its way over the ground, in search of water that was not."

Ballistic Experiments, from 1864 to 1880. By the Rev. Francis Bashforth. Pp. 33. (Cambridge: University Press, 1907.) Price 1*s*.

THE pamphlet is interesting reading as an unconscious revelation of the timidity of thought of our military authority. Afraid to trust its opinion, it waited for approbation to come from abroad before expressing a judgment.

Although carried out with our muzzle-loading guns, Mr. Bashforth's experiments were so careful as to require slight modification only to serve for the newest pattern of modern artillery, and the arrangement of his tabular matter for practical use has been adopted universally, and is never likely to be displaced.

Mr. Bashforth is the creator of the science of modern artillery, but our official world considers this a very improper remark to make, at least in his lifetime.

The rapid progress in electromagnetic science has made possible a great improvement in the chronograph, and further experiment is needed urgently if we are to make the best use of manufacture in the production of improved weapons of war.

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.*]

The Origin of Radium.

IN his two interesting letters published in NATURE of September 26 and October 10 respectively, Dr. Boltwood states that he has obtained undoubted proof of the existence of the parent substance of radium, and that he finds it to be allied in chemical properties with thorium. I may be permitted to describe some experiments which afford independent evidence that the parent substance of radium possesses in a chemical sense the properties of thorium, and that it occurs with the latter.

In experiments made with a new intermediate product obtained from thorium to which I have given the name "mesothorium," I was struck by the fact that old preparations of pure thorium contained relatively large quantities of radium. This appeared all the more noteworthy since the monazite sand from which the thorium is prepared contains only a very small quantity of uranium; the radium corresponding to this small amount must consequently have been separated from the thorium during the complicated processes used in extracting the latter.

A few months ago, therefore, I began a systematic investigation of the quantity of radium in samples of thorium salts of different ages. A weighed quantity of the pure nitrate, generally 10 grams, was dissolved in pure water, and the solution boiled and sealed up. After a sufficient interval the radium emanation was collected by boiling the solution, and shortly afterwards, after allowing the thorium emanation to decay, transferred to an electroscope and measured. Samples of thorium nitrate of very different but accurately known ages were placed at my disposal by the firm of Dr. O. Knöfler. It was found as a result that the older the sample the larger was the quantity of radium contained in it. The oldest sample of all, one dating from 1898, contained the greatest amount. In quite a new sample the quantity of radium was very small, 100 grams of the sample

being required for its measurement. The radium present in this case was about 1/100 that contained in the sample nine years old.

It was not to be supposed that an insufficient degree of purity was the cause of the large amount of radium in the old sample, nor is it probable that thorium itself slowly decomposes into radium. I therefore considered that in the technical preparation of thorium an active substance is separated with the latter, and in turn decomposes into radium; it is probably the direct parent substance of radium, for which search has been recently made. In order to test this view, an attempt was made to show the increase in the amount of radium in a solution of thorium; 100 grams of freshly prepared thorium nitrate was examined, the quantity of radium being ascertained. The amount of emanation collected after four days was used for calculating the equilibrium amount, which is reached after about a month. On August 17 the flask was sealed, and again tested on October 10; the amount was double as great as in the previous test.

Forty grams of thorium nitrate prepared at the end of April was examined in the same way and left during the vacation. In this case also there was a marked increase in the amount of radium.

Fifty grams of thorium nitrate made in June, 1907, was precipitated from acid solution with oxalic acid. In the filtrate the quantity of radium was determined, the same being also done in October. In each case the same result was obtained. The parent substance of radium had therefore been precipitated with the thorium. By mistake, the precipitated material was mixed with other thorium preparations, and could not, therefore, be further investigated.

About 1 mg. of radio-thorium (activity about 100,000) was freed as far as possible from radium (the small amount retained being determined) and sealed up on August 15. The solution on October 14 gave the same amount of radium emanation as before. The radio-thorium was prepared from thorianite by means of barium sulphate, and should not, therefore, have contained the parent substance of radium, as, indeed, was actually found to be the case.

Knowing the proportion of uranium and thorium in monazite sand, and assuming that all the thorium and the whole of the parent substance of radium are separated during the extraction of thorium, the life of radium can be calculated by determining the quantity of radium in a given weight of thorium of known age. I have assumed the monazite to contain on the average 0·3 per cent. of uranium and about 5 per cent. of thorium oxide. From this it follows that 1 gram of thorium nitrate in equilibrium with radium contains about $2 \cdot 10^{-8}$ gram of radium bromide. From the values I have found with samples of thorium of different age, the period of decay for radium lies between 2000 and 3000 years. Alterations in the proportions of uranium and thorium would naturally cause corresponding deviations in the value of the constant. The values given, therefore, only indicate approximately the order of magnitude of the period of decay, since I am ignorant of the exact composition of the monazite used as a source of the nitrates investigated.

I hope to publish more accurate details shortly in another place.

OTTO HAHN.

Chemical Institute, Berlin.

The Victoria Jubilee Technical Institute, Bombay.

I SEE in NATURE of November 7 advertisements for a principal and professor of chemistry for the Victoria Technical College in Bombay. Though I have no connection with the institute, and may be charged with unwarrantable interference, I think that it is only fair to intending competitors that certain facts should be made known.

I wish to point out, in the first place, that the management of this institution is in the hands of a board of trustees, and that the principal is not a member of this board, nor has he the right of communicating with the board except through the medium of the honorary secretary. The title of principal does not even secure to the holder of it the exclusive right of calling meetings of the staff, and, in fact, confers nothing more than the power to enforce discipline. On the occasion of the opening of the new laboratories in February last, I was much impressed by the fact that not only was the principal not among the speakers, but that he and his staff were barely referred to, and that their names only appeared in the descriptive pamphlet which was published for the occasion inside the cover and at the end.

Such were the conditions under which my friend Dr. Mackenzie held the appointment, and it was with no astonishment that I heard on my return from India that he had sent in his resignation. I may add that though Rs. 1000 per mensem with a residence appears to be a good salary, it must be remembered that there is no security of tenure of the appointment, and that the residence offered to Dr. Mackenzie lay between the dustiest road and the busiest railway in the heart of Bombay.

Should any chemist contemplate applying for the "chair" of chemistry with the view of carrying out research in his spare time and ultimately improving his position, I should like to remind him that he will do well to take his library with him. There are no scientific books in Bombay.

Before leaving Bombay I made it clear to some of my friends who are interested in the institute that, in the event of Dr. Mackenzie's resignation being accepted, I should make the facts public, and should warn other scientific men against accepting the appointment upon similar terms.

MORRIS W. TRAVERS.

London, November 9.

November Meteors.

THOUGH the general conditions under which the Leonid meteor shower of 1907 takes place are not the most favourable, still a display of moderate intensity may be expected. The shower promises to be most conspicuous on the night of November 16, when moonlight will interfere considerably with observations, especially in the case of the smaller meteors. The following are the times of the various maxima as computed by the writer, the results of these calculations being expressed in Greenwich mean time:—

Leonid epoch, November 15, 9h. The shower, which is of the third order of magnitude, succeeds the epoch, the principal maxima occurring on November 16, 17h., 17h. 30m., and 18h. 30m. There is also a weak secondary epoch on November 17, 10h., the shower in this case preceding the epoch, and having its principal maxima on November 16, 13h. 40m., 18h., and November 17, 2h.

The intensity of the maxima of a meteoric epoch is inversely as the order of magnitude of the shower connected with it. Two showers, though of different intensities, will, as may be seen, take place on the night of November 16.

Scattered through the rest of the month are several interesting minor showers, details of the most remarkable of which will now be given:—

Epoch, November 22, 4h. Shower of tenth order of magnitude. The shower precedes the epoch, the principal maxima occurring on November 20, 8h., November 21, 14h., and November 22, 3h.

Epoch, November 25, 12h. This shower, which is of the ninth order of magnitude, has its principal maxima after the epoch as follows:—November 26, 1h. 50m., November 27, 2h. 30m. and 6h. Of these, the latter two are the heaviest maxima.

Epoch, November 29, 18h. The shower, which is of the fifteenth order of magnitude, follows the epoch, the principal maxima occurring on November 29, 23h., November 30, 18h., and December 1, 4h.

Closely associated with the last shower is another, which occurs early in December, is of the fifth order of magnitude, and has its maxima on December 2, 11h., and December 3, 8h.

JOHN R. HENRY.

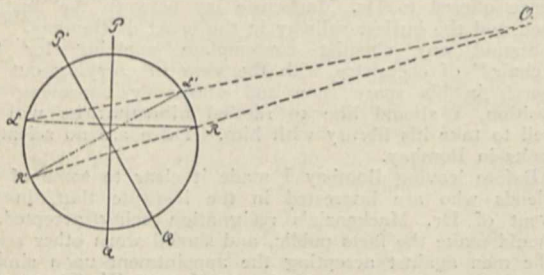
An Optical Illusion.

THE optical illusion described by Mr. Douglas Carnegie in NATURE of October 18, 1906, may be explained as follows:—

The thaumatrope generally reverses its apparent direction of rotation when the observer shuts one eye, or, better still, both eyes alternately, according to the physiological

law that the observation of a motion which is being stopped is in favourable circumstances followed by the perception of that motion in reversed direction.

The accompanying figure shows the card with its plane passing through the observer O. L and R are the intersections of the circumference of the card with an arbitrary horizontal line. Suppose that the card turns round its axis PQ from north to west, the observer will see L removing to the left and R to the right, and from this he can conclude the exact direction of the rotation, provided that he makes sure of L being behind and R before PQ, and not otherwise. For suppose L before PQ in L′ and R behind PQ in R′, the observed removal of these



points respectively to the left and to the right would lead to an apparent opposite direction of rotation—from north to east. Moreover, the axis PQ perpendicular to LR would seem to tilt away from the vertical to P′Q′ perpendicular to L′R′. Hence the illusion depends upon the following condition:—if L and R are seen in the right place with respect to each other, the rotation appears in its true direction, but if, on the contrary, L and R are seen in L′ and R′, so in the wrong place with respect to each other, the card will seem immediately to reverse its direction of rotation, and the axis will seem to tilt away from the vertical.

As an observer, viewing the true direction of the rotating card, will generally be unable to distinguish the right place of the two points when he shuts one of his eyes, the circumstances are favourable for the reversing of the direction of the rotating card.

Utrecht, October 5. L. U. H. C. WERNDLY.

The Interpretation of Mendelian Phenomena.

IF I have read Dr. Archdall Reid's letter in NATURE of October 31 aright, he draws a distinction between the study of heredity in general and the study of the problems of sexual reproduction, now defined as the problem of the function of sex (an expression with which I am perfectly contented). Among the problems of sex he includes the study of the actual transmission of characters as dealt with by Mendelians. The novelty of this classification is certainly attractive; but I find it difficult to understand what branches of knowledge remain to fall under the former head. In what does the study of heredity consist if not in the study of the transmission of characters from parents to offspring?

If by this apparent paradox it is only meant to imply that the Mendelians must confine their study to the transmission of characters by the sexual method, they may seek comfort in the reflection that this is by far the most important of all branches of heredity—it is the only one, for example, which affects the human race. Indeed, the rule that all organisms pass through a sexual cycle at some period of their existence has extremely few exceptions; but I, for one, see no reason for restricting the experimental study of heredity even to this extent. Mendel demonstrated the segregation of the germinal representatives of certain characters in the reproductive cells. What reason is there for doubting that such segregation may take place among the ova of a parthenogenetic individual? There is, in fact, evidence of the actual occurrence of such segregation. More than this, we know of segregation where reproduction is purely vegetative, as in the case of bud sports.

It is the claim of the Mendelians that they have discovered in certain cases some of the fundamental characters of an organism—the units of hereditary transmission, which are represented in the reproductive cells by definite entities known as allelomorphs. Sometimes these characters are identical with those which can be defined by simple inspection previous to experimental analysis, sometimes they are not. Sometimes the apparent character depends upon the simultaneous presence of several allelomorphs, each of which may segregate from its opposite in complete independence of all the others. Mendel himself suggested that this conception, the proof of which he left to his successors, might afford the explanation of certain botanical cases which do not appear to be widely different from that of the mulatto. If Dr. Archdall Reid will produce authenticated pedigrees showing the repeated crossing of the mulatto with pure white blood and pure black blood respectively, together with a detailed account of all the offspring produced, he will make a very substantial contribution to our knowledge of heredity in the human race, and one which will be examined with very great interest by Mendelians. In the absence of such evidence the statement that there is no segregation does not seem to me to be justified, even in this particular instance.

It has been pointed out that Mendel's discovery is leading to a change in our conception of the constitution of an organism comparable with the change which the advent of the atomic theory produced in chemists' conceptions of compound substances. Whatever biological problem we may now discuss, Mendel's facts have to be reckoned with. It is true that the only method so far discovered of studying the constituent characters of organisms consists in the crossing together of individuals in which some of the characters are different. This method is so closely comparable with that by which the chemist studies his compounds that Mendelians have often found a readier appreciation of their views among students of the more precise physical sciences than among biologists. The advantage of introducing exact experiment into the study of heredity ought to be obvious to all, and I fail to see any other objection to the method except its novelty.

If Dr. Archdall Reid desires to grasp this new conception, I can only recommend him to a renewed study of the literature of the subject, beginning with Mendel's own papers. Better still, let him repeat a few of the simpler experiments. There is no royal road to this knowledge; but it is knowledge which is rapidly revolutionising our entire conception of the constitution of a living organism. Dr. Archdall Reid is so far from appreciating this at present that further discussion seems likely to be of very little profit. I will conclude my contribution to this controversy with a word of warning. If Dr. Archdall Reid discards Darwin's opinion, based as it was upon an unequalled experience, that domestic and natural varieties have arisen by essentially the same process, he may find himself landed among a crowd of unsuspected difficulties.

Cambridge, November 2. R. H. LOCK.

Method of Observing the "Subjective Yellow."

A SIMPLE method of obtaining the sensation of yellow produced by the mixture of red and green lights is afforded by a small direct-vision spectroscope of the ordinary kind in which the slit can be rotated to adjust its line perpendicular to the plane of refraction. If the slit is turned slowly from this normal position, the bands of different colours of course take up a sloping direction across the spectrum, like books on a half-filled shelf. As the slope increases, the upper end, for example of the red, closes down on the lower end of the green, and as the two blend the clear yellow tint is produced. Other colour mixtures can be similarly noticed.

It may be added that if the slit is turned thus until its length lies in the plane of refraction, the violet end of the impure spectrum obtained is drawn out and so more easily observed than in the normal method of use, and is still pure enough for most of the purposes for which a simple spectroscope is of use.

JOHN H. SHAXBY.

University College, Cardiff.

ANTARCTIC ANIMALS.[1]

THE Trustees of the British Museum have published in stately form some of the natural history results of the National Antarctic Expedition (1901-1904), and we cannot but express our satisfaction that the volumes compare so well, both in matter and "get-up," with the similar publications of other European nations, and that they can be placed without reproach on the *Challenger* shelves. As the director of the natural history departments of the British Museum says in the preface to this second volume, "neither trouble nor expense has been spared in order to render the illustration and presentation of the natural history of the expedition worthy of the generous efforts both of Captain Scott and his fellow-explorers and of those who provided funds for that enterprise." Another matter for congratulation is that the results are being published so promptly, and for this thanks are due to the energy and organising ability of Mr. Jeffrey Bell, who has secured the co-operation of specialists, and has acted as sub-editor of the natural history portions of the reports.

FIG. 1.—Emperor Penguins' Rookery at Cape Crozier. From the "National Antarctic Expedition, 1901-1904."

The second volume begins with Dr. Edward A. Wilson's report on the mammals, a well-executed piece of work, most beautifully illustrated. The *Discovery* found no traces of the southern right whale (*Balaena australis*), which Sir James Ross reported as abundant in the Ross Sea in the 'forties of the last century, but the rorqual, the Australian whale (*Neobalaena marginata*), a bottle-nose, the killer (which levies toll on the seals and penguins), the dusky dolphin, and two new cetaceans. Dr. Wilson gives a very interesting account of the habits of the seals:—Weddell's seal (*Leptonychotes weddelli*), the sea-leopard (*Stenorhinchus leptonyx*), the crab-eating seal (*Lobodon carcinophagus*), the Ross seal (*Ommatophoca rossi*), the sea-elephant (*Macrorhinus leoninus*), Hooker's sea-lion (*Arctocephalus hookeri*). We should like to give an instance of the author's graphic style:—

"Coming back to the ship by boat from Enderby Island an hour or two after sunset, and on a particularly dark night, with neither stars nor moon, we watched the sinuous and graceful movements of about six large sea-lions that followed our boat apparently out of curiosity. Diving and twisting about beneath us in the pitch-black water, each animal was ablaze with light. Every limb and every movement could be seen, though they moved so rapidly that the eye could scarcely follow them; they played with one another and chased one another and the boat, now coming up to blow, as we could hear, a yard or two astern, and now diving deep down under the boat to appear often close in under the bulwarks; every stroke of the long powerful fore flippers was accurately conveyed to our eyes in the pitchy darkness by the brilliance of the phosphorescence covering them. . . . The sight was a most beautiful one. The animals moved with feints, and twists, and turns, now in curves, now in circles, but always with the sinuous motion of the body like a fish, supplemented by powerful strokes of the long fore flippers, and always with

[1] "National Antarctic Expedition, 1901-1904." Natural History. Vol. ii., Zoology (Vertebrata: Mollusca: Crustacea). Vol. iii., Zoology and Botany (Invertebrata: Marine Algæ, Musci), with numerous plates and illustrations. No continuous pagination. (London: Printed by order of the Trustees of the British Museum, 1907.) Vol. ii., 3*l.*; vol. iii., 2*l.* 10*s.*

the most wonderful rapidity. All this we saw most clearly in the blackest darkness, far more clearly, indeed, than such objects are wont to be seen even under the most favourable conditions, in the daylight."

Of course the memoir is not exactly full of sugar-plums of this sort; there are discussions of dental formulæ and plenty of other hard facts, but Dr. Wilson is to be congratulated on bringing not a little of the picturesqueness of reality into his scientific discourse.

In Dr. Wilson's report on the birds, we find abundant details regarding the life and ways of penguins. They are drawn or photographed in every conceivable attitude and situation—walking, "tobogganning," feeding, sleeping, on the nest and "on the run," crowing, piping, dirty and clean, moulting and "ecstatic." The pictures are delightful, and reflect great credit on artists and photographers, and the whole story of the life of the penguins is full of interest. Take the emperor penguin's egg-laying, for instance. The bird chooses the darkest months of the Antarctic winter in which to incubate its egg; it lays it upon sea-ice with no pretence at nesting, but removes it at once to rest upon its feet, where it is held wedged in between the legs closely pressed to a patch of bare skin in the lower abdomen, and covered from exposure by a loose-falling lappet of abdominal skin and feathers. Of course there is no "pouch," only a fold. The incubation requires seven weeks, and one bird cannot undertake this task. A dozen or more stand patiently round waiting for a chance to assist.

FIG. 2.—Hooker's Sea Lion. From the "National Antarctic Expedition, 1901-1904."

"Every adult bird, both male and female, in the whole rookery has a keen desire to 'sit' on something. There is every reason to believe that when the sitting bird feels hungry it hands over its treasure to the nearest neighbour that will undertake the duty of incubation."

But we must not quote more, strong as the temptation is. Dr. Wilson deals with five species of penguin, two skuas, Wilson's petrel, the Antarctic petrel, the giant petrel, and a score of other birds.

Mr. W. P. Pycraft has made out some very interesting points in his study of nestlings and embryos of the emperor and Adélie penguins. He shows that penguins develop two successive down plumages before assuming the normal definitive feathers. Another remarkable fact is that the feathers are moulted from large areas of the body at once. In their pterylosis the penguins are the most primitive of all Carinatæ. This accomplished osteologist also shows that the embryological evidence confirms what the palæontological evidence hints at, that the penguins are descended from birds which possessed full powers of flight. He gives an interesting discussion of their relationships, and of detailed points of interest such as the sealing up of the nares, which seems to have been a common heritage of all the birds belonging to the great Steganopod branch, except the Colymbi.

The collection of fishes, reported on by Mr. Boulenger, was a very small one, consisting of representatives of ten species, four of which are new.

Dr. W. G. Ridewood deserves congratulation in respect of his fine memoir on the two species of Cephalodiscus obtained by the *Discovery*. He gives a detailed account of *C. hodgsoni*, n.sp., and *C. nigrescens*, Lankester, compares the six species now known, discusses their relations with Rhabdopleura, and clears up a number of obscure details. He proposes to divide the genus into two subgenera—Idiothecia, *e.g. C. nigrescens*, in which the polypides live in separate tubular cavities, and Demiothecia, *e.g. C. hodgsoni*, in which the cavity of the tubarium is continuous. In both the new species obtained by the *Discovery* there are hermaphrodite individuals, with one ovary and one testis, as well as males and females with two ovaries and two testes respectively. Some light is thrown on the development of the buds and of the tubarium, as also on Harmer's "problematical body" (obliquely interlacing cross-striped muscle fibres) and on the peculiar refractive beads in the end bulbs of the plumes of *C. hodgsoni* (material of the tubarium in process of secretion). The seven plates illustrating this valuable memoir are of great excellence.

As to brachiopods, Mr. Edgar A. Smith describes two new species of Magellania, one of which, *M. sulcata*, is remarkable on account of the concentric sulcations and the coarse perforations of the shell. Its marked lines of growth have no analogue among recent forms, but recall the surface ornamentation of *Terebratula sulcifera* from the Lower Chalk.

Turning to molluscs, we find that the *Discovery* obtained only one cephalopod—a larval Histioteuthid—

in regard to which Dr. W. E. Hoyle communicates some notes furnished by Dr. G. Pfeffer. There were also some mandibles, obtained from the stomachs of seals and penguins. Mr. Edgar A. Smith finds twenty-one new species of gastropods in a collection of twenty-six. The most striking forms are *Trophon longstaffi*, and a new genus, Trichoconcha, which has a flexible tough shell, like a chestnut skin, and a beautiful hairy periostracum. The collection does not show any particular resemblance to the Arctic fauna, most of the genera having a world-wide distribution. The almost total absence of colour in nearly every instance is characteristic. Mr. Smith also describes a very remarkable Chiton (*Chaetopleura miranda*, n.sp.), simultaneously reported by Dr. J. Thiele (*Notochiton mirandus*, n.g. et sp.) from Bouvet Island—an instance of wide distribution. The third and seventh valves are stained red, the rest being dirty-whitish. In the collection of fourteen species of lamellibranchs, Mr. Smith found ten that are new, *e.g.* a beautifully sculptured Lima (*Limatula hodgsoni*).

Sir Charles Eliot describes five species of pteropods, and points out at once the distinctness and the relatedness of the northern and southern species of Limacina and Clione. It may be that some once cosmopolitan species have undergone similar but not identical changes in North and South Polar waters. The same authority also reports on the nudibranchs, twelve in all, ten of which are new. He establishes two new genera, Tritoniella and Galvinella, near Tritonia and Galvina respectively, and comes to the conclusion that the Antarctic and Arctic nudibranchs are similar rather than identical.

As to crustaceans, Dr. W. T. Calman describes two species of decapods obtained within the Antarctic Circle, viz., *Choriomus antarcticus* (=*Hippolyte antarctica*, Pfeffer) and *Crangon antarcticus*, Pfeffer, both of which were also collected by the German Polar Commission of 1882–3 at South Georgia. With the exception of the very imperfectly known *Crangon capensis*, Stimpson, *C. antarcticus* is the only southern species of the genus, and is widely separated from all the other species, which are confined to the temperate and (if Sclerocrangon be included) Arctic regions of the Atlantic and Pacific.

No Cumacea have previously been obtained from within the Antarctic Circle, but the *Discovery* collected four species, which Dr. Calman describes. Three are new, and the fourth is a variety of *Campylaspis verrucosa*, known from the north Atlantic and the Mediterranean, though probably with a much wider range.

Mr. A. O. Walker reports on fifty-three species of amphipods (eighteen new) in forty-three genera (four new). As in the Arctic regions, the Lysianassidæ preponderate. It was quite the usual thing to take ten to thirty thousand specimens of *Orchomenopsis rossi* in a single haul. Some of the forms have a wide distribution; thus *Ampelisca macrocephala* is an abundant Arctic species, and the ascidiicolous *Leucothöe spinicarpa* appears to be ubiquitous (the *Discovery's* winter quarters, Ceylon, Maldives, and our own seas). Among the peculiar forms we may notice *Thaumatelson herdmani*, the only known amphipod with its telson in the vertical plane, *Epimeria macrodonta* with long curved and sharp teeth on the body segments, and *Iphimedia hodgsoni*, so densely clothed with fine spines directed backwards that it has a shaggy appearance.

Dr. Johannes Thiele finds that the only leptostracan collected was *Nebalia longicornis magellanica*; Prof. G. Stewardson Brady reports on nine species of ostracods, of which seven are new, including a new cytherid genus Linocheles; Dr. A. Gruvel briefly discusses four cirripedes, including two new species of Scalpellum.

Mr. T. V. Hodgson has had an interesting task in dealing with the large collection of pycnogonids, which evidently have their headquarters in southern seas. He describes three new genera and twenty-three new species, raising the total of Antarctic forms to sixty-three. The new genus Austrodecus, perhaps a close relation of Tanystylum, is a curious little form with a slender and elongated proboscis, like the snout of a weevil beetle, no chelifori, six-jointed palps, and small ovigers; Austroraptus, another new genus, is remarkable for its spurred body and the length of its legs. These two genera, along with the genus Leionymphon, which is re-cast, belong to the family Ammotheidæ, but no true member of the genus Ammothea was found. The most interesting form is, of course, *Pentanymphon australis*, which excited much interest at the time, since it has an extra pair of limbs. It is abundant in circumpolar waters, where also the Scottish Expedition, under Dr. W. S. Bruce, collected a still finer species with the same peculiarity, which turned out to be *Decolopoda australis*, described by Eights some seventy years ago in a forgotten paper. The "bipolarity theory" is affected only by *Colossendeis australis*, for it is, among the numerous species of this genus, nearest to *C. proboscidea*, which occurs at the opposite end of the earth. We may direct attention to the useful device Mr. Hodgson has adopted of giving a brief *résumé* of the most important specific characters at the beginning of each detailed description. The author also contributes an interesting essay at the beginning of the third volume on collecting in Antarctic seas. Dr. E. L. Trouessart describes an Antarctic variety of the Arctic species of halacarid—*Leptospathis alberti*. The two forms hardly differ except in size and proportions, but as the author believes that the species will turn out to be cosmopolitan or subcosmopolitan, he does not attach any importance to its bipolar distribution. As a matter of fact, however, the species is not as yet known except in the two polar seas.

As to "worms," Dr. G. Herbert Fowler reports on three species of Chætognatha. He found the same three and one other in an old *Challenger* collection. He points out that *Krohnia hamata* ranges from 81° 30′ N. to 77° 49′ S., being cosmopolitan and fairly eurythermal; that *Sagitta hexaptera* is cosmopolitan and pantothermal; and that *S. serrato-dentata*, though found in subantarctic as well as north temperate seas, was absent at the colder stations of both *Discovery* and *Challenger*. Dr. O. von Linstow describes *Leptosomatum australe*, n.sp., which is the largest known free nematode, the female attaining a length of almost 50 mm., the male of 37·7 mm. He proposes a new group, Adenophori, for the free nematodes, which will not fit into the three groups Secernentes, Resorbentes, and Pleuromyarii into which he has disposed the parasitic forms. Mr. Arthur E. Shipley describes three species of Dibothriocephalus (two new) which were found living together in the stomach of Ross's seal. It is rather remarkable that the only cestodes brought back by the naturalists of the *Discovery* were got in one rare animal, and that they belong to one genus. The pleurocercoid stages may possibly be found in some cephalopod. We may note the author's enthusiasm; he speaks of *D. wilsoni*, n.sp., as a very attractive little tapeworm of few proglottides.

Turning to Cœlentera, we find, first of all, an interesting memoir by Prof. S. J. Hickson on the Alcyonarians. He finds that *Ceratoisis spicata*, n.sp., is a connecting link between the groups of species formerly separated into the two genera Ceratoisis and Primnoisis. The latter name must now disappear. Another new discovery is *Primnoella divergens*, which links Primnoella and Caligorgia. The collection in-

cluded another new species of Ceratoisis and five other forms previously described. Prof. Hickson and Mr. F. H. Graveley deal with the hydroid zoophytes, which include some interesting forms, especially *Hydractinia dendritica*, n.sp. Though there is no definitely new generic type, there are ten certainly new species and five more probably new—a very large proportion out of a total of twenty-five. It may be noted that only two of the twenty-five were got outside the limits of McMurdo Bay and the edge of the great ice-barrier, so that we have here a fine representation of the hydroid fauna from the most southerly limit of our knowledge of marine zoology. It is also interesting to find that three of the species are common on British coasts. Dr. John Rennie makes a note on the extraordinarily long tentacles of some unknown siphonophore. They were about as stout as an ordinary bootlace and nearly twenty feet in length. Mr. Hodgson gives a graphic account of the difficulties attending their capture.

Among the sponges, Mr. R. Kirkpatrick found four species of Tetractinellids, forty-three Monaxonellids, twenty-four Calcarea, no Keratosa, and ten species of Hexactinellids. He describes the Hexactinellids, of which three were new genera and eight new species.

The third volume ends with a report on the marine algæ (Pheophyceæ and Florideæ) by Mr. Gepp and Mrs. Gepp, a description of a new coralline by Dr. M. Foslie, and an account of the mosses by M. Jules Cardot. It need hardly be said that with such bulky volumes before us it has not been possible to give more than a hint of the amount of sound and interesting work which they contain.

THE CURE AND PREVENTION OF SLEEPING SICKNESS.

THE sleeping sickness is, and unfortunately continues to be, the most burning problem of European colonisation in equatorial Africa. Like any other medical problem, that of sleeping sickness has two sides, which may be distinguished broadly as prevention and cure. Investigators in all parts of the world have been experimenting actively with the object of finding a drug, or method of treatment, which shall act in sleeping sickness as quinine does in malaria; that is to say, which shall destroy the parasites in the blood, without seriously affecting the health of the patient. Up to the present, the atoxyl treatment has given the best results, but it has often failed to produce more than temporary amelioration, and it is open to doubt if it has produced a complete cure in any case, while, like other arsenical compounds, it may have serious toxic effects. On Thursday last, however, a communication was made to the Royal Society by Drs. H. G. Plimmer and J. D. Thomson, of the Lister Institute, on the effect of certain antimony salts; and, to judge from the preliminary experiments on rats, these compounds appear to be far more efficient in their curative action, and at the same time less toxic in their effects, than atoxyl. The experiments will be extended at once to larger animals and to man, and though it would be premature to say that the long-sought-for cure has been found, the outlook is certainly more full of hope than it has ever been before.

The question of the prevention of sleeping sickness is, of course, bound up with the etiology of the disease. It is known that the disease is caused by the presence of a minute flagellate parasite or "trypanosome," first in the blood, later in the cerebro-spinal fluid of the patients; and it is known that the trypanosomes are conveyed from diseased to healthy subjects by the bite of one, possibly more than one, of the species of blood-sucking tsetse-flies. It cannot be too emphatically stated, however, that the tsetse-fly is not, as so often stated, the "cause" of the disease; if the fly be not infected, its bite is harmless, and Koch and others have reported the existence of large areas in which the fly swarms, but in which sleeping sickness does not as yet exist, although the necessary condition for its diffusion is found.

It follows that the problem of prevention may be attacked in two ways; extirpation of the fly, or control of the infection. Considering the vast extent of the range of the species of tsetse-flies in Africa, considering, further, that these flies, being viviparous, have no free larval stages in which they can be destroyed, like mosquitoes, any notion of extirpating tsetse-flies must be considered as frankly utopian. The measures adopted by our Government are wisely directed towards controlling the spread of the infection. Since the fly haunts thick bush on the lake-shore exclusively, the jungle is to be destroyed at all ports, ferries, and landing-places on the lake, where it is unavoidable that human beings should visit the lake-shore; at other points the natives are to be removed from the shore, and persuaded or coerced to live out of the effective range of the fly. Natives known to be diseased are to be segregated, prevented from wandering into the "fly-belts," and placed under treatment. By this means it may be reasonably expected that the spread of the infection may be checked.

There remains, however, the possibility that some wild animal may play a part in spreading the infection, since other animals besides man are known to be susceptible to the trypanosome when inoculated with it in the laboratory. As yet, however, no vertebrate, other than the human species, has been proved to harbour the trypanosome of sleeping sickness in a state of nature. It is well known, however, that other species of trypanosomes, in no way connected with sleeping sickness, are found commonly in wild animals of all classes; and it may be added that the tsetse-flies are quite as willing to suck the blood of a reptile or bird as that of a mammal. Hence there is always the possibility that some species of wild animal may act as a "reservoir" from which the supply of the trypanosome of sleeping sickness may be kept up indefinitely through the agency of tsetse-flies. It is, therefore, of the utmost importance that further researches on the etiology of sleeping sickness should be carried on, with the special object, among others, of discovering any such indigenous source of the disease, for it need hardly be pointed out that it would be of little use to prevent tsetse-flies becoming infected from human beings if they could also obtain the infection from natural sources.

THE POLLUTION OF RIVERS.

ON Thursday, October 31, an influential deputation from the British Science Guild interviewed Mr. Burns, M.P., at the Local Government Board, upon the subject of legislation with respect to the prevention of the pollution of rivers, and the protection of the public against the contamination of shell-fish.

In most directions the tendency to the pollution of our water supplies increases with the demand for pure water, and the area from which such water can be obtained in the neighbourhood of our towns is diminishing. The existing local authorities have conflicting interests when dealing with river pollution, and considerations of guarding the purity of streams are often subordinated to those of refuse disposal and manufacturing requirements. What too often happens is that a sanitary authority, situated toward the head of the stream or upon one of its tributaries,

collects its own drinking water from a comparatively pure source, and then adopts the selfish policy of permitting its refuse matter to enter the stream below its own intake, with too little regard for the needs of its neighbour lower down the course of the same river. Perhaps it is hardly to be expected that, of its own initiative, a sanitary authority will face a great deal of extra trouble and expense (beyond what is necessary for its own purposes) in conserving the quality and quantity of water when the entire benefit is to be reaped by other authorities; and this is one of the reasons why a general policy should be adopted and enforced by a central authority.

Although certain river conservancy boards exist and have done good work, and several county councils have done much to reduce the contamination of streams, these bodies are unable to do all that is necessary. The Rivers Pollution Prevention Act of 1876 was not framed so as to render the assistance which such an Act could be made capable of, and most of our larger rivers course through more than one county or between the existing purely arbitrary boundary of counties. The rivers and watersheds of the country are, moreover, generally too extensive to be embraced by any existing sanitary authority.

The case in favour of putting the whole of the watershed areas under one controlling authority is therefore a very strong one. The matter, both in its magnitude and importance, is clearly a national one, and a central authority for the whole country is what is needed. The duty of such an authority would be to maintain a sufficient sanitary supervision and control over authorities whose districts form important catchment areas for our water supplies, with the view of maintaining the purity and volume of the waters at standards sufficient to meet the domestic and trade demands of the country as a whole. Such an authority would also arbitrate and advise upon points in dispute between sanitary authorities, or between sanitary authorities and local industries—in so far as these matters relate to the contamination of water; and the heavy expenditure now entailed by costly and often ill-advised litigation, frequently leading to unsatisfactory results, would more than pay for the expert handling of matters in dispute by the central authority.

There can be no difference of opinion upon the fact that the central authority in this matter should be the Local Government Board; and in the legislation which it is sought to promote certain powers in the above-mentioned direction would be given to that Board, and, in addition, measures are introduced to protect the public health against the pollution of shell-fish.

Mr. Burns received the deputation in a most sympathetic spirit, and expressed the hope of being able to introduce a Bill, dealing with matters referred to by the deputation, in the spring of next year.

SIR JAMES HECTOR, F.R.S.

DEATH has removed the last of the four distinguished geologists, F. von Hochstetter, Sir Julius von Haast, F. W. Hutton and Sir James Hector, who together laid the main foundations of the geology of the Dominion of New Zealand.

Sir James Hector was born in Edinburgh on March 16, 1834, and was the son of Alexander Hector, a Writer to the Signet. He was educated at the Edinburgh Academy and University, where he matriculated in 1852, took his degree of M.D. in 1856, and served as assistant to Edward Forbes and to Sir James Simpson. His knowledge of natural history and medicine, and the influence of Murchison, gained him the post of surgeon and naturalist to Captain Palisser's expedition to the Rocky Mountains of British North America. The expedition was in the field from 1857 to 1860, and its best known result was the discovery of the pass by which the Canadian Pacific Railway now crosses from the Great Plains of Canada to the Pacific coast. At the close of the expedition Hector visited the gold-fields of California and northern Mexico, and he reported upon the coal mines of Vancouver Island. On his return to Scotland he wrote a series of papers on the botany, ethnography and physical geography of the Canadian Rocky Mountains, and a paper, of modest length, "On the Geology of the Country between Lake Superior and the Pacific Ocean (between 48° and 56° N. lat.). . . ."

In the year of his return from America he was appointed geologist to the Government of Otago, and there began the main work of his life. He made extensive and arduous journeys through the province of Otago, which still contains the least known and most difficult country in New Zealand. Some of his results were given in 1863 in a New Zealand Parliamentary Paper on "An Expedition to the North-west Coast of Otago," in which he described the discovery of the pass from Martin's Bay to Lake Wakatipu. His success in Otago soon gained Hector promotion from a provincial to a federal appointment. He was made one of the Commissioners for the New Zealand exhibition at Dunedin in 1865, in preparation for which he made a tour through the colony to report on its economic resources; and in the same year he was appointed director of the Geological Survey of New Zealand and of the New Zealand Colonial Museum at Wellington. There, or in his cottage on the Hutt, a few miles away, he lived for more than forty years. During the first half of this time he issued a long series of important contributions to the natural science of New Zealand; their range was wide, for he was director of the zoological museum, the botanical gardens, the meteorological observatory, and the colonial laboratory, as well as of the Geological Survey. He was also for many years Chancellor of the New Zealand University. He nevertheless found time for extensive original researches. He wrote papers on glacial geology, the origin of the rock basins and the volcanic history of New Zealand; his zoological researches were mainly on the Cetacea, seals, and fish, and he wrote on many groups of New Zealand fossils, notably the moas, and on the discovery of the oldest known penguin, Palæeudyptes. He superintended and edited those valuable series of annual reports issued by the Colonial Museum and by the Geological Survey, beginning in 1867, which are the great storehouse of information on New Zealand geology. In 1868 he married the eldest daughter of the late Sir David Monro, who was then Speaker of the New Zealand Parliament. In 1873 he issued a sketch-map of New Zealand geology, of which the edition issued in 1886, with his "Outlines of New Zealand Geology," is still the best available. In 1879 he compiled an official "Handbook of New Zealand," a work of reference of permanent value, of which a fourth edition was issued in 1886. In that year he also wrote his well-known report on the eruption of Tarawera; he maintained that it was not a normal volcanic, but a hydrothermal eruption, due to a vast explosion of the superheated steam with which the ground around Lake Rotomahana was saturated. This view has not been confirmed for the eruption of Tarawera as a whole, but it is probably correct for the particular explosion which blew up Lake Rotomahana and its famous pink and white terraces.

Hector's work had meanwhile gained world-wide recognition. He had been elected a Fellow of the

Royal Society in 1866; he received the Order of the Golden Cross from the Emperor of Germany in 1874, the decoration of C.M.G. in 1875, and promotion to K.C.M.G. in 1887. He was awarded the Lyell medal of the Geological Society in 1875, and a founder's medal from the Royal Geographical Society in 1891. In the same year Hector was elected the third president of the Australasian Association for the Advancement of Science, and delivered his address on the history of scientific work in New Zealand. But after this period his work became less important. He continued to write short papers; the last which we remember is that on the distribution of the moa in New Zealand, in 1901. But he no longer showed his old energy or success, and the staff of the Geological Survey was transferred to the Mines Department. Hector retained his nominal position as director of the Geological Survey until 1903, but for many years he had no control over the Geological Survey work that was being done in New Zealand. He remained director of the Wellington Museum, the condition of which was often made the subject of severe reproach. Hutton publicly complained in 1899 that the plates that had been prepared years before for the monograph of the fossil Cainozoic mollusca and echinoids of New Zealand were never published, and that the valuable collections of fossils that had been made during the geological survey of the colony were "useless as they now exist in the museum of Wellington." In 1903 Hector resigned his appointments; he had for several years previously exercised little influence on scientific work in New Zealand, but the high value and wide range of his own scientific work, and the inspiring example of the energy and administrative capacity, which for so many years he devoted to the service of his adopted land, will secure him one of the foremost places in the roll of distinguished New Zealand pioneers.

J. W. G.

NOTES.

THE following list of those to whom the Royal Society has this year awarded medals was received a few hours too late for insertion in last week's NATURE. The awards of the Royal medals have received the King's gracious approval:—The Copley medal to Prof. A. A. Michelson, of Chicago, For.Mem.R.S., for his investigations in optics; a Royal medal to Dr. E. W. Hobson, F.R.S., for his investigations in mathematics; a Royal medal to Dr. R. H. Traquair, F.R.S., for his discoveries relating to fossil fishes; the Davy medal to Prof. E. W. Morley, of Cleveland, Ohio, for his contributions to physics and chemistry, and especially for his determinations of the relative atomic weights of hydrogen and oxygen; the Buchanan medal to Mr. W. H. Power, C.B., F.R.S., for his services to sanitary science; the Hughes medal to Prof. Ernest H. Griffiths, F.R.S., for his contributions to exact physical measurement; the Sylvester medal to Prof. W. Wirtinger, of Vienna, for his contributions to the general theory of functions.

THE honours announced on the occasion of the King's birthday on Saturday last are chiefly of political interest. Prof. T. Clifford Allbutt, F.R.S., has been appointed a Knight Commander of the Order of the Bath, but he is the only Fellow of the Royal Society we have been able to find in the list. The new knights include Dr. W. H. Allchin, Dr. W. J. Thompson, and Mr. Charles Whitehead, who is associated with scientific agriculture. Dr. A. Theiler, Government veterinary bacteriologist, Transvaal, has been appointed a Companion of the Order of St. Michael and St. George.

FURTHER particulars have reached us relating to the scientific expedition that will this month visit the Auckland Islands and the Campbell Islands, primarily to extend the magnetic survey of New Zealand to their sub-Antarctic outliers, but also to make zoological, geological, and botanical observations and collections. The expedition, as announced in NATURE of October 24 (vol. lxxvi., p. 644), has been arranged by the Philosophical Institute of Canterbury. The Government S.S. *Hinewoa* will take the expedition on the occasion of her annual trip to visit the depôts placed on the islands for shipwrecked mariners. Of the two dozen members, about half will be left on the Auckland Islands and the rest on the Campbell Islands, to be picked up on the return of the steamer. Among the zoologists will be Profs. Benham and Chilton and Mr. E. Waite; botany is represented by Dr. L. Cockayne and others, geology by Dr. P. Marshall and others, while the magnetic observers will be headed by Dr. Coleridge Farr, who has been engaged for the last few years in carrying out the magnetic survey of New Zealand.

A SMALL expedition will proceed from New Zealand in December to the Kermadec Islands. Five young enthusiastic men have arranged to spend twelve months on these uninhabited islands, collecting, observing, and photographing. The results of the expedition will, it is hoped, be worked out by naturalists in New Zealand.

A CHRISTMAS course of illustrated lectures, adapted to a juvenile auditory, will be delivered at the Royal Institution by Sir David Gill, K.C.B., F.R.S., on "Astronomy Old and New." The dates of the lectures are December 28 (Saturday), 31; January 2, 4, 7, and 9, 1908.

THE administration building of the Mount Weather Meteorological Observatory of the Weather Bureau was, *Science* reports, destroyed by fire on October 23. The loss is said to be 5000*l*., including some valuable instruments.

THE *Times* of November 7 reports that Sir Alfred Jones, president of the Liverpool School of Tropical Medicine, has received a communication from Dr. Kinghorn from Serenje, Zambezi. Dr. Kinghorn records the finding of tsetse-flies, and states that the general opinion throughout the country is that they are rapidly extending. Otherwise the country is singularly free from insect pests. So far, sleeping sickness has not appeared in the district.

A PAPER on disease prevention in the Territorial Army, with a proposed scheme for placing medical officers of health in relation to it, was read on November 8 by Sir Alfred Keogh, Director-General of Army Medical Staff, before the Society of Medical Officers of Health. He explained why an organised military department of sanitation must be called into existence. If in the Territorial Force the work involved is not done in time of war by those who constantly deal with kindred problems in time of peace, it cannot be efficiently done at all. He proposed to ask the medical officers of health of the country to combine in a voluntary organisation, having for its object the preservation of the health of the men who may one day be required to defend the country; to enrol themselves in the Medical Corps of the Territorial Force; to undertake voluntarily the duty of considering the problems to be solved during active operations within their own home area; to be ready to place their knowledge at the disposal of the authorities commanding their divisions of the Territorial Forces. The sanitary department of the Medical Corps would further consist of non-commissioned officers and men detailed to join battalions for the technical duties of water sterilisation, for disinfection, &c.

SOME interesting facts on the continued falling off in the production of natural indigo were given at a recent meeting of the Society of Chemical Industry by Mr. R. J. Friswell, chairman of the society. From Government returns it appears that for the five years ended 1904–5 the total acreage in India devoted to this cultivation was 755,900 acres. In 1905–6 this had fallen to 330,400 acres, or to less than 44 per cent. of its former area. By 1906–7 it had fallen further to 329,800 acres. Meanwhile, the production of synthetic indigo is advancing by leaps and bounds. No statistics are available as to the actual quantity made by foreign factories, but the imports into our own islands may be taken as a fair index. In 1905 synthetic indigo amounting to 32,246 cwt. was imported. In 1906 this increased to 39,042 cwt., an increase of 21 per cent. During the same years the imports of natural indigo were 8201 cwt. and 7641 cwt. respectively, a decrease of 6·8 per cent. Mr. Friswell thinks that natural indigo will for some years to come occupy a place in the world's market. Planters have, therefore, a breathing time to improve their methods, both biologically and chemically—biologically by improving the content of the plant, chemically by improving the methods of winning the indigo and making its quality constant.

THE International Congress on Tuberculosis will be held in Washington, D.C., from September 21 to October 12, 1908. We have received a preliminary announcement from the National Association for the Study and Prevention of Tuberculosis, which has been entrusted with the organisation of the congress. Dr. Frank Billings is the president of the National Association, and Mr. Roosevelt, Mr. Grover Cleveland, and Prof. William Osler are honorary vice-presidents, Dr. John P. C. Foster and Dr. Mazÿck P. Ravenel being the vice-presidents, and Dr. H. B. Jacobs the secretary. The association has appointed a special committee on the International Congress, of which Dr. Lawrence F. Flick, of Philadelphia, is chairman, and Dr. Joseph Walsh, of Philadelphia, secretary. The congress will be divided into seven sections, as follows:—Section i., pathology and bacteriology, president, Dr. William H. Welch, of Baltimore; section ii., clinical study and therapy of tuberculosis—sanatoria, hospitals, and dispensaries, president, Dr. Vincent Y. Bowditch, of Boston; section iii., surgery and orthopedics, president, Dr. Wm. J. Mayo, Rochester, Minn.; section iv., tuberculosis in children, etiology, prevention and treatment, president, Dr. Abraham Jacobi, of New York; section v., hygienic, social, industrial, and economic aspects of tuberculosis, president, Dr. Edward T. Devine, of New York; section vi., State and municipal control of tuberculosis, president, Surgeon-General Walter Wyman, of Washington, D.C.; section vii., tuberculosis in animals and its relations to man, president, Dr. Leonard Pearson, of Philadelphia. The section work of the congress will be carried on in the week September 28 to October 3. During that week there will be two general meetings. A tuberculosis exhibition will be open during the whole time of the congress.

MAYFIELD'S CAVE, Indiana, owing to its short distance (4½ miles) from the University laboratory, was recently selected for systematic exploration, both physiographically and faunistically. The results of this survey form the subject of a paper by Mr. A. M. Banta published by the Carnegie Institution of Washington. In the summary it is pointed out that small caves contain, as a rule, practically the whole cavern-fauna of the district in which they occur, while reference is also made to the probable origin of cave-animals.

OWING to the fact that radical structural differences, constant through large groups, are very few, while minor group-characters, in countless unexpected directions, are extremely numerous and varied, the beetles of the family Tenebrionidæ have always been extremely troublesome to the systematic entomologist. Confronted with this difficulty, Mr. T. L. Casey, in proposing a revised classification of the American representatives of the subfamily Tentyriinæ (Proc. Washington Acad., vol. ix., pp. 276–522), states that he does so with diffidence, although expressing the hope that he is on the right track.

ACCORDING to the report for the year ending on June 30, the Manchester Museum has received a bequest of books and money from the late Mr. Mark Stirrup, many years secretary to the local Geological Society. The interest of the monetary bequest (the first the museum has received) is to be devoted to the improvement of the geological collections. During the year, Prof. Hickson completed his account of the alcyonarian zoophytes obtained during the Antarctic expedition, and likewise identified and described a number of representatives of the same group obtained during the cruise of the *Huxley* in the Bay of Biscay.

OF late years the attention of naturalists interested in the phylogeny of the Insecta has been turned to the Symphyla, a group of arthropods apparently exhibiting to a certain extent characters common to millipedes, centipedes, and thysanurous insects. In the hope of further elucidating the generalised affinities of the Symphyla, Mr. S. R. Williams has therefore investigated the life-history of an American member of the group, *Scutigerella immaculata*, especially in reference to the eggs and the young larvæ, the results of which are published in the Proceedings of the Boston Society of Natural History, vol. xxxiii., pp. 461–485. In possessing seven pair of legs and ten dorsal scales, the larval Scutigerella more nearly resembles the adult than is the case with any diplopod of which the early history is known to the author, and it is therefore regarded as a highly specialised type rather than a generalised ancestral form, such as the hexapod larvæ of other diplopods are generally considered.

A MONOGRAPH of the genus Lepidium, prepared by Dr. A. Thelling, has been published in vol. xli. of the *Neue Denkschriften der schweizerischen naturforschenden Gesellschaft*. It consists of two parts, the first dealing with synonymy and morphology, the second with the classification of the species. The author splits the genus into five sections, differing slightly from the arrangement proposed by Prantl. The sections are distinguished primarily by the character of the fruit, whether winged or plain, and by the relative length and position of the style compared with the wing. Under morphology the variations in the number and position of the stamens and honey glands are noted; among the fruits, the three-valved capsule borne by a variety of *Lepidium sativum* is peculiar. The species are arranged in three geographical groups, comprising species from Europe, Asia and Africa, from America, and from Australia.

A REPORT on the prevention of malaria in British possessions, Egypt, and parts of America, presented by Prof. Ronald Ross to section vii. of the fourteenth International Congress of Hygiene and Demography, held at Berlin in September, has been reprinted from the *Lancet* of September 28 and issued in pamphlet form. In this report Prof. Ross sums up, so far as possible with the imperfect data at his disposal, the results of anti-malaria measures in British possessions. "The ideal procedure

for towns in the tropics consists (1) in the removal of mosquito-breeding waters; (2) in the treatment of old cases of malaria with quinine; and (3) in the protection, as an additional safeguard, of hospitals, barracks, jails, and as many houses as possible with wire gauze. To these we must add, as insisted upon by Stephens and Christophers, the principle of segregation of Europeans." The campaign at Ismailia has been the most successful one on record, so that in 1906 the Suez Canal Company officially reported that "toute trace de paludisme a disparu d'Ismailia." In this campaign the result is due to mosquito reduction, and also largely to cinchonisation. This example is all the more conclusive because statistics have existed for many years back. Successful and partially successful results have been obtained from many other districts, notably Klang and Port Swettenham, Hong Kong and Khartoum, and especially at Havana and Panama. Many of these results are hard to estimate on account of the insufficient data. That malaria can be stamped out—given the money—under almost any conditions can hardly be doubted; but for those who have doubts an experiment carefully planned, with all statistics carefully controlled and subject to criticism before, during, and after the experiment, would do much to remove prejudices which still exist.

THE Department of Agriculture in the United States has for some time advocated the sowing of early varieties of cotton in districts where the boll weevil flourishes. Another measure for reducing the pest, recommended in Circular No. 95, prepared by Mr. W. D. Hunter, consists in uprooting the cotton plants in the autumn as soon as the crop is cut off by the weevils; many weevils are thereby prevented from developing, and especially those which pass the winter and attack the next season's crop. It is further recommended that the plants be ploughed up and burnt.

MR. C. A. BARBER has contributed to the Memoirs of the Department of Agriculture in India, vol. i., No. 1, the second part of his investigation of the haustorium of *Santalum album*, the sandal-wood tree. The essential parts of the sucker are the cortical folds with which it grips the host root and the central core by which it penetrates. Vessels are developed around the core and in the upper part of the sucker, but there is discontinuity between them. No true bast is formed in the haustorium. The inter-relation between parasite and host is often remarkable. Sometimes the root is fiercely attacked, as in the case of *Cassia auriculata*; in other cases the parasite is unable to penetrate, as in Zizyphus. The haustorium may even attack another sandal root, when a fusion results, or a great struggle takes place.

THE greater part of the last issue of the *Kew Bulletin* (No. 9) is given up to an interesting account, communicated by Prof. H. H. W. Pearson, of a journey from Walfish Bay to Windhuk. The author distinguishes a botanical area of Walfish Bay where *Nicotiana glauca*, an Argentine colonist, and the native *Tamarix articulata* grow on the flats, and the cucurbitaceous plant *Acanthosicyos horrida* inhabits the sand dunes. The last-named exhibits a marvellous power of absorbing water and storing it in the stems thickly coated with cork. The dunes give place to a tableland, the "Namib," where *Zygophyllum Stapfii* is prominent. This is also the restricted habitat of Welwitschia. Further inland from Usakos to Winterhuk an Acacia park forest occurs. In the same volume the decade of "Diagnoses Africanæ" contains two new genera, Cordeauxia, a leguminous plant from Somaliland, and Peglera, a genus referred doubtfully to the Rhizophoraceæ.

THE Bulletin of the Italian Geographical Society, vol. viii., No. 10, contains a report on the establishment of meteorological stations at the following towns in Asia Minor:—Marash, Urfa, Diarbekir, Mesereh, Calat Scergat, and Babilonia.

FURTHER observations on the anomaly of the recession and progression of Alaskan glaciers are published by Dr. Otto Klotz in the *Geographical Journal* for October (vol. xxx., No. 4). The "Johns Hopkins" glacier has receded nearly seven miles during thirteen years, whereas the adjacent "Grand Pacific" has receded only about three and a half miles during the same period. Dr. Klotz emphasises the need for more observations of the Alaskan glaciers.

THE disputed question of the appearance of icebergs near the Orkney Islands in 1836 has been again raised by Prof. O. Krümmel in the *Zeitschrift der Gesellschaft für Erdkunde*, No. 7, 1907. Assisted by the marine superintendent of the Meteorological Office in London, Dr. Krümmel has published an extract from the log-book of S.M.S. *Cove* which seems to prove conclusively that two large icebergs were actually observed in the vicinity of the Orkney Islands in January, 1836.

AN ingenious instrument, termed a horticultural hygrometer, has been designed by Messrs. Negretti and Zambra. Buchan and Scott have shown that a knowledge of the temperature of the dew point in the late evening would enable gardeners and others to form a fair estimate of the probable minimum temperature to be expected, as it cannot easily fall below the dew point which existed at nightfall. The instrument in question makes use of this knowledge; it consists of dry- and wet-bulb thermometers, and of a cylindrical scale based upon the relation of the dew point to the difference of the readings of the thermometers. By turning the scale to correspond to this difference, it is seen at once from the position of the wet-bulb reading upon it, without the use of tables, whether the dew point is below freezing, and consequently whether frost may be expected. So far, however, as regular meteorological observers are concerned, we presume that they would probably prefer to rely on the use of simple hygrometrical tables.

THE thick fogs which have prevailed over so large a part of the country of late, and have been more than usually dense in London for so early in the season, have given prominence to the question of the dispersion of fog. A scheme invented by M. Demetrius Maggiora, by which a series of atmospheric vibrations are set up by means of explosions of acetylene or other gas in a strong steel cannon about 60 feet high and 6 feet in diameter, has been under the consideration of the Public Control Committee of the London County Council. Before committing themselves to any action on the subject, the director of the Meteorological Office, Dr. W. N. Shaw, F.R.S., has consented to examine and report upon the proposal and its suitability to the atmospheric conditions of London, and a report on the subject is anticipated at an early date.

SOME South African Tardigrada form the subject of a paper by Mr. James Murray in the Journal of the Royal Microscopical Society for October. The material for the paper was received from Mr. W. Milne, of Uitenhage, Cape Colony, in the form of gatherings of moss containing bdelloid rotifers. It yielded eight species of Echiniscus, five of Macrobiotus, and the one known species of Milnesium. Eight of the fourteen species were distinct from any species previously known.

HERBERT SPENCER'S claims as a mathematician form the subject of discussion and criticism at the hands of Dr. J. S. Mackay in the Proceedings of the Edinburgh Mathematical Society (xxv.). The author, referring to the geometrical theorems which Spencer claimed to have discovered, shows that these were well known before Spencer's time, and were not very clearly or lucidly enunciated by Spencer himself. An account of Spencer's views of antipathy towards the metric system and his advocation of the duodecimal system are also given, but his present critic considers that "his outfit of mathematical (or indeed any other) knowledge was both slender and scrappy."

THE occurrence of spinel in blast-furnace slags appears to have been first determined in 1880 by Muirhead, who found that highly aluminous slags left a proportion of very intractable residue, varying from 5 per cent. to 17½ per cent. of the whole weight. This when analysed proved to be spinel with about one-third of the magnesia replaced by iron. An interesting instance of the occurrence of spinel in a Hungarian blast-furnace slag is recorded in an abstract of a paper by Mr. J. Krenner in the October issue of the Journal of the Chemical Society. In a white, enamel-like slag obtained on smelting iron ores rich in manganese, very hard brown octahedral crystals were found. The analysis is in accord with the spinel formula; but this spinel contains more manganese than any artificial or natural member of the spinel group hitherto analysed.

MR. G. H. GULLIVER has contributed to the Proceedings of the Institution of Mechanical Engineers (1907, pp. 519–524) a paper on some phenomena of permanent deformation of metals, the object of which is to correct a hypothesis suggested in a previous paper in 1905 to explain the origin of the "contractile cross." It was then suggested that while the somewhat analogous "Lüders' lines" were due to slipping of the elementary crystals within the crystalline grains of the metal, the contractile cross was the result of the slipping of the irregular crystalline grains themselves over each other. It is now established that for aluminium, and probably for other ductile metals, the phenomena of constriction and fracture are due to excessive "slip-band" deformation, and that the contractile cross passes through the crystalline grains of the metal. It is somewhat influenced by the degree of coarseness of the crystalline structure, but is independent of the directions of the boundaries of the crystalline grains.

A COMPREHENSIVE review of the design, construction, and performance of the Cunard turbine-driven quadruple-screw Atlantic liner *Mauretania* is given in *Engineering* of November 8. The description is accompanied by 186 illustrations, many of which are two-page plates. A similar description was recently published of the *Lusitania*. The *Mauretania* and the *Lusitania* are sister-ships. They are, however, the production of different firms, and differ in numerous details, and particular attention is given in the description to these variations. The *Mauretania*, which has a length over all of 790 feet, a length between perpendiculars of 760 feet, a breadth of 88 feet, a depth, moulded, of 60 feet 6 inches, a gross tonnage of 32,000 tons, and a draught of 33 feet 6 inches, carries 563 first-class passengers, 464 second-class, and 1138 third-class. The average speed on the sea-going trial was 26·03 knots for 1200 miles.

A SIMPLE method of generating an alternating current of any desired frequency is described by Dr. Rudenberg in the *Physikalische Zeitschrift* for October 15. It consists in placing a capacity, and if necessary an inductance, in series with a series-wound dynamo, and running the machine in the ordinary way. The frequency of the current produced is determined by the capacity and inductance of the circuit, while the power is derived from the machine, which should have its field magnets laminated. A slight modification of the arrangement converts it into a sensitive receiver for wireless telegraphy.

THE *Verhandlungen der deutschen physikalischen Gesellschaft* for September 30 contains an extensive study, by Mr. L. W. Austin, of the conditions which influence the production of rapid electrical oscillations by means of the arc. He finds it possible to generate with carbon, or better with graphite, electrodes currents having frequencies of several hundred thousand per second, which, however, are not sinusoidal. The frequency with a direct-current arc increases with the current strength and with diminution of the arc length, but seems to be independent of the intensity of the oscillations. The effect is greatly increased by running the arc in hydrogen. The author recommends for telegraphic work an arc between silver or copper electrodes in air at about six atmospheres pressure, which possesses many of the properties of a rapid spark discharge, and allows a considerable resistance to be introduced into the shunt circuit.

AN important contribution to the study of the chemical changes occurring when air is submitted to the influence of electricity is contained in a paper by E. Warburg and G. Leithäuser in the *Annalen der Physik* (vol. xxiii., p. 210). It is shown that, contrary to the general opinion held hitherto, nitrogen pentoxide is always formed as well as ozone when air is subjected to the so-called "silent" discharge. The action of ozone on nitrogen pentoxide gives a strongly coloured gas "Y" having the same absorption spectrum as the substance supposed by Hautefeuille and Chappuis to be N_2O_6; the amount of "Y" formed is, however, always small in comparison with the quantity of nitrogen pentoxide present, a fact which makes it doubtful whether "Y" really has the composition N_2O_6 as first supposed, when the assumption was made that it was the only oxide of nitrogen produced by the discharge. Measurements are given of the absorption of light by the substance "Y" in the region of the visible spectrum, and also of the absorption by nitrogen pentoxide in the infra-red. The prominence of an absorption band at 5·75 μ in the latter case affords a very delicate means of detecting nitrogen pentoxide when present with other oxides of nitrogen.

THE Industrial Society of Mulhouse has issued a programme of prizes to be awarded by the society during the year 1908. The subjects open for competition this year remain practically the same as those for 1906, already summarised in NATURE (vol. lxxiii., p. 164), but a few minor alterations have been introduced. The programme can be obtained on application to the secretary at Mulhouse.

MR. GUSTAV FISCHER, Jena, has just published the fourth revised edition of Prof. W. Kükenthal's "Leitfaden für das zoologische Praktikum." A short section on spiders has been added after the chapter on insects. The character of the work was described in a review of the second edition published in NATURE of April 24, 1902 (vol. lxv., p. 581).

THE process of transmitting photographs by electricity devised by Prof. Korn, of Munich, and described in NATURE of August 29 (vol. lxxvi., p. 445), has been adopted

by the *Daily Mirror* for use between London and Paris. A demonstration of the methods and results obtained by this process was given at the offices of that journal on Thursday last, November 7.

A SECOND edition, revised and enlarged, of Prof. Prafulla Chandra Rây's "History of Hindu Chemistry, from the Earliest Times to the Middle of the Sixteenth Century A.D., with Sanskrit Texts, Variants, Translation and Illustrations," has been published by Messrs. Williams and Norgate. The book appeared first in 1902, and was reviewed in the issue of NATURE for May 21, 1903 (vol. lxviii., p. 51). Some material additions have been made to the historical portion of the introduction, throwing further light on the independent origin of the Hindu system of medicine and its priority to that of the Greeks.

THE second volume of the French translation of the third English edition of Mr. W. W. Rouse Ball's "History of Mathematics" has been published by M. A. Hermann, of Paris. The price is 8 francs. The translation is the work of M. L. Freund. The volume has been edited with additions by Dr. R. de Montessus, while M. G. Darboux's paper entitled "Étude sur le Développement des Méthodes géométriques," read at the St. Louis Congress in 1904, is appended. From the same publishers we have received a copy of the second French edition—the work of Mr. J. FitzPatrick—of part iii. of Mr. Rouse Ball's "Mathematical Recreations and Essays"; the translation follows the fourth English edition, and has been enlarged by the inclusion of numerous additions.

MESSRS. GEORGE BELL AND SONS have published a third edition of "A Laboratory Outline of General Chemistry," by Prof. Alexander Smith, professor of chemistry in the University of Chicago, which has been revised in collaboration with Mr. William J. Hale. The first edition of the book was reviewed in our issue for November 9, 1899 (vol. lxi., p. 27). In the preface to the present edition, the authors remark:—"In the effort to make misapprehensions and mistakes as nearly impossible as may be, the directions have been entirely re-written, and in many cases have been amplified, and a number of the experiments have been modified. An entirely new set of figures has also been drawn. To render the exercises more instructive, and still further to discourage mechanical work, a larger number of questions has been inserted."

OUR ASTRONOMICAL COLUMN.

OCCULTATION OF NEPTUNE BY THE MOON.—Dr. Downing directs our attention to an accidental omission from the Nautical Almanac for 1907, of which he publishes particulars in No. 389 (p. 412, November) of the *Observatory*. The data omitted were the particulars of two occultations of Neptune by the moon, due to take place on November 23 and December 20 respectively, and visible at Greenwich; they are as follow:—

Date 1907	Disappearance				Reappearance			
	Time		Angle from		Time		Angle from	
	Sidereal	Mean	N. point	Vertex	Sidereal	Mean	N. point	Vertex
	h. m.	h. m.	°	°	h. m.	h. m.	°	°
Nov. 23	1 4	8 57	131	171	1 47	9 40	218	260
Dec. 20	11 14	17 20	180	138	11 23	17 29	195	153

THE IMPROVEMENT OF CELESTIAL PHOTOGRAPHIC IMAGES.—In No. 31 (September 10) of the Lowell Observatory Bulletins, Prof. Lowell describes a method of combining the use of colour screens and isochromatic plates in the photography of Mars, whereby he has succeeded in obtaining much sharper images of the planet's details. In the first instance, it was seen that the colour curve for the 24-inch object-glass was much flatter in the yellow region, about λ 5600, than elsewhere, and further that the inclination of the curve was much greater on the blue than on the red side of the yellow region. To obtain maximum efficiency, then, it seemed necessary to exclude those rays more refrangible than λ 5000, and to bathe the plates so that the orange and red radiations should become more effective. Accordingly, Mr. Wallace was asked to construct screens which would absorb the rays of lower wavelength than λ 5000, and a Seed "23" plate, bathed with pinachrome and pinacyanol, was exposed in conjunction with the screen. This, however, was unsuccessful, and Prof. Lowell then tried Cramer instantaneous isochromatic plates having sharp maxima at λ 4600 and λ 5650. Using the orange screen, which cut out the λ 4600 maximum, very successful photographs were obtained, and Prof. Lowell hopes that during the opposition of Mars in 1909 this method will produce much better photographs than those already obtained. He places on record that one of his plates taken at the recent opposition showed a canal which had hitherto escaped detection, but was seen for the first time on examining the planet next night.

THE GREAT RED SPOT ON JUPITER.—The acceleration of the Great Red Spot on Jupiter is discussed by Mr. Denning in the *Observatory* for November (p. 411, No. 389), who points out that while the acceleration could be accounted for by the passage of the great S. temperate spot when this occurred, as in 1906, some other explanation must be sought for the acceleration during the past summer, when the S. temperate spot was on the opposite side of the disc to the red spot. Mr. Denning hints at the possibility of there being a minor acceleration when the two objects are in opposition, and indicates the necessity for further careful observations. The S. temperate spot has been visible since 1901, and seems likely to continue so for many years; it was in conjunction with the red spot in May, 1906, and will be so again in April-May, 1908.

RED STARS NEAR NOVA VELORUM.—On examining a plate taken with the 24-inch Bruce telescope on June 6, Mrs. Fleming found the spectrum of a new gaseous nebula, which on further examination proved to be the spectrum of Nova Velorum. This plate includes the region

R.A. 10h. 36m. to 11h. 23m., dec. −51° to −57° (1875),

and shows so many interesting spectra characteristic of red stars that Prof. Pickering publishes a list, in Circular No. 131, giving the C.P.D. designation, the position, the magnitude, and the spectral type of some thirty-four of the included objects. The spectrum of Nova Velorum includes seven bright lines at λλ 5013, 4926, 4862, 4643, 4611, 4340, and 4101 respectively, six of which appear to coincide with bright lines in the later spectrum of Nova Persei. The strong helium line at λ 4472, which was bright in Nova Persei (No. 2), is, however, absent from Nova Velorum.

THE SYSTEMATIC ERROR OF LATITUDE OBSERVED WITH A ZENITH TELESCOPE.—From his observations of latitude at Berlin, Herr Battermann found a systematic difference between the latitudes observed by the east-to-west and the west-to-east positions of the zenith telescope. In No. 4207 of the *Astronomische Nachrichten* (p. 97, October 17) Mr. K. Hirayama, of the Tokyo Observatory, discusses this error, basing his conclusions on the results obtained at various stations, and finds that the difference appears to vary with the zenith-distance. As to how the declination of the observed star can affect the reading of the micrometer requires further investigation, but Mr. Hirayama suggests that it may be a physiological effect produced by the varying speed of the star in the field.

INEQUALITIES IN THE MOTION OF THE MOON.[1]

THE most interesting result of Prof. Newcomb's researches on the planetary inequalities in the moon's motion is that he has found 1″·14 as the theoretical coefficient of the Jupiter evection term. This term was discovered empirically by Prof. Newcomb in 1876, and Mr. Nevill assigned its origin to Jupiter. Dr. Hill and Radau independently computed its coefficient as 0″·9. Two or three years ago it was pointed out that the observations indicated a coefficient 1″·1, and now Prof. Newcomb has obtained the same result by theory. This term is now worked out; the subject begins and ends with Prof. Newcomb, and has lasted thirty-one years. No indication is given in the memoir before us as to why Hill and Radau concurred in an imperfect value. It was a curious incident, as we know of no other case where any result of either of these two mathematicians has required revision.

In order to illustrate the methods of the memoir, we briefly indicate the process of calculating the Jupiter evection term.

First Stage.—Using the ordinary notation supplemented by $\alpha = \log a$, Prof. Newcomb starts from Delaunay, vol. ii., pp. 235–6 and 800, and obtains on p. 19 the equations of variation

$$\frac{d}{d(nt)}\alpha = \frac{a}{\mu}\left(\alpha_1\frac{\partial P_1}{\partial l} + \alpha_2\frac{\partial P_1}{\partial \pi} + \alpha_3\frac{\partial P_1}{\partial \theta}\right)$$

$$\frac{d}{d(nt)}e = \frac{a}{\mu}\left(e_1\frac{\partial P_1}{\partial l} + e_2\frac{\partial P_1}{\partial \pi} + e_3\frac{\partial P_1}{\partial \theta}\right)$$

$$\frac{d}{d(nt)}\gamma = \frac{a}{\mu}\left(\gamma_1\frac{\partial P_2}{\partial l} + \gamma_2\frac{\partial P_1}{\partial \pi} + \gamma_3\frac{\partial P_1}{\partial \theta}\right)$$

$$\frac{d}{d(nt)}l_0 = -\frac{a}{\mu}\left(\alpha_1\frac{\partial P_1}{\partial \alpha} + e_1\frac{\partial P_1}{\partial e} + \gamma_1\frac{\partial P_1}{\partial \gamma}\right)$$

$$\frac{d}{d(nt)}\pi_0 = -\frac{a}{\mu}\left(\alpha_2\frac{\partial P_1}{\partial \alpha} + e_2\frac{\partial P_1}{\partial e} + \gamma_2\frac{\partial P_1}{\partial \gamma}\right)$$

$$\frac{d}{d(nt)}\theta_0 = -\frac{a}{\mu}\left(\alpha_3\frac{\partial P_1}{\partial \alpha} + e_3\frac{\partial P_1}{\partial e} + \gamma_3\frac{\partial P_1}{\partial \gamma}\right)$$

P_1 being the potential of the disturbing forces.

He also gives (p. 18) the numerical values of α_1, &c., as follows:—

$$\alpha_1 = +2\cdot0228 \quad e_1 = \ \ 0\cdot0168 \quad \gamma_1 = -0\cdot0229$$
$$\alpha_2 = -0\cdot0301 \quad e_2 = -19\cdot1534 \quad \gamma_2 = -0\cdot0200$$
$$\alpha_3 = +0\ 0075 \quad e_3 = +\ 0\cdot0026 \quad \gamma_3 = -5\cdot5700$$

Second Stage.—Neglecting certain small terms, we have for the potential of the direct action of a planet

$$\frac{a}{\mu}P_1 = MK\,(\xi^2-\eta^2) - \tfrac{1}{2}MC\,(\rho^2-3\zeta^2) + MD2\xi\eta,$$

and a similar form for the potential of the indirect action

$$\frac{a}{\mu}P_1 = -m^2G(\xi^2-\eta^2) - m^2J(\rho^2-3\zeta^2) + m^2I2\xi\eta.$$

For brevity, the sum of the two may be written

$$\frac{a}{\mu}P_1 = 10^{-3}K'(\xi^2-\eta^2) - 10^{-3}C'(\rho^2-3\zeta^2) + 10^{-3}D'2\xi\eta.$$

In the above formulæ, ξ, η, ζ, denote the lunar coordinates divided by the moon's mean distance, the axis of ξ being directed towards the mean sun;

$$\rho^2 = \xi^2+\eta^2+\zeta^2;$$

and the coefficients MK, MC, MD, m^2G, m^2J, m^2I are known functions of the positions of the earth and the disturbing planet in their orbits. Of these six coefficients, the expansion of the first three in the form

$$\Sigma \begin{matrix}\cos\\ \sin\end{matrix} i(g_4-g') + jg',$$

i, j being integers, is exceedingly troublesome, and the expansion of the other three assumes that the mutual perturbations of the earth and planet have been calculated.

We are going to illustrate the methods of the memoir by considering as an example the perturbations arising from terms in P_1 with argument

$$2\pi - 2J \text{ or } 2D - 2g + 2g' - 2J.$$

[1] "Investigation of Inequalities in the Motion of the Moon produced by the Action of the Planets." By Simon Newcomb, assisted by Frank E. Ross. Pp. viii+160. (Washington: The Carnegie Institution, 1907).

Such a term may arise in P_1 by combining a lunar argument $2D-2g+jg'$ with a planetary argument

$$-jg'+2g'-2J,$$

j being given any integral value; but we will confine our attention to the case $j=0$, which gives rise to the only sensible term of the whole number.

We require, therefore, to pick out the planetary terms with argument $2J-2g'=N_4$, and the lunar terms with argument $2D-2g=N$.

The following extracts from the memoir cover the first part of the work:—

From p. 85, Table XXII.:—

$$10^3MK = +6''\cdot119\cos N_4 + 0''\cdot006\sin N_4$$
$$\tfrac{1}{2}10^3MC = -0''\cdot293\cos N_4 + 0''\cdot001\sin N_4$$
$$10^3MD = -0''\cdot005\cos N_4 + 6''\cdot114\sin N_4$$

From p. 97, Table XXXIII.:—

$$10^3m^2G = -24\cdot668\cos N_4 - 0''.358\sin N_4$$
$$10^3m^2J = -\ 8\cdot096\cos N_4 - 0''\cdot061\sin N_4$$
$$10^3m^2I = +\ 0\cdot363\cos N_4 - 23''\cdot488\sin N_4$$

Hence by addition, p. 145, Table XLV.,

$$K' = +30''\cdot81\cos N_4 + (0''\cdot38\sin N_4)$$
$$C' = -\ 8''\cdot39\cos N_4 - (0''\cdot06\sin N_4)$$
$$D' = (+0''\cdot35\cos N_4) - 17''\cdot37\sin N_4$$

It will soon appear that the six terms of K′, C′, D′ fall into two groups of three; one group of three is indicated by brackets, and will not be proceeded with, as the other and more important group suffices for illustration.

Third Stage.—With the notation (see p. 24)

$$\xi^2-\eta^2 = 2p\cos N$$
$$\rho^2-3\zeta^2 = 2q\cos N$$
$$2\xi\eta = k\sin N$$

we extract from Table XL., p. 112, for this argument $N=-2g+2\lambda-2\lambda'=2D-2g=2\pi-2g'$, the values

$$2p = +0\cdot007\ 809 \quad 2\frac{\partial p}{\partial \alpha} = +0\cdot000\ 30 \quad 2\frac{\partial p}{\partial e} = +0\cdot284\ 09$$

$$2q = +0\cdot001\ 807 \quad 2\frac{\partial q}{\partial \alpha} = +0\cdot003\ 73 \quad 2\frac{\partial q}{\partial e} = +0\cdot065\ 69$$

$$k = +0\cdot007\ 185 \quad \frac{\partial k}{\partial \alpha} = -0\cdot000\ 60 \quad \frac{\partial k}{\partial e} = +0\cdot261\ 69$$

and we note that the differentials with regard to γ are insensible.

These expansions are derived partly from Delaunay's lunar theory and partly from Brown's.

Fourth Stage.—In the differential equations of variation put $\frac{a}{\mu}P_1 = 2p\cos N$.

$$\frac{d}{d(nt)}\alpha = -2p\sin N.\alpha_0 \text{ where } \alpha_0 = \iota\alpha_1 + \iota'\alpha_2 + \iota''\alpha_3$$

(ι ι', ι'', are the coefficients of l, π, θ in N, or $2\pi-2g'$, so that $\iota'=2$, $\iota=\iota''=0$).

Similarly,

$$\frac{d}{d(nt)}e = -2p\sin N.e_0 \text{ where } e_0 = \iota e_1 + \iota' e_2 + \iota'' e_3.$$

We shall drop the equation for γ, and extract from Table XLVII., p. 146, the values

$$\alpha_0 = -0\cdot0602 \quad e_0 = -38\cdot307,$$

as may be easily verified from the values of $2\alpha_2$ and $2e_2$ at the beginning of this article.

From Table XLVIII., p. 147, we extract values of products of $p\ q\ \frac{1}{2}\ k$ by α_0 and e_0:—

$$\alpha_0 p = -0\cdot000\ 235 \quad \alpha_0 q = -0\cdot000\ 054 \quad \tfrac{1}{2}\alpha_0 k = -0\cdot000\ 216$$
$$e_0 p = -0\cdot149\ 20 \quad e_0 q = -0\cdot034\ 28 \quad \tfrac{1}{2}e_0 k = -0\cdot137\ 90$$

Again, noting that

$$\frac{a}{\mu}\frac{\partial P_1}{\partial \alpha} = \left(2+\frac{\partial}{\partial \alpha}\right)\left(\frac{a}{\mu}P_1\right)$$

$$-\frac{d}{d(nt)}l_0 = \left\{\alpha_1\left(4p+2\frac{\partial p}{\partial \alpha}\right) + e_1 2\frac{\partial p}{\partial e} + \gamma_1 2\frac{\partial p}{\partial \gamma}\right\}\cos N = 2L'\cos N$$

$$-\frac{a}{d(nt)}\pi_0 = \left\{\alpha_2\left(4p+2\frac{\partial p}{\partial \alpha}\right) + e_2 2\frac{\partial p}{\partial e} + \gamma_2 2\frac{\partial p}{\partial \gamma}\right\}\cos N = 2P'\cos N,$$

we shall drop the equation for θ_0, and noting that when q and k respectively replace p, then L′, P′ become in Prof. Newcomb's notation L″, P″ and L_4, P_4.

From Table XLIX., p. 147, we extract :—

$$L' = +0{\cdot}013\ 67 \quad 2eP' = -0{\cdot}298\ 75$$
$$L'' = +0{\cdot}006\ 84 \quad 2eP'' = -0{\cdot}069\ 08$$
$$L_4 = +0{\cdot}023\ 51 \quad eP_4 = -0{\cdot}275\ 19$$

In Prof. Newcomb's value of L′ we think a small error (about 0·00020) has been introduced.

Now putting

$$\frac{a}{\mu}P_1 = K_c' \cos N_4\ 2p \cos N - C_c' \cos N_4\ 2q \cos N + D_s' \sin N_4\ k \sin N$$

we get

$$-\frac{d}{d(nt)}l_0 = (2K_c'L' - 2C_c'L'' = 2\lambda_1) \cos N_4 \cos N + D_s'L_4 \sin N_4 \sin N$$

$$-\frac{d}{d(nt)}\pi_0 = \left(2K_c'P' - 2C_c'P'' = \frac{2\pi_1}{e}\right) \cos N_4 \cos N + D_s'P_4 \sin N_4 \sin N$$

$$\frac{d}{d(nt)}\alpha = (-2K_c'\alpha_0 p + 2C_c'\alpha_0 q = 2a_2) \cos N_4 \sin N + D_s'\alpha_0 k \sin N_4 \cos N$$

$$\frac{d}{d(nt)}e = (-2K_c'e_0 p + 2C_c'e_0 q = e_2) \cos N_4 \sin N + D_s'e_0 k \sin N_4 \cos N.$$

At this point we shall reject the terms in $N + N_4$ and write

$$-\frac{d}{d(nt)}l_0 = (\lambda_1 + \tfrac{1}{2}D_s'L_4 = h_{l,e'}) \cos (N - N_4)$$

$$-e\frac{d}{d(nt)}\pi_0 = (\pi_1 + \tfrac{1}{2}D_s'eP_4 = eh_{\pi,e'}) \cos (N - N_4)$$

$$\frac{d}{d(nt)}\alpha = (a_2 - \tfrac{1}{2}D_s'\alpha_0 k = h_{\alpha,s'}) \sin (N - N_4)$$

$$\frac{d}{d(nt)}e = (\tfrac{1}{2}e_2 - \tfrac{1}{2}D_s'e_0 k = h_{e,s'}) \sin (N - N_4).$$

Putting $\nu' = \dfrac{\text{mean motion of moon}}{\text{mean motion of } N - N_4}$

we obtain on integration

$$2\Delta e = -2\nu' h_{e,s'} \cos (N - N_4) = 2e_c' \cos (N - N_4)$$
$$2e\Delta\pi = -\nu' 2eh_{\pi,e'} \sin (N - N_4) = 2e\pi_s' \sin (N - N_4),$$

and by a double integration, remembering that $\Delta\alpha = -\frac{2}{3}\frac{\Delta n}{n}$,

$$\Delta l = \nu'\left(\frac{3}{2}\nu' h_{\alpha,s} - h_{l,e}\right) \sin (N - N_4) = l_s' \sin (N - N_4).$$

From p. 153 we extract

$$\nu' = 232{\cdot}720 \quad l_s' = +0''{\cdot}256$$
$$2e_c' = -1''{\cdot}158$$
$$2e\pi_s' = +1''{\cdot}164.$$

Lastly, if we substitute in

$$\delta v = \delta l + 2\delta e \sin g + 2 \cos g (e\delta l - e\delta\pi)$$

we get

$$\delta v = -1''.15 \sin (g + 2\pi - J).$$

Turning now to the statement of final results on pp. 156–9, we note, with the single exception of the Jupiter evection term, its mainly negative character. Results previously given by Radau and Brown are only very slightly modified, generally by quantities quite insensible to observation. Moreover, no explanation has been reached of the unknown term of long period. Thirty years ago Prof. Newcomb, in what are known as Newcomb's corrections, assigned a coefficient 15″·5 and a period of 273 years with an argument arising from the action of Venus to this unknown term. It is now known that the argument is impossible. The present writer thinks that both the coefficient and the period require some increase. At any rate, Newcomb's empirical term has now ceased to represent the observed motion of the moon. It is not, of course, to be expected that empiricism will predict with any accuracy for any length of time. In the last paragraph of his memoir, Prof. Newcomb recalls his attempt to establish an inequality in the earth's rotation that should simultaneously account for the motion of the moon and the transits of Mercury. About forty years ago there was an impression that planetary astronomy had been worked out by Hansen and Le Verrier. The lunar tables of the one and the planetary tables of the other marked immense advances on those of their predecessors, and the extant observations were not sufficient to sound any note of warning except that it might have been noted that Hansen's tables did not account for the ancient eclipses. We now have new planetary tables and the materials for new tables of the moon, but we cannot share the satisfaction of our predecessors of forty years ago. A very considerable list of residual phenomena has accumulated. Apses and nodes and secular terms do not accord with theory. In the moon some periodic terms are unexplained. In Mars it seems as if a term with one second as coefficient and period about twenty years is required to reconcile theory and observation. In the present memoir Prof. Newcomb has presumably excluded the action of the planets as a possible explanation of the vagaries of the moon.

A word ought to be said as to the excellent form of presentation of the subject by Prof. Newcomb. It illustrates the Roman maxim, so often quoted by the late headmaster of Eton, "Divide et impera"—subdivide into sections, and you will get the grip of it.

NEW FACTS ABOUT THE ARUNTA.

THE Arunta of Central Australia have loomed large of late in ethnological controversy, but we are destined to hear further discussion in the near future. Hitherto our information has been derived first from the observations of Mr. F. J. Gillen in part iv. of "The Report of the Horn Expedition to Central Australia," 1896, and later from the two well-known admirable books by Prof. Baldwin Spencer and Mr. Gillen. In a recent number of *Globus* (Bd. xci., No. 18, p. 285) Herr M. Freiherr v. Leonhardi has an article "On some Religious and Totemic Conceptions of the Aranda and Loritja in Central Australia," based upon information received from Herr C. Strehlow and Herr Reuther, of the Neuen Dettelsaur Mission, who have a mastery over the language of the Arunta, or Aranda. Some of the information thus obtained is so different from that recorded by Spencer and Gillen that it opens a new phase in the discussions concerning these remarkable people. Only the more salient points of Leonhardi's article can be here given; students will have to study it in detail, and they will await with eagerness the promised volume.

The Arunta certainly believe in a supreme, good, heaven-god called Altjira; he is the god of the upper world, and has little to do with men. He has the appearance of a tall man with a red skin and long hair falling over his shoulders, but he has feet like an emu, he eats vegetable food, and the flesh of the emu, which he spears. He is surrounded by beautiful youths and maidens, who are immortal. The stars are his camp-fires, the Milky Way his hunting-ground. Only certain specially conspicuous stars, such as the evening star, the Pleiades, &c., and sun and moon are ancestors of the Arunta, who once lived on earth and had certain totems. From this Altjira, who lives in heaven, and of whom no Tjurunga (Churinga) exists, must be clearly distinguished the ancestors, honoured as gods and endowed with superhuman powers, who lived on earth sometimes as animals, sometimes as men. In three neighbouring groups the supreme God is distinguished from the totem gods in the following way :—Dieri, supreme being, *Mura*, deified ancestors or totem gods, *Mura-Mura*; Arunta, supreme being, *Altjira* (the Uncreated), totem gods, *Altjira-ngamitjina* (the everlasting Uncreated) or *Intrara* (the Undying); Loritcha, supreme being, *Tukura* (the Uncreated), totem gods, *Tukutita* (the eternal Uncreated). Originally Gillen described a great spirit (*Ulthaana*), of whom no mention was made in the subsequent works, but in these "the most important spirit individual in the Arunta tribe is Twanyirika," though we are told he is not regarded "as a supreme being who in any way whatever was supposed to inculcate moral ideas." Neither is Altjira the guardian of cults and morals.

Herr Leonhardi writes:—"Among the most noteworthy of the discoveries of Spencer and Gillen was the idea that each man is the reincarnation of a totemic ancestor, and that after death, each soul returns to its totem centre, where the spirit individuals spend the time between the two incarnations. These child-germs enter the women, conception by means of men being unknown. In the neighbourhood of whichever totem centre a woman first feels pregnant, that becomes the totem of the child. I was not a little astonished when Herr Strehlow wrote that he could not find any reincarnation theory among the blacks, and that it must be a misunderstanding; but Spencer and Gillen are so positive, 'In every tribe without exception the belief in reincarnation is universal.'" Strehlow writes:—"I have made careful inquiries concerning the points raised. I have inquired of different blacks at different times, among others of three witch doctors, who are regarded as guardians of tradition, who grew up in heathendom. They all declare these ideas to be wrong. In different places there are numerous *ratapa* (origins of men, unborn men, who have body and soul, but are invisible). The male origins are in rocks, trees, or in the mistletoe growing on the latter; the female mostly in clefts in rocks. Each *ratapa* belongs to a certain totem, and the *ratapas* of the same totem are collected in one place. This was caused by the totem-ancestors 'getting tired' of their long wandering, and their bodies changed into rocks, trees, &c., and their souls collected in an underground cave. The child-germs are in these rocks and trees, and they go forth thence. If now a woman, who conceives, passes such a mistletoe branch or rock cleft, a *ratapa* enters as a grown youth or girl with body and soul, into her body, causing pains. The *ratapa* grows smaller in the woman's body until later it is born as a child. If an *apma* (snake) *ratapa* enters into a woman, the child belongs to the *apma* totem.

"When a man dies his soul (*etana*) goes, not to the totem centre, but to the island of the dead, where it remains for a time. Eventually it returns to its earlier dwelling place on the earth and says to its former friends, 'Be careful, lest you meet such a fate as mine!' If the dead man has left behind on the earth a small child, his soul enters into it and lives there until the child has grown up and has a beard, when the father's soul departs again, or it enters into his grandson in the same manner. It is finally destroyed by a flash of lightning. Thus one cannot speak of a reincarnation, but only of the temporary dwelling of the soul of the father or grandfather in his son or grandson." Strehlow assures Leonhardi that all the Arunta have the same belief.

"There are other means by which the children enter the women. The *atua ngautja* (souls of totem ancestors dwelling in underground caves) can also enter into the women, if they wish to return to this earth, though their final fate is utter annihilation. A child can enter its mother in animal or plant form. If a woman feels the first intimations of pregnancy immediately after seeing a kangaroo, which runs off and disappears, there is no doubt but that her child will be a kangaroo child.

"Each individual has relationship with two totems, he belongs to the one by birth, or rather by conception, this totem he calls *runga*. The other totem belongs to him, is bound up with him, has communion (*altja*) with him, so he calls it *altjira*. Thus the totem animal or plant of his mother which is forbidden to her to eat is his *altjira*, which belongs to him, of which he can eat as he will. A man named Ebalanga belongs to the iguana totem, so all iguanas are regarded as his friends, or even as his relations, for according to the ideas of the blacks he is himself an iguana. He may kill iguanas but sparingly, and eat only the tail and legs. The wild duck is his mother's totem, this is bound up with him, is his guardian, on whose flesh he feeds." As Leonhardi points out, "the great interest in these new facts is that we have here clearly a totem inherited through the mother. It may be that here is preserved a relic of earlier times, when the totem was inherited directly from the mother, as among so many other Australian tribes, and that the peculiar belief about the conception of children was a later development. As to the primitiveness of the Arunta and their neighbours, there has been much discussion, and the above facts may give new aspects to the controversy."

A word of warning seems desirable. The Arunta investigated by Herr Strehlow appear to have been Christianised, and some of their statements may have been influenced by the new teaching; also there may be slightly different beliefs among various sections of the Arunta. Doubtless these points will be fully discussed in the final publication. A. C. H.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—At the request of the special board for biology and geology, the general board is proposing to establish a demonstratorship in petrology. This demonstrator will be paid by fees, and not directly by the University.

The same board has also received a communication from the special board for biology and geology requesting that the title "Readership in Animal Morphology" (recently vacated by the election of Mr. Adam Sedgwick as professor of zoology) be changed to "Readership in Zoology." This will widen the subject of the readership so that it will include such subjects as variation and heredity, and will enable the University to provide for the teaching of these subjects, which for the last few years has been given by Mr. Bateson as deputy for the professor of zoology. The general board proposes that the annual stipend attached to the readership should be 100*l*., to be paid from a common university fund, and that the readership be attached to the board for biology and geology.

The Senate has sanctioned an alteration to the Previous Examination of some moment, although it excited no comment and little interest in the University. In future it will be possible for a candidate to take a paper on elementary heat and chemistry as an alternative to the papers on Paley's "Evidences" and elementary logic. In the same part of the examination a single combined paper on arithmetic and algebra will in future be set instead of the separate papers on those subjects.

There was a discussion last week on the proposal of the medical board to institute a third first M.B. Examination (chemistry, physics, and elementary biology) by holding one at the commencement of the October term. The proposal met with little opposition, though it was pointed out that the time of year was rather inconvenient. Supporters of the scheme hope that in time the October examination will largely take the place of the one held at present in December, and that the latter will ultimately disappear.

The electors to the Isaac Newton studentship give notice that the election to a studentship will be held in the Lent term, 1908. The studentships are for the encouragement of research and study in astronomy. Persons eligible are members of the University who have been admitted to the degree of Bachelor of Arts, and who shall be under the age of twenty-five on January 21, 1908. The studentship is usually of the value of 200*l*. per annum.

PROF. W. F. M. GOSS, one of the leading American authorities on railway engineering, has been appointed Dean of the college of engineering of the University of Illinois.

THE Civil Service Commissioners announce, in regard to open competitive examinations for clerkships in the Upper Division of the Civil Service, that, after next year, geography, treated scientifically, will be added to the list of subjects included under the head natural science of which four may be taken up.

A COURSE of eight lectures on the function of the mineral constituents of the soil in the nutrition of plants, by Mr. A. D. Hall, will be given, as part of the advanced lectures in botany of the University of London, in the lecture room of the Chelsea Physic Garden on Mondays and Thursdays, beginning on November 11 at 5 p.m. Dr. O. Rosenheim will give a course of three advanced lectures in physiology

on the borderland of animal and vegetable chemistry (proteins, lecithins, pigments, &c.) at King's College on Mondays, beginning on November 25, at 4.30 p.m.

THE Board of Education, South Kensington, has just issued the following list of successful candidates this year for Royal exhibitions, national scholarships, and free studentships (science):—*Royal exhibitions:* W. F. Frew, Plymouth; G. E. Morgan, Portsmouth; E. Grigg, Southsea; E. A. Steed, Devonport; W. E. Curtis, London; H. Carter, Triangle, Halifax; H. W. Turner, Portsmouth. *National scholarships for mechanics (Group A):* A. W. Judge, Portsmouth; A. Regnauld, London; F. R. Rogers, Devonport; C. Bartlett, Plymouth; F. H. G. Marks, Plymouth; J. H. Thomas, Ovenden, Halifax. *Free studentships for mechanics (Group A):* S. Ll. Symns, London; F. A. Bumpus, Birmingham; R. G. M. Frost, Plymouth; E. W. Stedman, Sheerness. *National scholarships for physics (Group B):* A. G. Tarrant, London; J. Hill, Glasgow; J. Macpherson, Manchester; A. Holmes, Gateshead; W. White, Glasgow. *Free studentship for physics (Group B):* W. C. Simmons, Southampton. *National scholarships for chemistry (Group C):* S. R. Illingworth, Shipley; H. Griffiths, Middlesbrough; A. T. Eggington, Ibstock, Leicester; A. Caruth, Birkenhead; L. W. Burridge, London. *Free studentship for chemistry (Group C):* F. A. Knott, London. *National scholarships for biology (Group D):* E. Bateson, Bradford, Yorks; J. Sharpe, Burnley; W. Rushton, Burnley. *National scholarships for geology (Group E):* C. H. Cunnington, London; T. Eastwood, Burnley; E. J. Wayland, London.

MACDONALD COLLEGE, Quebec, established and endowed by Sir William Macdonald, of Montreal, was opened to students on November 7. The object of the founder is the advancement of education, the carrying on of research, the spreading of knowledge likely to benefit rural districts, and the training of teachers for rural schools. From an article in the *Times* of November 9, we learn that the college property comprises 561 acres, and has been divided into the campus of 74 acres, where the buildings are located, with demonstration plots for grasses and flowers; a farm of 100 acres for horticulture and poultry keeping; and a live-stock and grain farm of 387 acres. The buildings have been planned in accordance with the most modern scientific principles. The main building includes departments for nature-study and household science, both with appropriate laboratories. Near the main building are buildings for biology and chemistry, each furnished with laboratories and lecture rooms. The main agricultural building contains greenhouses and laboratories of the live-stock farm, dairy, and horticulture department, the farm machinery hall, and a pavilion for live-stock judging. A poultry building with an annexed brooder house are adjacent to the poultry yards, and in addition there is provision for many other agricultural activities. The cost of the buildings and equipment exceeds 300,000*l.*, and, in addition, Sir William Macdonald has provided a permanent endowment of 400,000*l.* The college is incorporated with McGill University, and Dr. James W. Robertson, C.M.G., is the principal. The college includes a school for teachers, a school of household science, and a school of agriculture. Tuition will be free to residents in the Province of Quebec. There will be a small laboratory fee not exceeding 1*l.* to cover the actual cost of the materials used, and a contingency fee to cover possible breakages, penalties, and other demands. Board, room, and washing will be furnished for 13*s.* per week each, where two students occupy one room, and, in the case of students occupying single rooms, for 14*s.*

AT the Mansion House, London, a meeting was held on November 6 in furtherance of the interests of the permanent buildings fund of the University College of North Wales, Bangor. At the opening of the proceedings Lord Kenyon read a letter from the Prince of Wales, who, as Chancellor of the University of Wales, heartily wished success to the meeting, and pointed out that since the question of higher education in Wales was taken up by the Government twenty-seven years ago, it has been zealously supported by the people of the Principality. They have recognised it as an essential to their progress and prosperity, and this fresh effort should help Wales to render the highest services to the kingdom and Empire. A striking proof of this spirit is to be found in the support received from all classes to the original scheme for the college, when 30,000*l.* was raised by 8000 subscribers, of whom only sixty-eight contributed sums of more than 100*l.* and upwards. This spirit has been equally conspicuous in the case of the present appeal, towards which 30,000*l.* has been collected. During the last twenty-three years the successful and steadily increasing work of the college has been carried on in temporary buildings; but from the outset it was the deliberate policy of the college to provide a first-rate staff, and to postpone the question of buildings until the character of the institution had been determined by their efforts. When the Prince of Wales visited Bangor five years ago, the first step towards providing buildings had just been completed by the munificent gift of a site of the value of 15,000*l.* from the corporation. The laying of the foundation-stone by the King this year has now happily inaugurated the actual work of construction. The present intention is to endeavour to complete the arts and administrative section, but it is hoped that in the near future means may be forthcoming to erect the buildings for the science departments, the work of which must for the present be carried on in the old laboratories. A further contribution of 100*l.* towards the building fund was also received from the Prince of Wales, and announced at the meeting. In addressing the meeting, Lord Kenyon referred to the exhaustion of the resources of North Wales and to the depressed state of the slate trade, in connection with which reference was made to the large amount of support the college had received from the ordinary working quarrymen. Sir Harry Reichel, the principal, gave some interesting statistics showing the same spirit of spontaneous effort in the interests of the Welsh university movement on the part of the middle and working classes of North Wales that was referred to in last week's NATURE in connection with the visit of the Chancellor of the Exchequer to Aberystwyth. It was announced that 11,800*l.* had already been subscribed in London alone. It may be interesting to mention that the progress of the college and its influence on the schools of Wales is shown quite as much in the higher standard of attainment of the students as in the increase in numbers. The unmatriculated students, who used to form a large percentage, have now dwindled down to the vanishing point.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Microscopical Society, October 16.—Dr. J. W. H. Eyre, vice-president, in the chair.—Mr. **Taverner** exhibited a number of stereo-photomicrographs of water mites, taken with a stop behind the objective, as described before a previous meeting. They were taken in their natural colours by the Sanger Shepherd three-colour process.—Ghost images in the secondaries of *Coscinodiscus asteromphalus*, with some remarks on the highest useful ratio of magnifying power to aperture: A. A. C. E. **Merlin.** In an experiment suggested by some remarks of Mr. Nelson, the author was able to distinguish perfectly well-defined ghost images of the condenser stop in many of the cap perforations of *Coscinodiscus asteromphalus*. He used a selected Zeiss 3 mm. apochromat of N.A. 1·42 and a 40 ocular in conjunction with a Powell's dry apochromatic substage condenser. The exact size of the perforations was measured and found to be 1/83,300-inch.—A new prismatic ocular: A. A. C. E. **Merlin.** The author found that prolonged observations with the microscope in an upright position entailed great fatigue to the eye, and it occurred to him that by means of a properly designed prism a comfortable position might be secured. He obtained the assistance of Mr. E. M. Nelson, who computed a prism of the kind required, a diagram of which was drawn on the blackboard. It was constructed for the author by Carl Zeiss, and has proved efficient and satisfactory in use.—A new 1/6-inch semi-apochromatic objective: E. M. **Nelson.** The objective had a working distance of 1 mm.; its N.A. was 0·74, and its initial power 60.—Systematic exposure with transmitted light in photomicrography: A. **Lethorby.**

Chemical Society, October 24.—Sir William Ramsay, K.C.B., F.R.S., president, in the chair.—The constitution of phenol- and quinol-phthalein salts: a contribution to the quinonoid theory of colour: A. G. **Green** and P. E. **King.** The authors have succeeded in preparing the coloured carboxylic esters of the phthaleins and of their mono- and di-methyl esters. These esters are orange to red, are extremely unstable, being readily saponified, not only by weak acids or alkalis, but even by water. The facts observed disclose an exact parallelism between the esters and salts of these phthaleins and those of fluorescein, and place the quinonoid structure of these substances almost beyond question.—Keten: N. T. M. **Wilsmore.** The gaseous substance keten, produced by the action of a hot platinum wire on acetic anhydride, which was discovered by Dr. A. W. Stewart and the author (NATURE, 1907, vol. lxxv., p. 510), has been further examined. It has the formula $C_2H_2O_3$, and reacts with primary amines to form the corresponding acetyl derivatives.—Derivatives of the multiple keten group: J. N. **Collie.** The group $—CH_2.CO—$ (which the author proposes to call the "keten" group) can be made to yield by the simplest reactions a very large number of compounds of types largely obtained from plants. Illustrations of this were given from the various published papers of the author.—Production of orcinol compounds by the action of heat on the sodium salt of ethyl acetoacetate: J. N. **Collie** and E. R. **Chrystall.**—A simple gas generator for analytical operations: J. McC. **Sanders.** A simple constant supply apparatus for hydrogen sulphide was described which is suitable for use in schools and in commercial laboratories.—Some double ferrocyanides of calcium, potassium, and ammonium: J. C. **Brown.** *Inter alia*, the conditions for the use of ammonium chloride and potassium ferrocyanide as a qualitative test for calcium were given.—Determination of halogen in organic substances: J. **Moir.** The new method described last year by the author has been improved by adopting the Volhard method of back-titration with standard thiocyanate.—Racemisation by alkali as applied to the resolution of *r*-mandelic acid into its optically active isomerides: A. **McKenzie** and H. A. **Muller.** Various methods of effecting the changes (1) *r*-mandelic acid—→*r*-mandelic acid and *l*-mandelic acid, and (2) *r*-mandelic acid—→*r*-mandelic acid and *d*-mandelic acid were indicated.—The optical activity of cyclic ammonium compounds: F. **Buckney** and H. O. **Jones.** Out of fourteen compounds of this type examined, only one—allylkairolinium-*d*-bromocamphorsulphonate—gave conclusive evidence of the existence of optical activity.—The action of phosphorus pentachloride on hydroxytrimethylsuccinic ester. 1 : 2-Dimethyl*cyclo*propane-1 : 2-dicarboxylic acid (1 : 2-dimethyltrimethylene-1 : 2-dicarboxylic acid): H. **Henstock** and Miss B. E. **Woolley.**—The condensation of acetaldehyde and its relation to the biochemical synthesis of fatty acids: H. S. **Raper.** It has been suggested that the formation of fatty acids in animals depends, firstly, on the breakdown of the carbohydrate to acetaldehyde, and, secondly, on the condensation of this with the formation of the higher fatty acids. This hypothesis is confirmed in part, since it has been found that β-hydroxybutyraldehyde, the first product of the condensation of acetaldehyde, on further condensation yields an aldehyde containing eight carbon atoms united in a straight chain.—The influence of solvents on the rotation of optically active compounds, part x., effect of the configuration and degree of saturation of the solvent: T. S. **Patterson,** A. **Henderson,** and F. W. **Fairlie.**—*para*Toluidine monohydrate: J. **Walker** and H. H. **Beveridge.**—Hydrates of some quaternary bases: D. C. **Crichton.**—Two volumetric methods for the determination of chromium: A. W. **Gregory** and J. **McCallum.** The authors describe (1) a modified form of the persulphate method for the estimation of chromium in iron and steel, and (2) a method depending on the oxidation of the chromium with sodium bismuthate.

Faraday Society, October 20.—Mr. N. T. M. Wilsmore in the chair.—The electrolysis of salt solutions in liquefied sulphur dioxide: Dr. Bertram D. **Steele.** Electrodes of various metals were used, and the changes at anode and kathode studied. With platinum and mercury a rapid diminution of current took place, when solutions of sulphur dioxide were electrolysed, possibly due to the formation of sulphur films. With electrodes of silver, copper, and iron of large area, constant currents were maintained. Iodine was liberated at anode, but no metallic potassium was obtained at kathode. The author concludes that sulphur cations exist in solution.—The action of aluminium powder on silica and boric anhydride: F. E. **Weston** and H. Russell **Ellis.** The authors show that it is possible to obtain silicon and boron by reduction of the respective oxides with extremely finely divided aluminium powder, the oxide being also excessively finely powdered. Great difficulty, however, is experienced in removing the alumina from the metalloids.—The reduction of metallic oxides with calcium hydride and calcium: Dr. F. M. **Perkin** and L. **Pratt.** A mixture of copper oxide and calcium hydride reacts with great ease according to the equation $2CuO + CaH_2 = 2Cu + CaO + H_2O$, the ignition taking place by means of a match. Pyrolusite, tinstone, and hæmatite also react readily, but require to be heated in a furnace or the reaction started by means of a fuse. Zinc oxide appears not to be reduced. Wolframite and rutile react only with difficulty. Lead sulphide and antimony sulphide also react vigorously. Boron can also be produced from boric anhydride or borax, and silicon (in small quantities) from silica. Dr. Perkin has already shown the extreme ease with which metallic oxides react with metallic calcium. The authors now show that the reaction with wolframite is particularly energetic, the tungsten being obtained as a fused regulus. Calcium will also replace strontium and barium from their chlorides and hydroxides. It likewise replaces all the alkali metals from their chlorides and hydroxides, the reactions being extremely violent.

PARIS.

Academy of Sciences, November 4.—M. H. Becquerel in the chair.—Comparative study of the phenols as parthenogenetic agents: Yves **Delage** and P. **de Beauchamp.** The successful results obtained with tannic acid, described in a previous paper, suggested the trial of other allied substances, the phenols and phenolic acids. Experiments have been made with phenol and the three dihydroxybenzenes, resorcinol being the only active substance of the three latter. Of the trihydroxybenzenes, phloroglucinol is nearly equal in activity to resorcinol, pyrogallol and the unsymmetrical isomer being much inferior. Difficulties of solubility prevented much work being done with the hydroxy-acids. Salicylic and vanillic acids gave poor results, about the same order as phenol; protocatechuic, and especially gallic, acid gave better and more constant results. The suggestion is put forward that the activity of the phenols in parthenogenesis may be proportional to their affinity for oxygen.—Contribution to the therapeutics of trypanosomes: A. **Laveran** and A. **Thiroux.** After reviewing the remedies that have been suggested, arsenious oxide, atoxyl, and mixtures of these with mercury salts, and describing their own experimental results on these substances, the authors propose the injection alternately of atoxyl and arsenic trisulphide. This treatment has given very good results in the cure of rats and guinea-pigs artificially infected with *surra*.—The sugar in the blood plasma: R. **Lepiné** and M. **Boulud.** The authors lay stress on the large errors introduced into the determination of the amount of sugar in the blood plasma by neglecting the glycolysis which goes on during the separation of the blood corpuscles. They detail the methods by which they in part surmount this difficulty, but conclude that the estimation of the sugar in the blood can only give, at the best, a rough approximation to the amount of sugar carried to the tissues.—Observations of the sun made at the Observatory of Lyons during the second quarter of 1907: J. **Guillaume.** Observations were possible on forty-eight days, and the results are expressed in tabular form showing the spots, their distribution in latitude, and the distribution of the faculæ in latitude.—Hyperelliptic surfaces: G. **Bagnera** and M. **de Franchis.**—The adjoint functions of M. Buhl: C. **Popovici.**—Some properties of integral equations: E. **Goursat.**—The free path and number of electrons in metals: L. **Bloch.**—The influence of pressure on the absorption spectra of vapours: A. **Dufour.** An experi-

mental study of the change in the absorption spectrum of bromine vapour under pressures varying from one to twenty atmospheres.—A new element, lutecium, resulting from the splitting of Marignac's ytterbium: G. **Urbain.** The separation was effected by fractional crystallisation of the nitrates from nitric acid of density 1·3. The characteristic lines in the arc spectrum of the new element are given. For the purified ytterbium resulting from the separation the name of neo-ytterbium is proposed.—Bi-secondary butylene chlorohydrin: K. **Krassousky.** An account of this compound, recently described as new by M. Louis Henry, was published by the author in 1902. Further details of its preparation and properties are given. —The alkaline granite *massif* of Dahomey: Henry **Hubert.**—The uralitisation of pyroxene: Louis **Duparc.** —Remarks on the structure of the aleurone grains in the Graminaceæ: A. **Guilliermond.** The author modifies some conclusions drawn by him in previous publications. The aleurone grains in the Graminaceæ offer analogous characters to those of the lupin. They are distinguished only by their smaller content of protein (the latter constituting only a thin layer round the globoids), by the smaller number and larger size of the globoids, and by the insolubility of the protein in potash after fixation by Ladowsky's method or by alcohol.—The experimental production of grapes without pips: Lucien **Daniel.** The production of ripe grapes without pips can be caused by vigorous pruning immediately after the fruit is set, and is produced by overfeeding at the time when the fertilised seed starts developing with great activity.—The evolution of Frenzelina, intestinal parasites of decapod crustacea: L. **Léger** and O. **Duboscq.**—Classification of the Zygopterideæ according to the characters of their leaf impression: Paul **Bertrand.**—Variations of density and amount of oxygen of pools of sea water: R. **Legendre.** —Observation of a discontinuous lightning flash: M. **Luizet.**

DIARY OF SOCIETIES.

THURSDAY, NOVEMBER 14.

ROYAL SOCIETY, at 4.30.—On the Cranial and Facial Characters of the Neandertal Race: Prof. W. J. Sollas, F.R.S.—Some Features in the Hereditary Transmission of the Self-Black and the "Irish" Coat Characters in Rats: G. P. Mudge.—On the Inheritance of Eye-colour in Man: C. C. Hurst.—On the Result of Crossing Round with Wrinkled Peas, with Especial Reference to their Starch Grains: A. D. Darbishire. —On the Rate of Elimination of Chloroform from the Blood after Anæsthesia: G. A. Buckmaster and J. A. Gardner.—Implantation of Actively Proliferating Epithelium: Dr. J. O. Wakelin-Barratt.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The Dielectric Strength or Insulating Materials and the Grading of Cables: Alexander Russell.

MATHEMATICAL SOCIETY, at 5.30.—Annual General Meeting.—Election of Council and Officers.—On Hypercomplex Numbers: J. H. Maclagan Wedderburn.—Addendum to a Paper on the Inversion of a Repeated Infinite Integral: T. J. I'A. Bromwich.—Generalisation of a Theorem in the Theory of Divergent Series: G. H. Hardy.—Uniform and Non-uniform Convergence and Divergence of a Series and the Distinction between Right and Left: Dr. W. H. Young.—Application of Quaternions to the Problem of the Infinitesimal Deformation of a Surface: J. E. Campbell.—Nodal Cubics through Eight given Points: J. E. Wright.— The Invariants of a Binary Quintic and the Reality of its Roots: Dr. H. F. Baker.—On a Transformation of Hypergeometric Series: Rev. Dr. E. W. Barnes.—On a Transformation of a Certain Hypergeometric Series: Prof. M. J. M. Hill.—A General Theorem on Integral Functions of Order less than One-half: J. E. Littlewood.

FRIDAY, NOVEMBER 15.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Labour-saving Appliances at the Mines of the New Kleinfontein Co., Transvaal: E. J. Way.

MONDAY, NOVEMBER 18.

SOCIOLOGICAL SOCIETY, at 8.—Mental Defects: Dr. Charles Mercier.

TUESDAY, NOVEMBER 19.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.15.—Excavation of a Barrow on Chapel Carne Brea, Cornwall, and other Papers: H. King and B. C. Polkinghorne.—The Wild Tribes of the Ulu Plus: F. W. Knocher.

INSTITUTION OF CIVIL ENGINEERS, at 8.—*Discussion*:—The Extension, Widening and Strengthening of Folkestone Pier: H. T. Ker.—*Probable Paper*:—The Tranmere Bay Development Works: S. H. Ellis.

ROYAL STATISTICAL SOCIETY, at 5.—Presidential Address: The Right Hon. Sir Charles W Dilke, Bart., M.P.

WEDNESDAY, NOVEMBER 20.

GEOLOGICAL SOCIETY, at 8.—Glacial Beds of Cambrian Age in South Australia: Rev. W. Howchin.—On a Formation known as "Glacial Beds of Cambrian Age" in South Australia: H. Basedow and J. D. Iliffe.

ROYAL METEOROLOGICAL SOCIETY, at 7.30.—The International Balloon Ascents, July 22 to 27, 1907: Reports by W. H. Dines, F.R.S., J. E. Petavel, F.R.S., W. A. Harwood, Capt. C. H. Ley, R.E., and Prof. W. E. Thrift.—Discussion of the Meteorological Observations made at the British Kite Stations, 1906-7: Miss M. White, T. V. Pring, and J. E. Petavel, F.R.S.

ENTOMOLOGICAL SOCIETY, at 8.

ROYAL MICROSCOPICAL SOCIETY, at 8.—(1) François Watkins' Microscope; (2) A Reply to Prof. Porter's and Mr. Everitt's Criticism upon the Paper, On the Limits of Resolving Power for the Microscope and Telescope: E. M. Nelson.—Mercury Globules as Test Objects for the Microscope: J. W. Gordon.—Light Filters for Photomicrography: E. Moffat.

SOCIETY OF ARTS, at 8.—Inaugural Address by Sir Steuart Colvin Bayley, K.C.S.I.

THURSDAY, NOVEMBER 21.

ROYAL SOCIETY, at 4.30.—*Probable Papers*:—Results of the Interaction of Mercury with Alloys of Other Metals: J. W. Mallet, F.R.S.—Note on the Sensibility of the Ear to the Direction of Explosive Sounds: A. Mallock, F.R.S.—On the Silver Voltameter: Part i., A Comparison of Various Forms of Silver Voltameters: F. E. Smith; and a Determination of the Electrochemical Equivalent of Silver: F. E. Smith and T. Mather, F.R.S.; Part ii., The Chemistry of the Silver Voltameter: F. E. Smith and Dr. T. M. Lowry.—On the Normal Weston Cadmium Cell: F. E. Smith.—On a Method of Depositing Copper upon Glass from Aqueous Solutions in a Thin Brilliantly Reflecting Film, thus Producing a Copper Mirror: Dr. F. D. Chattaway, F.R.S.—On Luminous Efficiency and the Mechanical Equivalent of Light: Dr. C. V. Drysdale.—The Dispersion of Double Refraction in Relation to Crystal Structure: T. H. Havelock.

CHEMICAL SOCIETY, at 8.30.—The Interaction of Metallic Sulphates and Caustic Alkalies: S. P. U. Pickering.—The Chemistry of Bordeaux Mixture: S. P. U. Pickering.—Aromatic Azoimides, Part iii., The Naphthylazoimides and their Nitro-derivatives: M. O. Forster and H. E. Fierz.—Studies of Dynamic Isomerism. Note on the Action of Carbonyl Chloride as an Agent for Arresting Isomeric Change: T. M. Lowry and E. H. Magson.—Emulsions: S. P. U. Pickering.—The Electrometric Measurement of the Hydrolysis of the Salts of Anilinium, Ammonium, Aluminium, Chromium, Thallium, Zinc, Magnesium, Cerium, Thorium, Nickel and Cobalt: H. G. Denham.

INSTITUTION OF MINING AND METALLURGY, at 8.

LINNEAN SOCIETY, at 8.—Abnormal Structures in Leaves, and their Value for Morphology: W. C. Worsdell.—Specimen-preservation in Australian Museums: J. G. Otto Tepper.—Revision of the Genus Illigera, Blume: S. T. Dunn.—*Exhibits*:—Luminous Larva from British Guiana: C. W. Anderson.—Living Specimens of Peripatus, from South Africa: Prof. A. Dendy.—*Linaria arenaria*, and other British Plants: G. C. Druce.

FRIDAY, NOVEMBER 22.

PHYSICAL SOCIETY, at 5.—On Singing Sand from New England: S. Skinner.—Exhibition of a Micromanometer: L. Bairstow.—A Diabolo Experiment: Vernon Boys.—Exhibition of a Gyroscope illustrating Brennan's Monorailway: Prof. H. A. Wilson.

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