THURSDAY, APRIL 18, 1907.

METEOROLOGICAL OPTICS.

Meteorologische Optik. By Prof. J. M. Pernter. In three parts. Pp. 558. (Vienna and Leipzig: W. Braumüller, 1902–6.)

THE subject of "meteorological optics" has scarcely yet reached recognition as a distinct branch of physical science, as one of which it were desirable that the phenomena should be systematically gathered together in order that the interaction of all the circumstances affecting any one group of appearances might be the more clearly appreciated. The various matters which may be legitimately included under such a title have, individually, not failed of their full share of attention and discussion—in the nature of the case they have from the earliest times been the subject of curious, though not always careful, observation and speculation, and of most of the phenomena an explanation, at any rate approximate, has already been satisfactorily given. The cause of the blue of the sky and of the "twinkling" of the stars, the theory of mirage, of the rainbow, of halos and mock suns, of all these much has been written, and by many physicists of eminence, but an exhaustive classification of all the questions which fall within the domain of meteorological optics has perhaps hardly been attempted.

From the optical side, the most complete account of the subject previously given is to be found in Mascart's "Traité d'Optique"; but the accumulation of meteorological data has proceeded somewhat more rapidly of recent years, and it is to the meteorologist that we must look for the exact quantitative solution of many problems in which the optical theory has already been correctly indicated. Prof. Pernter has every qualification for the task which he has set himself, and as director of the Imperial Institution in Vienna for the study of meteorology and terrestrial magnetism he brings to his subject an acquaintance with meteorological data such as few can claim. His book will rank as a classic of scientific literature, and is little likely to be superseded, within more than one generation, as the standard work on this branch of natural science.

Prof. Pernter explains that his work is based on lectures delivered during a period of ten years in the Universities of Innsbruck and Vienna. It is, however, singularly free from the defects one is prepared to find in a volume so produced; it is neither too diffuse nor too exclusively technical, and while essentially scientific, in the strictest sense, in its aim of giving an exact numerical explanation of the phenomena recorded, it furnishes a descriptive account of the appearances dealt with, from the records of observations, old and new, which the least scientific reader can scarcely fail to find attractive.

To the contents of the four sections into which the subject is divided the author's own classification is the best guide. The first section deals with the apparent forms of the vault of the sky and the phenomena connected therewith—over-estimation of the heights of mountains, the apparent variation in size of sun, moon, and constellations between horizon and zenith, &c. In section ii. are included all the phenomena which owe their origin to the gaseous constituents of the atmosphere, whether under normal or abnormal conditions—astronomical refraction, depression of the horizon, mirage, the "Fata Morgana," and the scintillation of the stars. In the third section are considered the effects due to the presence in the atmosphere of masses of particles the appearance of which is intermittent—clouds, whether of ice crystals or rain-drops; and here we find a full discussion of halos and parhelia, coronæ and rainbows. The fourth section, which will be issued next autumn, will treat of the phenomena due to the existence in the atmosphere of very minute particles of whatever nature which are always present, but which are especially numerous at certain times, as after volcanic eruptions. The classification thus indicated is both natural and convenient; with but rare exceptions it brings together all those phenomena which are of similar origin, and therefore demand similar treatment.

Of the first section it will suffice to say that Prof. Pernter gives a very careful discussion of the apparent form of the "vault" of the sky, basing his numerical results especially on the observations of Reimann. His conclusion is that the form is that of a segment of a circle, the arc of which subtends at the centre an angle of the order of 40°. From this it follows that estimations of dimensions near the horizon and at higher altitudes will differ widely, a factor having important bearings, as already indicated, in regard to many every-day phenomena, to which we may add the apparently oval form of halos and coronæ at low altitudes. In his explanation, or rather his suggestion, as to the direction in which an explanation must be sought, the author follows Gauss, who first made experiments to show that this subjective effect is mainly due to the normally upright position of the body, and to the abnormal, or at least unusual, procedure involved in raising the eyes from the horizon to the zenith. It need hardly be added that there are many points here demanding further discussion.

The second section passes from the consideration of the effects due to atmospheric refraction under normal conditions to a very full and interesting account of the various phenomena due to reflection and refraction when the density of successive layers of the atmosphere shows abnormal variations or when the density in any region is subject to rapid fluctuations. Prof. Pernter is perhaps here at his best. For the descriptive portion of the work he has sought the most typical examples to be found in scientific literature, giving in the words of the actual observers the details the explanation of which he afterwards follows out as closely as possible from the most exact data obtainable relative to the variations of atmospheric density. We may direct attention especially to the author's theory of cases of exceptional "visibility" of distant objects, apparent nearness and magnification. His theory of the

different forms of mirage, whether due to reflection from above or below, or from the side, is essentially that given by Tait in his paper "On Mirage" in the Edinburgh Transactions. Of the "Fata Morgana," two specially interesting examples are cited from observations by Prof. Boccara in 1900 and 1901, while of distortion due to abnormal atmospheric refraction the most striking cases are those seen by Arctowski, as quoted from the records of the Belgian Antarctic Expedition.

The theory of the scintillation of the stars and planets, and of the analogous phenomena observed in the sun and moon when almost eclipsed, has aroused an exceptional amount of attention, and is here very fully considered. Lord Rayleigh has discussed the matter in a paper on the theory of stellar scintillation, where the failure of the "interference" theory as propounded by Arago is made clear. The various optical effects in which the phenomenon may be said to consist, the quivering and the fluctuations in intensity and colour, as well as the meteorological conditions, the extent and character of the atmospheric "striæ," with the best methods of observation and measurement, are most completely dealt with in the papers by Karl Exner in the *Sitzungsberichte* of the Vienna Academy of Sciences and elsewhere. Prof. Pernter accepts what he designates the Montigny-Exner theory as giving a complete and exact explanation of the whole phenomenon.

The theory of halos, of parhelia and anthelia, and allied phenomena given in the third section of the book is founded on the classical work of Bravais "Sur les Halos," which dates from the middle of last century. Though Prof. Pernter speaks of this theory, elaborated by Galle and Bravais, as giving an entirely satisfactory and in all main essentials complete explanation of the phenomena, he is yet able, with the greater mass of more exact records of observations at his command, and the more accurate knowledge as to the form and optical characteristics of ice-crystals—six plates of reproductions of photographs of various types of ice-crystals are given—to confirm or correct in many details the earlier theory. The rarity of some of the appearances necessarily renders numerical confirmation difficult, and it may be well to note, for example, the desirability of further careful observations of the "schiefe Bögen von Löwitz," the lateral arcs tangential to the halo of 22°; and of the parhelia related to the halo of 46°, especially the colour effects when the sun is in the horizon. The whole discussion is fully and clearly given, and is very suggestive of the possibilities of further meteorological research.

The author next deals with the phenomena due to diffraction effects, whether seen directly by transmitted light or by reflection—coronæ, the "Glory" or "Brockengespenst," iridescence of the clouds, &c.—with an exposition of the theory as developed by Fraunhofer, Verdet, and Exner, and based on Airy's development of an expression for the variation in light intensity in the diffraction image. The volume concludes with a complete discussion of the rainbow. Prof. Pernter follows the theory of Descartes to the point where its neglect of the consequences of diffraction leaves it inadequate to explain the phenomena, basing his subsequent development on the Airy "rainbow-integral" for the intensity of light in the neighbourhood of a caustic.

Prof. Pernter suggests that, in a subject of which so much has been written in monograph, his work must necessarily be of the nature of a compilation. He expresses the hope, however, that it may perhaps claim to be more than a mere compilation. No one who has read his work with any attention will be likely to question this claim. Rather it may be taken as the model of what a standard treatise on a branch of physical science should be, written by one whose researches have done very much to remove difficulties and to lighten obscurities. Dealing as it does with matters of absorbing interest, it is unquestionably a book to be read by everyone who takes an interest in the study of natural phenomena.

THE NEW EVOLUTION.

Recent Progress in the Study of Variation, Heredity and Evolution. By R. H. Lock. Pp. xv+299. (London: John Murray, 1906.) Price 7*s.* 6*d.* net.

THE labours of a new school of biologists, ably represented in this country by a band of energetic workers at Cambridge of whom the author of the present book is not the least distinguished, have been of great service both direct and indirect to the study of evolutionary method. It was perhaps to be expected that in the first flush of enthusiasm caused by the re-discovery of an important generalisation like Mendel's, judgments should be formed and statements made some of which may seem to pass the bounds of scientific caution; but signs are not wanting that a more restrained attitude is beginning to prevail, and it is a healthy symptom that the free use of the experimental method, rather than mere academic discussion, characterises the work of the new evolutionists.

A noteworthy point in the biological movement of the day is the response that is being given in various quarters to the reasonable demand for quantitative treatment of the facts of variation, selection and heredity. From the side both of the biometricians and of the Mendelians, statistical evidence is being accumulated and dealt with on a scale that might have satisfied Stanley Jevons himself. It must be confessed that the pretensions of these two schools are at present more or less antagonistic to each other and to the convictions of orthodox Darwinians; it is certain, however, that the questions raised in the course of this three-cornered rivalry are of the greatest importance, and that nothing but good can come of their thorough discussion.

The book before us gives an elementary but generally clear and skilful exposition of the present aspects of the evolutionary problem. It is the work of one whose sympathies are confessedly Mendelian and mutationist, but who shows a real desire to do justice to the views of opponents. Mr. Lock's point of view is far removed from that of certain half-

instructed writers in the lay Press, according to whom natural selection is nothing but a discarded fashion of the mid-Victorian period, as obsolete to-day as the pork-pie hat and the crinoline. But he is none the less a disbeliever in the Darwinian account of the origin of species.

High as are the merits of Mr. Lock as an expositor, there are points, as we think, on which his arguments must fail to carry conviction. The phenomena of adaptation we hold to be of supreme importance in the interpretation of evolutionary process. It is difficult to exaggerate the extent to which adjustment to the circumstances of life prevails in every department of organised nature. This is a fact which the advocates of "mutation" do not fairly face. Mr. Lock is too candid not to admit that "organic beings on the whole are, as a general rule, very closely fitted for the conditions in which they have to pass their lives." But after adducing certain well-known instances of "animals having peculiar habits, and possessing at the same time special organs which render them well fitted for these habits and no others," he manages to convey the impression that such cases are not very common, and that, considered as evidence of the power of natural selection, the best of them are open to criticism. Then, after a sketch of the theories of mimicry and protective resemblance, he adds that it is "uncertain whether this principle [of natural selection] can hold good as the true description of the origin of any sort of resemblance."

"Perhaps a still more serious criticism," he goes on to say, "of the methods of those who spend their time in seeking out or devising cases of adaptation has been made by Bateson, who points out the logical difficulty that we can never make any quantitative estimate of the amount of benefit or the reverse which any particular structure may afford to its possessor." Most biologists will allow that quantitative methods should be used wherever possible for the solution of the problem, and it is curious that Mr. Lock should apparently not be aware that there are several instances in which this has been done. We do not see where the "logical difficulty" lies; on the question of fact we regret to differ from Mr. Bateson, if his opinion is here correctly stated.

The underlying idea in all that Mr. Lock has to say on the subject of adaptation by selection is the doctrine that specific differences arise by way of "mutation," or *de novo*, and not by the accumulation of continuous or "fluctuating" variations. The position is ably argued, and the results of the laborious experiments of de Vries and of the remarkable work of Johannsen are brought to bear with the skilful touch of a genuine investigator who is personally conversant with the matter in hand; nor does Mr. Lock's general attribute of fairness here desert him. A point, however, on which we should like to be satisfied is this: the author asserts that "no one questions the validity of natural selection as a means of exterminating types which are unfitted for their environment"; further, he thinks it at least probable that certain types have survived in consequence of their "fitness." But, since these latter types arose, as he would say, suddenly or discontinuously, how did it happen that they sprang into being in such exact harmony with their surroundings? Would Mr. Lock have us fall back upon the theory of "directed variation," or, what comes to the same thing, Paley's view of "contrivance" by special creation? If it be replied that a well-adapted type must have arisen, not by one or more large mutations, but by a series of mutations both numerous and minute, we should wish to know how such mutations are to be distinguished from continuous variations. To say, with de Vries, that selection of individual differences is powerless to raise permanently the mean of a species, seems perilously like begging the question. As soon as the mean had been permanently raised, the result would be claimed as a mutation.

We have space only for one further remark. If Mr. Lock will take his Aristotle again, and read, with its context, the passage he has quoted on p. 116, we think he will see that he has mistaken that philosopher's meaning, as, indeed, Darwin did before him.

F. A. D.

NOTES ON WATER PLANTS.

Biologische und morphologische Untersuchungen über Wasser- und Sumpfgewächse. Part ii. By Prof. Hugo Glück. Pp. xvii+256. (Jena: Gustav Fischer, 1906.) Price 18 marks.

THIS work forms the second instalment of the author's studies on water plants. It deals chiefly with the European species and varieties of Utricularia, and, as was perhaps inevitable, one result has been to increase the number of the forms hitherto recognised as distinct. A prominent feature of the book lies in the attention devoted to the so-called *Turions*, or propagation buds, which occur so frequently in aquatic phanerogams.

Several other aquatic genera also are dealt with, *e.g.* Ceratophyllum, in which Prof. Glück finds a specialised form of shoot provided with anchoring leaves, much reduced in character, which serve to fix the plant in the mud. These leaves differ from the ordinary foliage leaves in the absence of chlorophyll and in the almost complete suppression of the intercellular spaces so characteristic of the latter.

The conclusions reached as to the morphological interpretation to be placed on the different parts of the Utricularia plants do not essentially differ from those drawn by Goebel about sixteen years ago as the result of an extensive series of investigations on tropical as well as on European species of this remarkable genus. The special feature of interest attaching to them lies in the impossibility of establishing a consistent distinction between the stem and leaf in these plants. One can pass into or be replaced by the other in the most irregular manner, and either of them may in turn be represented in position by one of the bladders that form so characteristic a feature of the genus. As Prof. Glück remarks, the

morphological distinction so commonly insisted on as between axial and foliar structures is largely the result of preconceived views as to their essentially separate nature, or, as we would prefer to put it, of the general experience that they are distinguishable. But morphological differentiation is really not irrevocable. There are many ways in which the normal (hereditarily transmitted) form may be changed if the sequence of those internal chemical changes that determine the structure at any given time and in any given instance can be interfered with, and this consideration should put us on our guard against the introduction of transcendental ideas into our morphological conceptions.

In the lower plants, in which the sequence of structural change has remained less stereotyped, it is sometimes easy to control the course of development, and, within limits, to induce considerable modifications in organisation. As an illustration we may recall the well-known case of the influence of light in determining the dorsiventrality of Marchantia. This plant produces lens-shaped brood bodies or gemmæ, and when these are allowed to germinate, the surface (whether upper or lower), which is illuminated, assumes the structure of the normally dorsal, the less, or non-illuminated, surface that of the ventral aspect. The behaviour under experimental conditions of *Aneura ambrosioides*, another liverwort, may also be quoted. This plant forms beautiful tufts or sheets of pinnate thalli spread over the surface of the wet rocks or banks on which it occurs. But by appropriate methods of cultivation the plants can be made to grow erect, and then the ends of some of the pinnæ turn downwards to grow and ramify in the soil. The change thus induced is not necessarily permanent, and a restoration of the normal environment at once causes further growth to advance along the previous lines. But the interest attaching to such an experiment is enhanced when it is known that there are other nearly allied species the response of which to the influence of the *ordinary* environment takes precisely that form assumed by *A. ambrosioides* as the result of the introduction of certain special conditions. Many other examples of a similar kind will occur to those who are familiar with the results of the so-called "experimental morphology."

In the higher plants a certain degree of latitude of organisation is generally recognised, but its limits do not, as a rule, exceed the chief morphological barriers. The genus Utricularia, however, stands out amongst the flowering plants as one that has pre-eminently broken loose from the trammels of hereditary tradition. The chain of events which in the vast majority of plants are linked together in a sequence so orderly that the final result—differentiation into stem and leaf—seems invested almost with the sanctity of a law of nature is here rudely interrupted. It is to this very circumstance that the Utricularias owe their great importance from the biological standpoint, and any contribution to our knowledge of the group is assured of an attentive reception. J. B. F.

A NEW ATLAS.

The M.P. Atlas. A Collection of Maps showing the Commercial and Political Interests of the British Isles and Empire throughout the World. Forty plates. (Edinburgh and London: W. and A. K. Johnston, Ltd., 1907.) Price 25*s.* net.

THIS atlas consists of a series of maps chiefly representing the British Empire. They are very clearly printed, and some of them are decidedly good specimens of cartography. The bathy-orographical map of the British Isles is particularly worthy of notice. It is beautifully clear, and in every way an excellent piece of work. The special feature of this map is the orographical colouring, the effect of vertical relief being obtained by means of a system of colour-tinting in shades of brown, the shades increasing in density with the elevation. The bathymetrical colouring is in shades of blue. As this is such an effective map, it is a pity the same scheme of colouring was not adopted for the other physical maps, as in comparison they, and particularly that of India, are much inferior productions.

Throughout the atlas there is, unfortunately, a lack of uniformity in the style and execution of the maps which detracts in no small degree from their artistic merit. The collection is composed of engraved and lithographed maps, and the contrast between the fineness of the former and the coarser work of the latter is in many instances very pronounced, more especially when examples of the two styles occur on the same sheet, as on Plate 36. This variety in the method of production and certain inconsistencies which are to be found in the maps make it quite obvious that they have not been drawn specially for this atlas, but collected from various sources. There would be nothing to say against this system of using the same maps for different atlases, provided, of course, that they have been completely revised and brought up to the date of publication. But there is a great objection to the inclusion of old, or only partially revised, maps in a new atlas, and there are not a few in the "M.P. Atlas."

Quite a large number of the maps have already appeared in other atlases published by Messrs. W. and A. K. Johnston, most of them in the well-known "Royal Atlas," and many require much more thorough revision to bring them up to the date on the title-page. For instance, on the map of Asia (Plate 20), the physical features are shown exactly as in the same map in an edition of the "Royal Atlas" published fourteen years ago, notwithstanding the considerable alterations and additions recent exploration has made necessary. Then, again, there are railways and political boundaries that require correction. With regard to the latter, attention may be directed to a discrepancy between the boundary of northern Nigeria as shown on the general map of Africa (Plate 29) and on the map of the West African colonies (Plate 34). But no doubt these matters will receive the publishers' attention in revising the atlas for a future edition.

The atlas contains, besides the frontispiece—a bathymetrical hemisphere with London as centre—fifty-three maps. There is a political map of the world in Mercator's projection, and four small world-maps on an equal-area projection showing productions and consumption of foodstuffs, rainfall, and postal delivery. This last map employs a novel method of showing by a system of colouring the number of days taken to convey letters, posted in London, to different parts of the globe where there is a postal service. Next follows a useful series of maps showing steamer routes, railways, and telegraphs. Europe is represented by one general map and fourteen physical, commercial, and political maps of the British Isles. Asia has eight maps, of which India takes up six; the others are a general map of the continent and one of Persia and Afghanistan. The number of maps given to Africa is disproportionally large. In addition to one general and five divisional maps, there are four of the British African colonies, while the Australasian colonies are comprised in three maps—a general map of Australia on two sheets, unfortunately on different scales and in entirely different styles, and a map of New Zealand. With regard to the American continent, there is no general map of Canada, only three fairly large-scale divisional maps, and general maps of North and South America, the latter on two sheets. There is also a map of the North American Transcontinental railways.

The atlas has no index, which much lessens its use as a work of reference.

SOME BOOKS ON CHEMICAL ANALYSIS.

Notes on Qualitative Analysis, Concise and Explanatory. By H. J. H. Fenton. New edition, revised. Pp. vi+147. (Cambridge: University Press, 1906.)

Church's Laboratory Guide. Revised and partly rewritten by Prof. E. Kinch. Pp. xvi+349. (London: Gurney and Jackson, 1906.) Price 6*s.* 6*d.* net.

Inorganic Qualitative Chemical Analysis for Advanced Schools and Colleges. By W. S. Leavenworth. Pp. vi+153. (Easton, Pa.: Chemical Publishing Co.; London: Williams and Norgate, 1906.) Price 6*s.* 6*d.* net.

Outlines of Qualitative Chemical Analysis. By F. A. Gooch and P. E. Browning. Pp. vi+145. (New York: J. Wiley and Sons; London: Chapman and Hall, Ltd., 1906.) Price 5*s.* 6*d.* net.

Qualitative Analysis as a Laboratory Basis for the Study of General Inorganic Chemistry. By W. C. Morgan. Pp. xiv+351. (London: Macmillan and Co., Ltd., 1906.) Price 8*s.* net.

Smaller Chemical Analysis. By G. S. Newth. Pp. 147. (London: Longmans, Green and Co., 1906.) Price 2*s.*

DR. FENTON'S well-known "Notes on Qualitative Analysis" is a mine of closely-packed practical information which, as the title-page states, is concise and explanatory. A student who works through the book and remembers only half the tests described should be well charged with chemical facts. The ordinary equations are generally used, an equation in terms of the ionic hypothesis being occasionally brought under the notice of the student.

Church's well-known "Laboratory Guide," which has been revised and partly re-written by Mr. E. Kinch, is exactly what its name implies. It is a practical guide to students of agriculture who wish to apply their chemical knowledge to that subject only. It does not pretend to deal with theory, which is left to the lecture-room, and the explanatory part is therefore reduced to a minimum. The book contains a series of exercises on the preparation of simple substances, on qualitative analysis, and, finally, on quantitative analysis, which fills up more than half the book. The simpler preparations being completed, the student is introduced to superphosphates, soils, and manures. Blood and bones and various materials of agricultural interest are dealt with qualitatively and quantitatively. Thus the student is not allowed to feel that he is being caught in the toils of pure science which may lead him anywhere or nowhere; he is, as it were, kept in full view of the farm and in touch with its products. There is very much to be said for this method, provided the scientific foundations are carefully laid. As to the exercises themselves, they are evidently devised and described by an experienced hand.

The volume on "Inorganic Qualitative Analysis," by Mr. Leavenworth, is very like other books on the same subject. The directions are clear, correct, and concise—if anything too concise, for the suggestion that a reaction in certain circumstances may fail, is rarely recorded. The more general use of equations and the discussion of theoretical points would have made the exercises more of an intellectual and less of a mechanical process.

Of a somewhat different stamp is the volume by Gooch and Browning. The subject is approached in a more philosophical spirit. The principle of mass action—the basis of all chemical change—is discussed in the introductory chapter. The reactions are expressed by equations, and the conditions affecting precipitation, &c., are carefully indicated. The student is thus made to feel that each step requires a little forethought; that each reagent can only be effective under properly chosen conditions—in short, his intelligence is appealed to. There are several unfamiliar methods introduced, such as the separation of manganese from cobalt, nickel and zinc by means of acetic acid, the use of potassium ferricyanide for distinguishing cobalt and nickel, and the use of amyl alcohol for separating strontium and calcium. The English reader is reminded that "Robin's egg blue," which describes the colour of the manganates, has reference to the American bird. Although the constitution of salts is described under the terms of basic and acidic ions, no attempt is made to develop the subject on Ostwald's "Scientific Foundations"; but the usual equations are employed. The book is carefully written, well printed, substantially bound, and may be confidently recommended as quite one of the best of its kind.

The volume on "Qualitative Analysis," by Dr. Morgan, is less a work for the beginner than for the student who has already acquired a certain familiarity with experimental chemistry. It is, in fact, a comprehensive study of analysis from the theoretical side. The author has not merely raised his cap to the new teaching and adopted the old, like some authors referred to in this notice, but has boldly plunged into the ionic hypothesis and consistently adhered to it. The book is divided into sections, the first of which deals with general principles, such as mass action, equilibrium, reversible changes, and dissociation; the second section is devoted to reactions of the common elements, arranged according to the periodic system, and the third deals with systematic analysis. It is simply and clearly written, although the American spelling and the alternate use of names and symbols in the text are a little confusing to the English reader. Nevertheless, the book has a distinct character of its own; it is interesting and suggestive, and will fill a gap in chemical philosophic literature.

Newth's "Smaller Chemical Analysis" is an abridged edition of the qualitative section of the "manual," and includes a few quantitative exercises. The small edition possesses the characteristic features of the deservedly popular parent volume. For the student who is not intending to become a chemist, but who is taking chemistry as an adjunct to other studies, this abridgment will give him a very good notion of analysis. He will learn a little manipulation, the use of reagents, and the behaviour of the common metals and acids. There is nothing that is really novel in the treatment of the subject. A passing reference is made to ionic dissociation, but the theory is not actually applied. The figures which are taken from the "manual" are excellent, with perhaps the exception of the drawing of the wash-bottle and blow-pipe, in which the operator's moustache seems to form an essential part of the apparatus.

J. B. C.

OUR BOOK SHELF.

Animal Micrology. Practical Exercises in Microscopical Methods. By Dr. Michael F. Guyer. Pp. ix+240. (Chicago: University of Chicago Press; London: T. Fisher Unwin, 1906.) Price 9s. net.

THE term "micrology" has not received any general acceptance on this side of the Atlantic. There seems to be no reason why the term "histology" should be displaced by this more modern word. Though, however, we may take exception to the title of the book, we are not disposed to regard other than favourably the work itself.

The study of this book leads to some reflection as to the methods by which instruction in histology can most advantageously be given. Manuals of instruction are perhaps generally written so as to act as a *complement* to the teacher's personal directions. This book, however, will replace the teacher himself. The directions given are so precise and simple as probably to be sufficient to furnish an effective guide to a student with practically no previous training in microscopic work. The question is, however, whether there are not disadvantages in this method. The defect seems to be that a student using such a book may not have enough scope for his ingenuity and resource. It certainly fails to give much stimulus to a student's power in the elaboration of new methods. But as the book is intended by the author primarily for the beginner, and as probably most students using it will adopt it simply to assist them in acquiring a competent knowledge of histological methods without any intention of making use of them in later research, it must be stated that, so far as this objective is concerned, the book is worthy of the highest praise.

The general arrangement of the work has no markedly novel features, but the expositions of the methods recommended are admirably clear. The smallest details of procedure are carefully marshalled, and the student is generally left without any opportunity of making a mistake. But the instruction afforded is not simply telling the student how the methods are to be carried out; there are added, and this is one of the distinguishing features of the work, explanations of the possible reasons why occasionally failure may occur, and remedies for such failures. The author hopes that three classes of workers may be benefited by its use. The student in class or the independent individual worker will doubtless profit, but we hesitate to think that a book can be at the same time valuable as an instruction manual for elementary classes and as a general reference book for the teachers of those classes.

The crucial test of the value of the work must necessarily consist in the actual experiment of using it in class. We venture to think, however, that the volume will react to this test in a most successful manner.

Elementare kosmische Betrachtungen über das Sonnensystem und Widerlegung der von Kant und Laplace aufgestellten Hypothesen über dessen Entwickelungsgeschichte. By Prof. Gustav Holzmüller. Pp. v+98. (Leipzig: B. G. Teubner, 1906.) Price 1.80 marks.

THIS little book, in which is summarised the essential parts of a series of lectures given at various times, is another praiseworthy attempt to make the results of mathematical analysis available to those who have not received the necessary preliminary training. How far the author has been successful in conveying precise information to this class it is difficult to judge. As a rule, it would appear that those who do read such books do not stand in need of the elementary treatment offered, while those for whom the book is intended fail to grasp the nature of the demonstration. The author discusses some of the ordinary dynamical problems connected with falling bodies, and also Kepler's laws, as resulting from the operation of a central force. He adds some remarks on perturbations and tidal phenomena, but these sections are necessarily of the most sketchy character. There is a very good chapter on the present condition of the sun, written in a popular manner, and in which the author introduces some interesting topics; but here, as in other parts of the book, we would willingly have been spared the quotation of such big numbers, inserted, apparently, with the view of arresting attention. Finally, Prof. Holzmüller examines the data on which rests the acceptance of the nebular hypotheses as developed by Kant and Laplace. We are not disposed to quarrel with his conclusions, which may be stated thus. The hypotheses set up by these philosophers to explain the development of the solar system are inadequate to explain the past history, and furnish unsatisfactory guides for the future. They cannot be regarded as a contribution to exact science, but

rather as unhealthy accretions. At the same time, the author, following Gauss, has failed to recognise the extreme diffidence with which Laplace put forward his hypothesis. By many, the caution and reserve with which Laplace accompanied his suggestions will always be regarded as a model of good taste and evidence of a correct scientific attitude.

The New Hygiene. By Elie Metchnikoff. Pp. viii+104. (London: William Heinemann, 1906.) Price 2*s.* 6*d.*

THIS little book contains the three Harben lectures delivered by Dr. Metchnikoff at the Royal Institute of Public Health last year, an appreciative preface being contributed by Prof. Ray Lankester. The "Hygiene of the Tissues" is the title of the first lecture, and in it the phenomenon of phagocytosis is discussed at some length, and since this fact is considered to be the principal means of defence of the body against the invasion of microorganisms, and since such drugs as alcohol, opium, and many others impede phagocytosis, it is concluded that their use should be avoided or limited in the treatment of disease, and certain substances such as blood serum and salt solution, which stimulate phagocytosis, employed in certain circumstances. In the second lecture, on the hygiene of the alimentary canal, the evil effects of parasitic organisms are dealt with, and the use is advocated of sterile food so far as is possible. The third lecture deals with hygienic measures against syphilis, and the use of inunction of mercurial ointment as a prophylactic against infection detailed. The book is of extreme interest, and one that should be widely read by the educated public.

R. T. H.

Synopsis of Mineral Characters. Alphabetically arranged for Laboratory and Field Use. By Ralph W. Richards. Pp. v+97. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1907.) Price 5*s.* 6*d.* net.

THE title of this convenient pocket-book serves to define its scope. Emphasis is laid upon crystal form, habit, system, cleavage, hardness, fusion, and solubility in hydrochloric or other acid. Definitions of mineral terms and of rocks associated with the minerals included are also provided. The arrangement of the matter makes reference to the book easy.

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.]*

Anomalous Dispersion and Ionisation

MY criticism of Mr. Schott's interesting experiment (NATURE, March 14, p. 461) was due to my carelessness in reading his brief account. I failed to notice the words "and the tube" in his description of the battery connections, which fact, together with the low voltages which he used, gave me the impression that he employed the current to heat the wire, the ions being derived from the hot metal.

The experiment as actually performed is of considerable interest. Everything depends upon just what is meant by "the dispersion is completely annulled." I infer that the oppositely curved branches of the spectrum move back into the original straight line, but nothing is said as to whether the gap caused by absorption is filled in. The dispersing power of the sodium tube depends upon the density gradient of the sodium vapour, as we pass from the floor to the roof of the tube. Anything which interferes with this will alter the dispersion. If the discharge stirs up the vapour and renders it homogeneous over each cross-section of the tube, the dispersion will be annulled, while the absorption will remain. The nature of the action going on in the tube can probably be learned by looking through the tube at a bright sodium flame, or a gas flame provided with a blue screen which transmits only the region 4600–4900. It will be found that the upper portion of the tube is fairly transparent to the radiations, while the vapour along the floor is quite opaque to them. The effect of the current on the transparency at different levels should be noted.

There has always appeared to me to be some mystery about the behaviour of sodium vapour in highly exhausted tubes, for it is difficult to see how equilibrium can exist between the dense vapour along the floor and the nearly perfect vacuum along the roof. In the light of recent experiments which I have been making, I now believe that I have found the solution of the apparent difficulty. The actual density of the vapour along the floor has in all probability been over-estimated. It is usual to exhaust the tubes to a pressure of a millimetre or two. In all probability, pure sodium vapour at two millimetres pressure is what we should call a very dense vapour (considered optically). Suppose, now, we heat the floor of the tube to the temperature at which the vapour pressure of sodium is equal to the pressure of the residual gas in the tube. The density of the sodium vapour considered alone (partial pressure) will depend upon the rate at which it can diffuse through the residual gas to the cooler roof of the tube. If the sodium vapour is given off from the molten metal more rapidly than it can diffuse away, we may have pure sodium vapour at the surface of the metal, and mixtures of sodium and hydrogen in decreasing proportion as we pass upwards towards the roof, the total pressure being the same at every point, however. If this is the true state of things, the dispersing power of the tube would disappear if every trace of the residual gas was removed. I intend shortly to test this point. I have already found that in the long steel tubes such as are used in observing the magnetic rotation of the vapour, the density of the sodium vapour is greatly increased by the admission of hydrogen or air. In this case the central portion of the tube is uniformly heated with an electric oven, and the sodium distils away to the cooler portions. The presence of hydrogen or nitrogen hinders this process, the gas holding back the sodium vapour, so to speak, and allowing it to acquire a density, or rather pressure, equal to its own.

This way of looking at the state of affairs in the tube may prove helpful in explaining the interesting effects observed by Mr. Schott, whose further experiments I shall follow with interest.

R. W. WOOD.

Baltimore, April 2.

Positive Streams in "Crookes" Tubes.

REFERRING to the abstract of Mr. F. W. Aston's very interesting paper read before the Royal Society on December 13, 1906, "On Experiments on the Length of the Kathode Dark Space with Varying Current Densities and Pressure in different Gases," published in your issue for April 11 (p. 574), may I point out in reference to the therein contained statement that "the stream of positive ions may be strikingly shown by a rotatory mica mill mounted inside the dark space which rotates violently in the opposite direction to the familiar ones designed to show the motion of kathode rays away from the electrode," that in my two papers "On the Circulation of the Residual Gaseous Matter in a Crookes' Tube," read before the Physical Society, and published in the *Philosophical Magazine* for October, 1898, I showed similar results, *i.e.* that mica mill wheels which turned in one direction under kathode-ray bombardment, turned in the opposite direction when so placed as to be just outside of the stream of kathode rays, thus indicating a current of particles proceeding towards the kathode, which particles I found to be charged positively?

These results, as stated in my first paper, could only be obtained with extremely high vacua, when no doubt the mica mill wheels were inside the dark space, as is found necessary by Mr. Aston.

A. A. CAMPBELL SWINTON.

66 Victoria Street, Westminster, S.W., April 13.

TWO CONTRASTED WESTERN CANADIAN TRIBES.[1]

MR. HILL-TOUT'S volume fully maintains the standard established by its companions which have already appeared in the "Native Races of the British Empire" series, edited by Mr. N. W. Thomas. In clearness and lucidity it perhaps surpasses either of them, for, instead of numberless insufficiently known groups, such as those of Australia, or an inextricable mass of humanity such as crowds British Central Africa, it deals merely with two well-defined linguistic stocks, the Salish and the Déné, occupying clearly marked areas, and characterised by distinct ethnographic features. Over the vast area between Hudson Bay and the Pacific Ocean diversity of climate has produced diversity of development, and the introductory chapter describes the geography, flora, and fauna of the region, and gives a brief history of the accounts of the early explorers before proceeding to the grouping of the native races.

Rarely can two adjacent districts be found presenting greater physical contrasts than those on the two sides of the coast ranges. To the east is the elevated plateau or "dry belt" with a temperature ranging from 110° in the shade in the summer to considerably below zero in the winter, while on the west the climate is like that of the south coast of Devon. Beyond the Rocky Mountains extends as far as Hudson Bay a dreary plain of rocks, marshes, lakes, and rivers, inclement and unattractive. This naturally results in a marked differentiation in the mode of life of the coast Salish from that of the interior Salish, whereas the latter in this respect more resemble the Déné who live to the east of the Rocky Mountains. It is interesting to note that among the western Déné, the Loucheux, the social divisions seem to owe their origin to an economic variation. They are divided into three exogamic divisions or phratries, called respectively Fish people, *Chit-sangh* (=fair); the Animal people, *Nah-t'singh* (=dark); and the Bird people, *Tain-gees-ah-tsah* (middle or half-brightish). This seems to be a colour grouping. The *Chit-sangh* are very fair, in some instances approaching to white, and live largely on fish; the *Nah-t'-singh* live entirely on the flesh of the reindeer, and are very dark-skinned compared with the *Chit-sangh*; while the *Tain-gees-ah-tsah* live on salmon trout and moose-meat, and are neither so fair as the *Chit-sangh* nor so dark as the *Nah-t'-singh*.

Déné Maids in Native Costume. From "British North America. 1. The Far West."

In spite of local diversity, both Salish and Déné show the "Pan-American" facial features, which are common throughout the whole continent, together with a secondary type, approximating to the so-called Mongoloid type, but no other than facial resemblances seem to the author to be common to the whole race.

Among psychic characters, the most striking are cowardice and honesty. "In point of valour they fall far below the eastern tribes." "The Northern Déné are generally pusillanimous, timid and cowardly," but they are proverbial for their honesty and their hospitality, and were in pre-trading days also for their chastity. Their folk-tales and tribal traditions

"show us that their lives were moral and well regulated; that deep shame and disgrace followed a lapse from virtue in the married and unmarried of both sexes. The praise and enjoyment of virtue, self-discipline and abstinence in young men is no less clearly brought out; whilst respect and consideration paid by the young everywhere to their elders affords an example that more advanced races might with profit copy."

The ethical principles of the Thompson Indians exhibit sound practical morality, and

"People who inculcate such virtues in the minds of their children can scarcely be called debased, or be said to be greatly in need of instruction from ourselves."

If they have fallen away from such high standards the fault is not theirs, but ours. "We assumed a grave responsibility when we undertook to civilise these races."

All the main features of native life are well and succinctly described—houses, clothes, food, domestic and warlike implements, customs at birth, courtship, marriage and death, social organisation, and religious beliefs. We wish, however, that the section on sociology had been more complete; but the most important omission is that of language, concerning which no information is given, although the author has elsewhere published a good deal on the linguistics of the Salish, on which subject he is an authority.

The volume ends with an interesting summary, describing the ordinary life of an average native "From the Cradle to the Grave," a brief and valuable synthesis of the preceding material.

"The life of an average Western Indian, as it was lived in the earlier days, was not that of a vicious

[1] "British North America. 1. The Far West: the Home of the Salish and Déné." By C. Hill-Tout. Pp. xiv+263; with 33 full-page illustrations and 1 map. (London: Archibald Constable and Co., Ltd., 1907.) Price 6s. net.

and degraded savage. He had advanced many stages beyond this when we first came into contact with him, and his life, though simple and rude, was on the whole well ordered and happy; and if his wants and aspirations were few, so were also his cares and worries."

The illustrations are numerous and very good; we are told on p. 139 that hammers are commonly regarded by the uninformed as pestles, "but this is an error," yet in the description of the accompanying plate they are described as "pestles" and "hammers." It is greatly to be regretted that the utility of this book is restricted by the extremely inadequate "bibliography" (*sic*). The author's valuable papers in the Reports of the British Association, especially for the years 1899, 1900, and 1902, are not mentioned, neither does he give an exact reference to his own papers in the Journal of the Anthropological Institute. No clue is given where can be found, to take only two examples, Farrand's excellent paper on the basketry designs of the Salish Indians or the printed MS. of Mr. B. R. Ross. The single allusion to Prof. F. Boas is to his work on skull-deformation (reference again omitted), and the series of British Association Reports ending in 1898 is not even mentioned, although the twelfth and final report, with a good index, is of exceptional value. The important summary of Canadian ethnology in the Annual Archæological Report for 1905 (Toronto, 1906) contains papers by the author on the coastal Salish, and by Father Morrice on the Dénés, besides other valuable contributions by various authors, and as references are given to the literature the report serves as an admirable text-book on the anthropology of Canada. It is strange that no allusion is made to this publication; at all events, we recommend students who read Mr. Hill-Tout's book to consult the report in order to supplement his deficiencies.

THE LEICESTER MEETING OF THE BRITISH ASSOCIATION.

THE British Association is assured of a hearty welcome to Leicester for its seventy-seventh annual meeting to be held there from July 31 to August 7, under the presidency of Sir David Gill, K.C.B., F.R.S. Leicester is a place of great antiquity, few towns in England having a longer history of uninterrupted activity. Its Roman remains include the "Jewry Wall," a remarkable example of brickwork, and some mosaic pavement *in situ*. The geological features of the district are comprehensive, the Charnwood Forest, with its rocks providing many a geological puzzle, being within a few miles of the town. Botanists, too, have a happy hunting-ground there. The local committees and sub-committees are working hard to ensure the success of their efforts, and great interest is being shown on all sides in the visit of the association to Leicester. A guarantee fund of more than 3300*l.* has been raised towards the necessary expenses of the welcome, and this without any public appeal being made. No less than eleven amounts of 100*l.* and upwards are included in this sum.

A call has been made on all the principal halls and public buildings throughout the town for general and sectional use, and it is believed that the arrangements when completed will be most satisfactory in every way. The greatest difficulty the executive have had to meet has been the fact that Leicester possesses no town hall or public building large enough for the purposes of the holding of the usual conversazione and general reception of the large number of members and guests anticipated. An ingenious suggestion, however, on the part of the chairman of the executive committee (Mr. Alfred Colson), which has met with the full approval of all concerned, promises to overcome all obstacles, and even to make the proposed conversazione additionally attractive on account of the unique way in which it will be housed. The intention is to utilise the whole of the present museum buildings, including the art gallery and mayoral reception rooms, for the use of which permission has been granted, and to erect on the four sides of the grass square adjoining a loggia or corridor constructed entirely of timber, 25 feet in width, forming a covered promenade about 500 feet in length. The four outer sides will be closed, but the inner sides, overlooking the grass plot, will be open, and so constructed as to be easily beautified with floral decorations. Internally the loggia will be draped with incombustible material and fitted with electric light and suitable furniture. Besides answering for the reception to be given by the Leicester Literary and Philosophical Society, the structure and grounds, with a military band in attendance, will make a convenient general rendezvous throughout the week.

A further edition of a very interesting work, "Glimpses of Ancient Leicester," by a local author, Mrs. Fielding Johnson, is being issued in connection with this meeting, and a handbook by another Leicester lady, Mrs. Nuttall, will be provided. The latter book will contain chapters on subjects of scientific interest prepared by various experts specially for the use of visitors.

Excursions are being arranged to many points of interest in the district, and the Mayor, Alderman Sir Edward Wood, J.P., will issue invitations to an evening *fête* in the Abbey Park. Sir Samuel Faire, J.P., will give a garden-party, and it may be taken for granted that the social side of the meeting will be well provided for. The comfort and enjoyment of all attending the meeting will not be overlooked, while the objects of the existence and visit of the association will throughout the week have the first consideration and thought.

AN AËRONAUTICAL EXHIBITION.

THE well-arranged collection of balloon appliances and models of aëroplane systems organised by the Aëro Club in connection with the Motor-car Exhibition in London presented a striking contrast to the want of organisation in the aëronautical section of the Milan exhibition of last year. The large, almost empty room at Milan, with no attempt at systematic display except in connection with the exhibits of the Prussian Government Meteorological Station, has no counterpart in the present exhibition. Here everything was well displayed, and there was no lack of exhibitors and assistants ready to give information to any inquirer.

In studying the exhibits, I paid special attention to the aëroplane models, with the object of ascertaining how far they were likely to furnish material that would further the systematic study of the problem of stability, and in particular of longitudinal stability, which is the more difficult of study. It appears, both from theory and experiment, that a very slight change in the form or dimensions, or even in the velocity of propulsion, of a model may change its motion from stable to unstable, and that if one machine travels safely through the air, another very closely resembling it may overturn at once. The general character of the exhibits does not seem to indicate that the constructors of flying models have

really grasped the all-important stability problem, or that the necessity of carefully studying the small oscillations of gliders, both stable and unstable, has been appreciated. It seems probable that a great many constructors of would-be flying machines do not even know what is meant by a moment of inertia, yet both theory and experiment tend to show that the stability of a machine depends partly on its moment of inertia being neither too large nor too small.

The models exhibited are of various sizes, and adapted for propulsion through the air by means of twisted elastics, like the familiar toys; they are, however, of various dimensions, say from about 3 feet to 6 feet. The trials which were made at the Alexandra Palace on Monday thus involved none of the dangers attendant on experiments with man-carrying machines. It is to be hoped that some means were taken to record the actual motions of the models while in the air. Such a record, if made in a way that would enable the positions and the velocities of the models to be plotted at every instant of the motion, could be made to furnish material the study of which will greatly advance our knowledge of the flight problem. From what I learnt at the exhibition, it appeared that this matter had not received much, if any, attention, but I was given to understand that two kinematographs would be employed to obtain the necessary records. The necessity for two is obvious, and I can only hope that the requisite measurements of base line and angles were also attended to.

In the following remarks I shall assume the result that a machine supported on aëroplanes has two kinds of longitudinal oscillations of different period, either of which may give rise to instability. This is not generally known, but it is desirable to analyse the models even in the light of ideas which are to some extent anticipatory. The rough notes taken are far from exhaustive, but they summarise a few points regarding some of the more conspicuous exhibits.

Ezio Tani shows a most elegant and beautifully constructed mechanism in connection with the *motor*; the arrangement of wings does not *look* very practicable.

Balston and Cochrane both exhibit propellers, &c., of corrugated aluminium.

The *avroplane* looks a fairly practicable model. The arrangement of two sets of planes tandem fashion appears suited for stability, at any rate so far as the short oscillation is concerned, but a great deal depends on whether the planes are parallel or inclined at a slight angle. On the other hand, the increased moment of inertia caused by the projecting framework and the considerable distance between the front and hind surfaces may give trouble with the long-period oscillation.

The Drexler model seems to go to the other extreme, and suggests that the shortness of base may lead to trouble with the quick-period oscillation. Here the planes are superposed, not arranged tandem.

Weiss's *albatross* is really a model of a bird with curved wings. How far this imitation of the shape of bird's wings conduces to stability cannot be completely studied without further experimental data than are at our disposal. The model looks as if it would glide well for a short distance, but without a very careful system of recording, short flights teach us but little.

Montford Kay shows a model of great length with propeller placed in the middle of a number of long parallel aëroplanes. The arrangement seems ill-calculated for obtaining much lifting force from the air.

Piffard shows a reasonable form of model with two pairs of superposed aërocurves, one behind the other. As arranged at the exhibition, the combination looked as if it would be unstable for moderate velocities, but a slight change in the inclination of the aërocurves might make all the difference.

T. W. K. Clark shows the most genuine attempt to cope with the problem of stability, he having followed the lines laid down by Chanute in the matter of flexible framework. From what I could gather, however, the necessary movements for balancing were not arranged to take effect automatically, but the machine was a small-sized model of a type intended to be balanced and controlled by the dexterity of an aëronaut.

It would be impossible from these rough observations to draw any very definite conclusions about the probable results of the competition, but it may be apposite to remark in conclusion that failures may teach quite as much as successes if only they are properly studied.

G. H. BRYAN.

THE STUDY OF EARTHQUAKES.

THE Imperial Earthquake Investigation Committee of Japan has supplemented its well-known Publications by a bulletin, issued with the object of securing a quick publication of short notes and preliminary reports on seismological subjects. The series opens with a very interesting number; there are papers on the determination of the time of origin of a distant earthquake, on the methods of calculating the velocities of earthquake propagation, on the Tokyo records of the Calabrian earthquake, and, most interesting of all, a discussion of the cause of the San Francisco earthquake, by Prof. Omori, who describes the great fault-fissure, referred to in NATURE of June 21, 1906 (vol. lxxiv.), and notices that near Pt. Arena and at some other places it did not show at the surface as a simple fault-fissure, but as a zone of distortion crossed by parallel shear-cracks, from the direction of which he concludes that, besides the relative displacement of the two sides of the fault zone, there was a general compression of the country from north to south. This displacement was no mere surface phenomenon, as it appeared in the tunnel near Wright station, some forty miles S.S.E. of San Francisco, at a depth of some 700 feet from the surface. From the direction of overthrow of objects, Prof. Omori concludes that the whole of the country along the fault has been displaced towards the N.N.W., but the west side more than the east.

In Austria the collection of earthquake statistics has been taken over from a committee of the Imperial Academy of Sciences by a newly extended Government Institute of Meteorology and Geodynamics. The first of the seismological publications of this institute is a catalogue of the earthquakes of the Austrian Empire in 1904, which are detailed province by province, with the addition of a general summary. A catalogue of this sort is as important and useful as a collection of meteorological tables; it is little more interesting to read, but, if not pleasant reading in itself, this little pamphlet suggests some interesting if not very comforting considerations. The science of seismology is essentially an English one; it is to Englishmen, and practically to two of them, that most of its fundamental concepts owe their origin; the ideas, which give vitality, and the terms which are in universal use, have almost all been born in this country, yet England remains without any permanent or official organisation for the collection of earthquake information, while one country after another is establishing a special service for this purpose. Nor can the neglect be excused by

the plea that the British Government is not concerned in the subject as are those of Japan and Italy, for, if we are fortunately exempt from the visitation of seriously destructive earthquakes, this is not true of our possessions; moreover, as one of the principal suppliers of the materials which will be used in the building of earthquake-proof construction, we have a distinct national interest in earthquakes. In England, too, has been formed the most valuable organisation which exists for the study of those broader aspects of seismology in which the cooperation of widely separated observers is necessary; at more than fifty stations, scattered over the surface of the globe, instruments capable of recording distant earthquakes have been set up, and all report to one central station, where an abstract of their records is periodically published, but this organisation, which we owe to Prof. Milne, is entirely dependent on the energy and initiative of one man, it has no official status or permanent foundation, which will ensure its permanence or extension.

Meanwhile, Germany has been to the fore and instituted an International Seismological Association, which, not content with the holding of periodical meetings, on the model of the international congresses, has established a central bureau at Strassburg, where it aims at concentrating the study of earthquakes and the collection of seismological data. So far its activities have been largely devoted to the preparation of a catalogue of the earthquakes of the whole world, necessarily too incomplete to be of great scientific value, and to the collection, for the purpose of publication, of the seismograms of the Valparaiso earthquake, which, as has been shown in our pages, do not exist in that complete form, uncomplicated by the effect of other disturbances, which is necessary for scientific study. As aids to the advancement of science these count for very little, as advertisements they are invaluable; and in saying this we insinuate nothing against the founders of the International Seismological Association, we may acquit them of any commercial intention, we recognise the great services which its promoter has rendered to science, but the facts remain that, where the information is there will people go for advice, and where they go for advice there too will they obtain their materials; and so we are in a fair way to a repetition of the lesson of the Jena glass.

INDIAN ORCHIDS.[1]

ONE of the largest and most generally distributed of the natural families of Indian plants, the Orchids form at the same time a group in which considerable interest is taken by European residents in our eastern dependency. No order affords more satisfactory data where questions as to the distribution of species have to be dealt with or points connected with endemism require illustration. The value of such data increases as the records for particular areas approach completeness. In order that the records for at least one area might be made as nearly as possible exhaustive, Sir G. King planned, and with the help of Mr. R. Pantling, who made the necessary drawings, carried out a scheme for the description and delineation from fresh material of every orchid known to occur in Sikkim. The results were published in "Orchids of the Sikkim-Himalaya," which forms the eighth volume of the Calcutta Garden Annals.

The present work is, as Mr. Duthie explains, to be regarded as a supplement to that on the orchids of Sikkim. The area dealt with, which comprises the whole of the Himalaya to the west of Nepal, between 70° 30′ and 80° 40′ E., is no doubt much more extensive than the area investigated in the previous volume, which comprises only that part of the Himalaya which lies between Nepal and Bhutan, from 88° to 89° E. But though this be the case, the number of species to be dealt with is much smaller; only 173 orchids are known to occur in the whole north-western Himalaya, as compared with 449 in Sikkim alone, and of these 105 are common to both areas. The same thoroughness has, however, characterised the search for material, and the same care marks the description of the species, though some may regret that the scope of the work has not allowed of fuller criticism in certain places of the work of previous writers. The author has been especially fortunate in having at his disposal the services of a competent artist, Mr. Hormusji Deboo, who has prepared fifty-eight highly satisfactory figures of those species that are to be found in the north-western Himalaya, but that do not occur in Sikkim.

Apart from its value to systematic botanists and students of phytogeography, the work will be welcomed by residents in the hill stations of the north-west Himalaya as the previous volume has been by residents in Sikkim, who in their study of the orchids they meet with find themselves, particularly at first, unable fully to appreciate the characters and relationships of the species before them when they have to rely for information on technical descriptions, however excellent, that are unaccompanied by illustrations. Regret will perhaps be felt that so few plates have been given. It is true that figures of the other 105 species are to be found in the work on the orchids of Sikkim, and it will be realised that the editor of the Annals must have felt himself precluded from incurring the expenditure involved in figuring the same species a second time. Still, the fact remains that the figures in the work on the Sikkim orchids, though good, fail to come up to the standard of the work of a trained draughtsman.

The author may be congratulated on the production of a memoir which sustains the character imparted to these Annals by the distinguished botanist who founded the series. The two ideals of scientific accuracy and practical utility, aimed at in previous volumes, have been kept steadily in view, and the enlightened liberality of the Government of Bengal, which has rendered their publication possible, will be as gratefully recognised by botanical workers generally as it is by the editor of the Annals in the dedication of the volume before us.

A RECENT ADVANCE IN THE KNOWLEDGE OF CANCER.

A COMPLETE presentation of the doctrine of the gametoid nature of malignant growths and of the grounds upon which that doctrine rests is contained in the first report on the cytological investigation of cancer, recently published.[1] The papers dealing with this subject have appeared in various publications, commencing with the original communication to the Royal Society by Farmer, Moore, and Walker in 1903, and they are here collected together and pre-

[1] "The Orchids of the North-Western Himalaya." By J. F. Duthie. Annals of the Royal Botanic Garden, Calcutta, vol. ix. part ii. Pp. ii+131; with 58 plates. (Calcutta: Bengal Secretariat Press, 1906.)

[1] University of Liverpool and Royal Infirmary Cancer Research Laboratories (Mrs. Sutton Timmis Memorial Fund). First Report on the Cytological Investigation of Cancer, 1906. By J. E. S. Moore and C. E. Walker. Pp. 87. (Liverpool: Published for the Liverpool Cancer Research Committee by the Priory Publishing Co., n.d.)

faced by an account of maiotic phenomena generally and a detailed comparison of those phenomena with the changes observed in cancer-cells.

It will be remembered that the authors of the communication referred to drew a comparison between the nuclear phenomena in cancer-cells and those characterising the process of maturation in the cells of reproductive glands. The degree of similarity between the two processes was found to be such as to suggest the inference that the type of cell-proliferation in the two cases was identical; and to those possessing a sense of the morphological significance of nuclear form this conclusion appeared to be warranted.

Deviations from the normal mitotic process were, however, already well recognised in cancer-cells, and had been interpreted as being purely pathological phenomena. Upon this view the resemblance between the nuclear forms met with in cancer-cells and those encountered in reproductive tissue would be regarded as accidental, and, in particular, the approximate halving of the number of chromosomes in individual cells of a group exhibiting extensive numerical variations both above and below that number would be looked upon as a merely chance occurrence.

Before this interpretation could be considered to have been satisfactorily displaced, it was, therefore, necessary to demonstrate that the definite halving of the chromosomes occupies a dominant position in the cancerous process, and to trace in every detail the points of similarity between that process and the maiotic process of reproductive tissue. Further research in these directions has tended to strengthen the original contention. By constructing the frequency-curve of the numerical variations of chromosomes in cancer-cells, the important position occupied by the definite halving of the number of chromosomes has been exhibited in a convincing manner; and the parallelism between the normal maiotic and the cancerous modes of cell-division has been traced in such detail as, apparently, to leave few points for further comparison.

It may, then, be confidently affirmed that the cancerous process has now been definitely and accurately referred to its physiological type, and, although the process may deviate from its type in certain particulars, marked rather by degree than kind, such as the number of post-maiotic divisions, the validity of the assertion is not thereby affected, since the different circumstances in which the two processes arise must inevitably find expression in corresponding modifications in the processes themselves.

A caution is given on p. 25 against a too hasty assumption that all gametoid tumours are malignant. It is well known that the malignancy of cancerous growths varies in degree in different cases, and that, as regards histological characters, every stage of transition may, in the case of certain organs more especially, be traced in different tumours between structures bearing the distinctive marks of malignancy and such as are undistinguishable from benign growths. It is conceivable that at the limit of such a series of transitional forms, tumours may exist which, whilst possessing the features of gametoid growths, are devoid of the properties which denote malignancy. The point is one of great theoretical interest, although in practice it is probable that such tumours would be treated as malignant in view of their close relationship to definitely malignant growths. The authors, however, barely touch upon this aspect of the subject, but suggestions are thrown out which appear to indicate further research into the nature of malignancy and a prospect of substantial results.

NOTES.

APPARENTLY, the British Government is indifferent to any increase of facilities for the advancement of knowledge, for it makes no attempt to show active interest in organisations and institutions concerned with science and higher education. The Carnegie Institute at Pittsburg was dedicated last week in the presence of a large and distinguished company, but neither the British Ambassador nor any member of the British Embassy was present at the ceremony, though invitations were sent. On the other hand, the German Emperor was represented by a special commission of six members of the highest rank; France and Italy were also represented, and there were present numerous representatives of other Embassies and Legations. It is unfortunate that England should have been without a political representative upon such an occasion, but the omission is only another instance of the failure of British statesmen to understand the significance of anything relating to science or progressive learning. The *Times* correspondent states that the absence of British representatives and the consequent tone of the whole proceedings left a regrettable impression among the British and Canadians, who formed a large majority of the foreign guests. He remarks:—"By Germany an opportunity has been cleverly and quite legitimately seized; by England it has been, by sheer stupidity, carelessly neglected." These words could be applied to so many similar instances that they may be considered as describing the characteristic attitude shown by the two countries to scientific work. We hope to give an account of the opening of the institute in an early issue.

PROF. ROSS contributes a second letter to the *Times* of April 13 on the subject of Mr. Haffkine's prophylactic and the Mulkowal disaster. We are not so much concerned with the details of the case as with the broad questions suggested by recent occurrences in connection with the steps taken to prevent the spread of plague. Prof. Ross maintains that the whole story affords another signal instance of the disregard for science so frequently displayed in British administration, and the evidence he offers establishes his position. He states that in the nine years up to the end of 1905 more than 4,000,000 deaths from plague were recorded in India alone, and Prof. Simpson says that 20,000 deaths are still occurring there every week. Though plague had been raging in Hong-kong for two years before the outbreak in Bombay, the authorities appear to have organised no system of sanitary intelligence, to have investigated few of the cases, and to have had no bacteriological department at hand. The result was that when plague appeared all was confusion. "No one seemed to understand," says Prof. Ross, "that such epidemics can be successfully combated only by the methods which succeed in the case of a military invasion. There was no scientific head of the defensive organisation, which was not even centralised until March, 1907. Generals and civilians were made dictators in a matter of which they had no knowledge, and occupied themselves with burning sulphur at street corners, and so on; and then, when these tactics failed, laid the blame on their subordinates, the doctors, whose advice they had frequently ignored, and whose science they had habitually despised. Everywhere, instead of the knowledge, organisation, and discipline which are essential in such emergencies, we saw only nescience, confusion, and vacillation. . . . History shows that plague, if taken in time, can be quickly eradicated; and in my opinion the blame for this terrible visitation must be laid largely on those who governed the

country, but neglected until too late the precautions and organisation indicated by sanitary science." It is remarkable that our statesmen learn with such difficulty the value of the application of the methods of science to administrative matters, especially in view of the object-lessons provided by neighbouring nations, lessons sufficient to convince the least thoughtful of the use of science in deciding national difficulties. It cannot be repeated too often, in the hope that eventually our legislators and administrators may learn the truth, that the nation which makes the most intelligent use of scientific discoveries and systematically approaches all questions in a scientific manner will assuredly occupy the most honoured place among the peoples of the world.

THE Upsala commemoration of the Linnæus bicentenary will take place on May 23–25. The celebrations, which are to be held under the auspices of the University of Upsala, will begin on May 23, in the Aula of the University, with a formal reception of the guests. On the evening of the same day a further reception will be held in the University buildings. On May 24 there will be a promotion to degrees, only Swedish doctors being promoted. It is proposed this year to revive the ancient custom of conferring degrees in the cathedral instead of in the University Aula. The evening of May 24 will be taken up by a dinner given to the guests by the University, and it is probable there will also be demonstrations on the part of the students. On May 25 the Royal Academy of Sciences, Stockholm, will also commemorate the bicentenary in Stockholm. All foreign delegates invited by the Upsala University will be provided with free hotel accommodation during their stay in Upsala and Stockholm.

MAGNETOGRAPHS of Prof. Watson's pattern have been installed recently in the Helwan Observatory near Cairo.

MR. F. E. BEDDARD, F.R.S., has been appointed an honorary member of the New Zealand Institute.

M. DESLANDRES has been elected president of the Astronomical Society of France for the year 1907–8.

THE summer meeting of the British Archæological Association will be held this year in Dorset, with Weymouth as the headquarters.

THE Croonian lecture of the Royal Society will be delivered by Prof. J. B. Farmer, F.R.S., on Thursday next, April 25, "On the Essential Constituents of the Nucleus and their Relation to the Organisation of the Individual."

A REUTER message from Mexico states that the towns of Chilpancingo and Chilapa, in the State of Guerrero, have been destroyed by an earthquake.

THE British Science League and the British Empire League will give a complimentary dinner to the Colonial Prime Ministers at the Whitehall Rooms on Thursday, May 2, at 8 p.m.

THE annual dinner of the Institution of Mining and Metallurgy will be held at the Hotel Cecil on Friday, May 3. Prof. W. Gowland, president of the institution, will occupy the chair, and many leading representatives of pure and applied science have accepted invitations to be present.

ON Tuesday next, April 23, Prof. W. Stirling will deliver the first of a course of three lectures at the Royal Institution on "Stimulation, Luminous and Chemical." The Friday evening discourse on April 26 will be delivered by Mr. J. Swinburne, on "New Illuminants," and on May 3 by Sir James Crichton Browne, on "Dexterity and the Bend Sinister."

THE International Commission of Scientific Aërostation at its last meeting at Milan in October, 1906, resolved, on the recommendation of M. Teisserenc de Bort, to carry on during the years 1907 and 1908 the investigation of the upper atmosphere in the northern hemisphere on a much more extended scale than has hitherto been attempted. The Royal Meteorological Society has been invited to take part in this scheme, and the council proposes, if possible, to organise and equip special stations in different parts of the British Empire north of the equator. Unmanned "registering" balloons carrying self-recording instruments, and also smaller "pilot" balloons, are to be used, the heights and drift of which will be determined by theodolites. The ascents in 1907 are to be made on three consecutive days in each of the months July, September, and November.

"BLACK rain" fell in Pembrokeshire on April 10. It was accompanied by a violent thunderstorm and a darkened atmosphere. The ominous darkness was observed as far east as Cardiff, but the violent thunder, &c., was confined to districts further west. Discoloured rain is also said to have fallen at Carmarthen. There have been several such falls in South Wales of recent years. One of these occurred round Barry, as well as in the west of England, on January 23, 1902, and the matter was carefully discussed by Dr. Mill before the Royal Meteorological Society. A second fall took place on February 21, 1903. This was more extensive than the other, and the dust differed appreciably from that of the previous fall. Analysis of the 1903 dust made at Cardiff College led to the belief that it was probably volcanic. Traditional accounts of falls of frogs, snails, and fish occur in the annals of Glamorgan.

THE *Daily Chronicle* of April 10 contained the following paragraph:—"A thunderbolt fell at Birkenhead yesterday, and several persons had narrow escapes from death. When a storm seemed about to burst over the town a ball of fire swept over the Bidston Observatory, and struck a mound of earth, whence it rebounded into a field, and set fire to some gorse there. A vanman who was near at the time was knocked down, and a florist working in his garden was enveloped in a ring of flame and whirled several yards, while the spade with which he was working was hurled over the hedge. A cow grazing in a field was brought to the ground by the shock, and several workmen in the vicinity, who had trowels in their hands, were considerably alarmed at being knocked off the ladders on which they were working. People who were several hundred yards away from the spot where the bolt fell received violent shocks, and were last night suffering from nervous prostration." Inquiries made at the Bidston Observatory with reference to the so-called "thunderbolt" and the amount of damage occasioned, show that there is little foundation for this somewhat sensational report. Some of the features associated with the presence of "ball lightning" seem to have been noticed. There does not seem to be any evidence that a globe of light was seen, but there were some signs of horizontal motion, and the characters of the after effects resemble those produced by this unexplained phenomenon. But the essential mark of slow motion common to "ball lightning" was certainly not noticed, and the injury to workmen at some distance, though slight, points to the more ordinary effects of lightning.

The injuries produced seem to be more nearly akin to those described as lightning strokes in the open field. The irregularities of the surface of the land in the immediate district are very slight, and owing to the difficulty that lightning has in striking down upon a smooth plane surface, the boring of a hole in the ground some 2 feet in diameter and 18 inches deep has directed attention to this particular discharge by reason of its unusual character. There was no evidence of fused silica near this hole.

THE Port Erin Biological Station has never been more fully used by workers in marine biology than during the present Easter vacation. From the last week in March onwards throughout April, systematic collecting at sea and investigations in the laboratory have been actively pursued by as many biologists as can be comfortably accommodated. During the first half of April ten to twelve investigators occupied seats in the laboratory, and about the middle of the month a dozen senior students came in addition. The researchers include Prof. B. Moore (biochemistry), Dr. H. Roaf (physiology of crustacea), Mr. J. Pearson (cancer), Mr. R. D. Laurie (biometrics), Mr. W. J. Dakin (Pecten), Prof. Herdman, Mr. Wollaston, and Mr. Gunn, all from Liverpool University; Prof. Hickson, Mr. Chaffers, and Mr. Whitnall, from the Victoria University of Manchester; Mr. Unwin, from the University of Leeds; and Mr. Chadwick, the resident naturalist. Plankton collections, both surface and deep, are being taken periodically, at stated localities, over a limited area for statistical purposes, from the S.Y. *Ladybird*, and the usual sea-fish hatching and distribution of larval plaice is in progress.

DR. B. GLANVILL CORNEY, chief medical officer of the Government of Fiji, directs our attention, in a letter received from Fiji, to an instance of poisoning by turtle's flesh which occurred at a village in the island of Vanua Levu, Fiji. The turtle was cooked immediately after being killed, and no question of unfitness for food through putrescence arises; indeed, neither the history of its capture and preparation for the oven, nor of the symptoms which supervened after its ingestion, points in any way to poisoning by ptomaines. The indications were, on the other hand, that the turtle itself had become poisoned before its capture, presumably through having consumed some unaccustomed article of diet on the reefs. That something was wrong with the turtle before it was caught seems certain, as the men who captured it are reported to have discussed the question as to whether it was fit to be eaten. Dr. A. W. Campbell, district medical officer and magistrate of the locality near where the poisoning occurred, reports the history of the attacks as follows:—Severe headache and vomiting, abdominal pain; diarrhœa not marked. So far as could be ascertained, in several cases an interval of seventy-two hours intervened between the ingestion of the turtle and the first symptom, and in most cases there was an interval of twenty-four hours. Some four or five days after the attacks began, ulceration of the lips, tongue, cheeks, and fauces occurred, and every one of the cases seen was so affected. Abdominal pain was not marked in the later stages. Twenty-five deaths in all were attributed to poisoning by the turtle's flesh.

THE fourth part of vol. v. of the Annals of the South African Museum contains a paper by Mr. S. Schenkling on new beetles of the family Cleridæ, and a second, by Mr. P. Cameron, on parasitic Hymenoptera.

A DEFINITE mode of measuring the fossæ in the interior of the human skull forms the subject of a paper by Mr. A. Hrdlička, published as No. 1521 of the Proceedings of the U.S. National Museum. Such measurements are of considerable importance in estimating brain-volume, even in cases where the brain itself is available, the weight of that organ tending to alter the shape of its lower surfaces when removed from the skull.

WE have received copies of several parts of vol. xvi. of the Transactions of the Academy of Science of St. Louis, published at various dates during 1906. The first of these is devoted to an account of the celebration of the fiftieth anniversary of the first meeting of the academy. Land-snails from Michichan form the subject of a paper by Mr. F. C. Baker, while Mr. R. J. Terry describes the nasal skelton of the salamander *Amblystoma punctatum*, and Mr. S. Weller discusses the fauna of the Palæozoic Glen Park limestone.

IN their report for the year ending June, 1906, the trustees of the Australian Museum record their opinion that collections made in New South Wales ought not to be permitted to pass out of the country, especially when, by a simple process of combination amongst the State departments interested, the collections in question could be acquired at a reasonable cost and subdivided amongst the various metropolitan and country museums. It is also stated that until the museum is enlarged no further progress can be made in the exhibition of specimens to the public.

AMONG the contents of part iii. of the third volume of the quarterly issue of Smithsonian Miscellaneous Collections, reference may be made to a paper by Prof. Theodore Gill on various non-European representatives of the carp family (Cyprinidæ). One of the most remarkable features in the distribution of the group is the total absence of barbels (Barbus), which are so numerous and so widely spread in the Old World, from North America. This feature, coupled with the peculiarities of the North American cyprinid fauna generally, is held by the author to afford a strong argument against the inclusion of the northern portions of the three northern continents in a single zoological region. It is noteworthy, however, that an approximation to Old World types is met with among the cyprinid fauna of the Pacific slope of North America which is lacking in that of the opposite side of the continent.

FROM a distributional point of view, great interest attaches to the description by Prof. Al. Mrázek, of Prague, in the *Sitzungsberichte der kgl. Böhm Gesellschaft der Wissenschaften* for 1906 of a member of the group of flat-worms known as the Temnocephalidæ, from Montenegro. These worms, which are parasitic on fresh-water crayfish and crabs, have hitherto been known only from tropical and subtropical countries, such as Australasia, Malaya, Madagascar, India, Chili, and Brazil, and the occurrence of an outlying form in the Palæarctic area is therefore very remarkable. There are, however, other features in the fauna of Montenegro which indicate that it is of a somewhat abnormal type. The host of the worm is the crustacean *Atyaëphyra desmaresti*, a species with a rather wide distribution in the south of Europe. The locality where the worm was found is the delta of the river Morača, which discharges into the lake of Scutari, and on this ground the name *Scutariella didactyla* is proposed for the new form, which is regarded as generically distinct from Temnocephala. To the same issue Prof.

Mrázek contributes an account of a polypharyngeal planarian from Montenegro, this being the second representative of that group from this country.

No. 93 of the *Bulletin de l'Institut Océanographique*, published at Monaco, contains an illustrated account, by Mr. E. L. Bouvier, of the Paris Museum, of zoological observations made during a cruise in the Atlantic in 1905 on the Prince of Monaco's yacht *Princess Alice*. After briefly referring to the cetaceans and pelagic fishes observed, the author devotes considerable space to the invertebrate fauna of the Sargasso Sea, which he declares to be of surpassing interest to the naturalist. Among the numerous species figured, one of the most striking is a copepod crustacean (*Copilia vitrea*), in which the eyes are unusually large, while the swimming-limbs are richly garnished with feather-like expansions. In the latter respect this crustacean presents a curious analogy to the well-known Sargasso fish *Antennarius marmoratus*. Other Sargasso invertebrates, like a species of Sagitta, obtain protection by means of the pellucid nature of their tissues. Considerable interest attaches to the observation that the hemipterous insects Halobates differ from all other pelagic forms in not seeking shelter below the surface in stormy weather. A second chapter is devoted to the deep-sea fauna, among which the author directs special attention to the remarkable holothurian *Pelagothuria bouvieri*.

THE *Irish Naturalist* for April contains the report of an address on the problems of an island fauna delivered by Mr. C. B. Moffat, as president, to the Dublin Naturalists' Field Club on January 8. Starting with the fact that the modern fauna of Ireland is poorer than that of Great Britain, and the latter inferior in richness to that of the Continent, the author raises the question whether the theory that this poverty is due to animals having been unable to effect an entrance into these areas affords a satisfactory solution. The idea that oceanic islands have received their faunas by dispersive agencies is held to be untenable, such faunas, it is argued, being merely remnants of larger ones derived from ancient continental connections. On this hypothesis, there would seem to be grounds for the belief that island faunas have an inherent tendency to self-effacement, and it is suggested that this tendency may be in part due to weakness in those members of a species which inhabit the peripheral zone of its distributional area. "Both Great Britain and Ireland," it is urged, "certainly have lost, within times that were at least subsequent to the beginning of the ice-age, a considerable number of species, which are shown by the explorers of our caves to have flourished here when we had still a continental connection. How they came to die out . . . we cannot say. But I do think it is a mistake to assume that the insulation of the British and Irish areas has affected our fauna and flora in no other way than by preventing the advent of new species. We have to explain how we have lost as well as how we have failed to gain."

IN an account, forming vol. ii., No. 1, of the Philippine Journal of Science, dealing with polypodiaceous ferns collected from one locality, San Ramon, on the Philippine island of Mindanao, Mr. E. B. Copeland discusses their distribution in the different vegetative zones and their structural adaptations. The collection amounted to the large number of 184 species, of which one-seventh were local and the rest Malayan. In addition to the ecological notes, that are very interesting but too detailed for summarising, the author has essayed the difficult task of formulating a taxonomic grouping of the order that is illustrated in a genealogical tree. Lastræa is regarded as a central type from which many branches, *e.g.* Microlepia, Polystichum, and Goniopteris, have sprung; Polypodium, Athyrium, and Acrophorus are associated with Lastræa as primitive forms.

THE third number of the Kew Bulletin for the current year contains a list of flowering plants and cryptogams sent from Labrador by Sir William McGregor. Special interest attached to the lichens, as it was suggested that an attempt would be made to naturalise the reindeer if the food material it requires was available in sufficient quantity. According to the notes accompanying the specimens, *Cladonia rangiferina* appears to be abundant, and with it are commonly associated *Cetraria aculeata* and *Platysma nivalis*. An article, "Alpine Notes from Sikkim," is extracted from a letter written by Mr. I. H. Burkill describing a tour in search of Aconite tubers; an illustration shows *Aconitum spicatum* and a hybrid Aconite in flower. A new genus of Compositæ is defined from Tibetan material by Mr. J. R. Drummond under the name of Chlamydites, having affinities with the Tibetan plant *Cremanthodium Deasyi*. Two economic articles provide information on the distillation of camphor and the cultivation of ginseng, a variety of *Aralia quinquefolia*, in Korea.

IN the Journal of the Franklin Institute (vol. clxiii., No. 3) Prof. Oscar C. S. Carter describes in detail the Government irrigation project at Yuma. The project contemplates diversion of the waters of the Colorado River about ten miles north-east of Yuma, Arizona, into two canals. In Arizona these canals will irrigate all the bottom lands of the Colorado and Gila rivers between the Laguna dam and the Mexican boundary, an area of 84,000 acres, and in California the bottom lands in the Yuma Indian Reservation, an area of 17,000 acres. Engineering skill of the highest order will be required. The Roosevelt dam in the Salt River Cañon, Arizona, will be solid masonry 285 feet high, and, joining the cañon walls several hundred feet apart, will form a lake twenty-five miles long and 200 feet deep. The details given tend to show that the United States will soon take the lead as the foremost country where irrigation is practised on a large scale.

THE Transactions of the Institution of Engineers and Shipbuilders in Scotland (vol. l., part v.) contain a suggestive paper on the mechanism of power transmission from electric motors, by Mr. Wilfrid L. Spence. He brings forward possible alternatives to the commoner methods, with typical applications of each system. Direct coupled drives are to be preferred to all others whenever practicable. Belt drives are to be preferred to any form of strictly positive connection between constant speed motors and fly-wheel operated machinery. A fly-wheel is quite useless with a constant speed motor positively connected to its load. Single reduction spur gear may be regarded as the standard gear transmission for ratios up to 5 or 6 to 1. When the distance between centres is great, the idler spur gear (cast-iron pinion, raw-hide idler, and cast-iron wheel) is a substitute for plain single reduction gear. Chain gear may, as a rule, also be used, but only for ratios up to 5 or 6 to 1. For ratios up to 30 to 1, and where space is not of much account, double reduction spur gear is applicable. As treble reduction spur gear, which is applicable for reduction between 40 and 150 to 1, takes up much space and is costly, it is not to be recommended. When extreme compactness is desirable,

planetary gear drives may be used, and where silent running is desired with total enclosure, and a right-angled transmission is permissible, there is nothing to equal worm gear, which shows to best advantage for reductions of 15 or 20 to 1.

WE have received from Messrs. Wratten and Wainwright specimens of their M screens and "Verichrome" and "Allochrome" plates for photomicrography, together with an explanatory booklet. The screens, nine in number, consist of gelatin films impregnated with dyes which admit the passage of light of certain wave-lengths, the values of which are given. We have examined spectroscopically the light transmitted by each of them, and find it to be correctly stated in the booklet, which also contains a table of the absorption bands of the principal staining agents, together with the proper screen and plate that should be used to photograph a specimen stained with any of the stains named. The booklet contains a concise statement of the principles involved, of the method of combining the screens, directions for tricolour work, exposure, developing, &c. The plates are undoubtedly some of the best for photomicrography that have yet been placed on the market, and the "Allochrome" plates will be found very useful in ordinary work by those who desire pictures of natural objects showing the proper gradations of light and shade. A criticism which might be made is that the gelatin screens are somewhat delicate, being easily affected by damp and heat (it is true they may be obtained cemented between two glass plates, but are then much more costly). We have no hesitation in saying that Messrs. Wratten and Wainwright have made a distinct advance, and have brought out their screens and plates on lines far more scientific than has hitherto been done.

THE London Geological Field Class has arranged its excursions for the study of the London district, under the direction of Prof. H. G. Seeley, F.R.S., to commence on Saturday, April 27. Mr. J. W. Jarvis, St. Mark's College, Chelsea, is the honorary secretary.

THE Halifax Education and Public Library Committee has arranged for the publication of a series of descriptive pamphlets on the more important objects in the Bankfield Museum under its care. We have received a copy of the fourth of the series, sold to the public for one penny, which is on "Egyptian Tablets," and is written by Mr. Thomas Midgley, curator of the Bolton Museums. The tablets in the Halifax Museum were brought from Thebes to this country by Mr. Jeremiah Rawson about 1839. They were built into the wall of one of the rooms of the Halifax Literary and Philosophical Society, and remained practically forgotten until eight years ago, when they were transferred to the Bankfield Museum, walled in, and covered with glass. The pamphlet contains the result of Mr. Midgley's work in deciphering the tablets. The inscriptions all consist of prayers to various gods that funeral offerings of food, drink, and so on may be given to the deceased in an after life. Mr. H. Ling Roth, honorary curator of the museum, contributes a preface to the pamphlet.

MR. EDWARD M. LANGLEY, of Bedford, writes announcing the discovery of an interesting contribution to the history of English mathematics in the form of a hitherto unpublished letter by the discoverer of "Taylor's theorem." The letter in question was addressed to the Rev. Mr. Newcome, fellow of St. John's College, Cambridge, under date November 24, 1711. In alluding to the appointment of Saunderson to the Lucasian chair of mathematics at Cambridge, Brook Taylor expresses his opinions on the then prevailing spirit of mathematical teaching in the following words, which possess considerable interest in the light of modern thoughts on the subject. The writer says:—"I am very glad Mr. Saunderson has it and hope he will fully answer the expectations the Electors have of him. He is an extraordinary Algebraist, and I expect great Improvements in that Art from his hand; but (if I might have my desire) I would rather wish he would apply himself to the cultivation of Pure Geometry. That is a large subject, worthy of the labours of a Professor, and is abundantly more entertaining than the Contemplation of mere abstract quantities, which are the proper objects of Algebra; but that, truly speaking, is but an introduction to Mathematics as Logic is to Philosophy. *And it is my opinion that the prevailing humour of treating Geometry so much in an Algebraical way has prevented many noble discoveries that might otherwise have been made by following the methods of the Ancient Geometricians.*"

THE report of the Hampstead Scientific Society for the year 1906 shows that the work of the society has continued in a uniformly satisfactory manner. The society has been added to the list of "associated societies" of the British Association, and is affiliated to the South-Eastern Union of Scientific Societies. The Christmas juvenile lectures were successfully repeated, and a nature-study course for the benefit of those teaching young children was conducted by Mr. W. M. Webb.

THE general report on the operations of the Survey of India during the survey year ending September 30, 1905, has now been published. It was during the year with which the report deals that the Government of India appointed a committee to consider, among other matters, the state of the maps in each province and the measures required to bring them up to date. This committee has since reported that in many parts of India the maps are so out of date as to be of little use, and in some cases even misleading, owing to changes in roads since they were prepared. In order to carry out the recommendations of the committee it will be necessary to revise in the field practically the whole of the existing 1-inch maps of India, and to survey on either the 2-inch or the 1-inch scale the whole of the country for which maps on neither of these scales have ever yet been prepared. Omitting the Baluchistan Agency and the tribal area of the North-West Frontier Provinces, it is estimated that an area of 525,800 square miles of original survey will have to be re-surveyed, that a practical re-survey will have to be made of 479,000 square miles, while the maps of 266,300 square miles may be capable of revision in the field. There remains an area of 266,300 square miles for which cadastral maps are or will be available from which to prepare topographical maps with inconsiderable corrections in the field, and 135,900 square miles, chiefly in Burma, for which the maps are modern, and merely require re-drawing. It is proposed that the whole of this work should be carried out within twenty-five years, while the survey of Baluchistan, the North-West Frontier Province, and the country adjacent thereto should be completed within a much shorter period.

THE reviewer of the "Zoological Record" in last week's NATURE (p. 557) regrets to find that in the notice he omitted the second *n* in *Tyrrannosaurus* and *Tyrannosaurus*.

OUR ASTRONOMICAL COLUMN.

A NEW COMET (1907*b*).—A telegram from the Kiel Centralstelle announces the discovery of the second comet of the present year by Mr. Mellish, at Madison, on April 14. The magnitude of the object is given as 11·0, and its position at 10h. 20m. (Madison M.T.) on the day of discovery was R.A.=6h. 40m., dec.=+8° 0′.

A second telegram from Kiel states that the comet was observed by Bianchi at Rome on April 16. Its position at 8h. 22·1m. (Rome M.T.) was

R.A.=7h. 0m. 17·5s., dec.=+17° 19′ 14″.

This is about 2½° south of ζ Geminorum, and crosses the meridian at about 5 p.m.

A NEW NEBULA.—Whilst searching for new double stars on January 18, the Rev. T. E. Espin discovered a nebula in the constellation Perseus which he believes to have been previously unrecorded.

This object precedes B.D.+33°.746 by 7·8os., and is 2′ 25″ south of it, so that it lies somewhere about halfway between ε and ξ Persei. It is about 6″ in diameter, and is elongated towards the north, its brightness being about equal to that of a tenth-magnitude star. The later observations appear to suggest a planetary nebula with a small star on the northern edge (Monthly Notices R.A.S., vol. lxvii., No. 5, March).

COMET 1905 IV.—A further observation of comet 1905 IV. (1906*b*) is recorded in No. 4166 (April 5) of the *Astronomische Nachrichten* by Prof. E. Becker, who, with the large refractor of the Strassburg Observatory, saw it as a small round body, of about the tenth magnitude, on March 4. The observations of this comet now cover a period of about 2¼ years.

In the same journal Prof. Weiss gives a continuation of his ephemeris, extending from April 2 to June 5, which shows that the comet is apparently travelling very slowly through Libra in a north-westerly direction towards Virgo.

THE TEMPERATURE OF MARS.—Hitherto the chief obstacle to the belief that Mars is habitable by any such beings as inhabit the earth has been the extremely low temperature probably obtaining on the Martian surface, but in No. 25, vol. xlii. (March), of the Proceedings of the American Academy of Arts and Sciences, Prof. Lowell shows that, by taking all the phenomena into consideration, this obstacle may be removed. Previous calculations of the temperature have been deduced solely from the relative distance of Mars from the sun, and a recent investigation gave −33° F. as the mean temperature of the planet.

Prof. Lowell points out, however, that other factors, such as the relative albedoes of the planets, the screening effect of clouds, the blanketing effect of the atmosphere, &c., should be taken into account, and, on this basis, he finds that the mean annual temperature of Mars, if the heat were retained as well there as here, would be about 72° F. As the retention is greater in the case of the earth, this value is considerably reduced in the final calculation, taking all the known factors into consideration, and a mean temperature of about 47° F. is obtained. Prof. Lowell also finds that the boiling point of water on Mars would be about 111° F. (44° C.), that the amount of air per unit surface is about two-ninths that found in the case of the earth, whilst the relative density of the air at the surface is only about one-twelfth.

GALILEO IN THE VAL D'ARNO.—The April number of the *Monthly Review* contains an interesting article by Miss Janet Ross giving some details of Galileo's life whilst he dwelt near Florence, first as court mathematician and philosopher, then as a prisoner at the hands of the Inquisition. It was at a villa known as "Le Selve," near Signa, that he discovered spots on the sun and wrote his treatise on the planets, his history of sun-spots, and other works; whilst in a second villa in the neighbourhood, now known as the "Villa dell' Ombrellino," he wrote the "Saggiatore" and commenced his "Dialogues on Motion." After the persecution at Rome in 1633 he lived at Il Gioello, Arcetri, and it was here that the Inquisition forbade him to converse with anyone, so that from that date until his death in 1642 he was an isolated prisoner, and for the last four years was totally blind. Miss Ross also gives some interesting facts concerning the philosopher's family affairs.

ANOTHER NEW ASTRONOMICAL JOURNAL.—From the Società Astronomica Italiana we have received the first three numbers (January, February, and March) of its monthly bulletin, the *Revista di Astronomia e di Scienze affini*. The society was founded by Prof. Boccardi, of the Turin Observatory, in November, 1906, and has for its principal aim "the vulgarisation of astronomical conceptions." These bulletins contain original articles, astronomical notes, and reviews, together with ephemerides and notes concerning celestial phenomena for the succeeding month, and are published by the society at Turin.

THE STONYHURST COLLEGE OBSERVATORY.—Father Sidgreaves's report of the work done at the Stonyhurst Observatory during 1906 contains, in addition to some astronomical notes, the detailed results of the magnetic and meteorological observations made during the year. On the astronomical side, the sun was observed and drawings of the solar surface made on 212 days, and the large grating spectrometer was employed on the larger spots. For this work a new heliostat is being built which will carry a 12-inch mirror, and when the instrument is complete it will be possible to employ the full aperture of an 8-inch objective for use with the large Rowland grating in solar spectroscopy. Good spectrograms of Mira Ceti and some selected brighter stars were obtained during the year. The mean magnetic declination for 1906 was 17° 48′·3 W.

THE TWENTIETH YEAR AT BLUE HILL OBSERVATORY.[1]

BLUE HILL OBSERVATORY on January 30, 1905, completed its twentieth year's work, and it is noteworthy that three out of its staff of four have been there at least eighteen years. Owing to the crowds of people brought to the hill by the electric cars, it was found necessary in 1905 to enclose the observatory by wall and fence, some of the secondary instruments having previously been moved for the same reason. Blue Hill is one of the few American observatories where the standard instruments have remained in the same position and with unchanged environments for so long a time, so that, except for the fact that the times of observation were changed to agree with those made by the U.S. Weather Bureau, the records are all strictly comparable. Since 1901 the observations have all been published in the metric units, English units being only used in parallel in the summaries.

The exploration of the upper air by means of kites carrying instruments which recorded continuously was first originated at Blue Hill in 1894. In 1901 the first observations over the North Atlantic were made by the director, Mr. A. L. Rotch, and Mr. Sweetland, using kites flown from a steamer. Kite observations are now made whenever possible on the days fixed by the International Committee for Scientific Aëronautics. These are generally the first Thursday in each month. In 1903, fifteen flights were made, nine of these being on days fixed by the committee. The average height reached was 2214 metres. In 1904, eight out of fourteen flights made were on appointed days, and the average height was 2300 metres. In 1905, sixteen days were assigned by the International Committee, and at Blue Hill flights were made on twelve of these and on four other days; the average height reached was 2120 metres. During the three years the maximum height reached was 4468 metres, or 14,662 feet. Since 1894, 280 flights have been made at Blue Hill.

In September and December, 1904, and January, 1905, at the St. Louis Exhibition Assman balloons were liberated with instruments. During the summer of 1905 another series of ascents was executed by Mr. Fergusson. Out of the thirty-five balloons liberated at St. Louis, thirty-two have been returned, most of them with records of pressure and temperature. The records show that fifteen balloons

[1] Annals of the Astronomical Observatory of Harvard College. Vol. lvii., part ii. Observations and investigations made at the Blue Hill Meteorological Observatory, Massachusetts, U.S.A., in the years 1903 and 1904.

reached a height of more than 8000 metres (five miles). Two of them had travelled at a rate of 100 miles per hour. The maximum height reached was 17,037 metres, or nearly eleven miles, and the lowest temperature recorded was −79° C., at a height of 14,800 metres.

While Mr. Clayton was crossing the Atlantic to Gibraltar to join M. Teisserenc de Bort and M. Maurice on the cruise of the *Otaria*, he executed six kite flights, and on the cruise nineteen flights were made. From the Azores, Madeira, and Canary and Cape Verde Islands twelve balloons were sent up, and records were obtained of the wind velocity and direction up to altitudes of 13,600 metres. It was demonstrated that the upper return trade winds in the northern hemisphere blow generally from the south, and that the chief features of the vertical distribution of temperature and humidity were the differences between the east and west sides of the permanent anticyclone and the stratification of the atmosphere in the region of the trades and the doldrums (see NATURE, November 16, 1905, and March 8, 1906). These investigations are to be continued to see if the proximity of land influences the upper-air currents over the ocean.

In the tables giving the records obtained by the flights in 1903 and 1904 at Blue Hill, the reading corresponding with the different altitudes of the kites, are all compared with simultaneous readings made in the observatory, and the initial and final readings on the meteorographs are compared also with those at the station at the base of the hill. The height of the kite was determined from its angular height and the length of the wire, with a correction for sag. When the kite was not visible, its height was determined from the corrected readings of the barograph it carried.

In order to eliminate the effect of sluggishness of the instruments, the temperature readings were taken from the records at points which coincided with stationary points in the flight. Humidity was recorded by means of a hair hygrometer, which had been standardised by comparison with a psychrometer before and after the flight. The direction of the current in which the kite was flying was determined by the azimuth of the kite from the reel.

During 1902 and 1903 a long series of observations was made to study the effect of meteorological conditions on atmospheric refraction. From Blue Hill, Boston Lighthouse can be seen more than fourteen miles away, and the difference between the geodetic and observed dip of the line of sight observed three times a day. W. M.

SCIENTIFIC WORK IN THE STRAITS SETTLEMENTS AND CEYLON.

THE last number of the Journal of the Straits Branch of the Royal Asiatic Society is full of matter interesting to various classes of readers:—for botanists, Mr. H. N. Ridley's studies on the grasses, sedges, Scitamineæ, and Begonias of Borneo; for zoologists, Mr. P. Cameron's account of the Hymenoptera of Sarawak; for anthropologists, Mrs. Bland's description of the curious Anyam Gila basketry of Malacca, and Mr. Howell's Dyak ceremonies in pregnancy and childbirth, with a list of remarkable taboos imposed upon the woman before and after delivery; and, lastly, for folklorists, several tales collected by Messrs. Maxwell and Laidlaw. The most important contribution to the number is Mr. Ridley's article on the menagerie at the Botanic Gardens, Singapore. This was started by a local society in 1859, taken over by the Government in 1874, and, finally, the valuable collection was dispersed in 1903 on the ground that the authorities could not afford funds for buildings and a modest annual grant for maintenance. It is certainly a misfortune that this institution should have met such a fate. As Mr. Ridley points out, there are few places in the world better suited for a zoological garden than Singapore. Maintenance charges are low, and the vicinity of the source of supply renders it possible to procure specimens at a small cost. Mr. Ridley gives valuable notes on the various genera, and supplies useful hints on the methods of keeping animals in captivity. He lays down as a maxim that "the only way of knowing what an animal thinks is comfortable and snug is to keep it and observe its ways. It will soon let you know what it likes, which probably does not at all fall in with your ideas of what it ought to like." His notes on the habits of the larger Quadrumana are based on first-hand knowledge. A pair of Indian jackals, he tells us, bred in the gardens, which is, to say the least, unusual. The Malay tapir (*Tapirus indicus*) displayed remarkable cryptic characters. When in its young pelage it hid in a palm bush, "and when I went to fetch it, on opening the bush and looking down, I could not see it. I seemed to be looking on the dark brown ground with spots of sunlight through the leaves. The little animal lay in such a position that the yellow spots were exactly where the vertical sun rays would fall, the yellow streaks resembling the slanting streaks of light from the side. It was for a few minutes quite invisible, though I was looking down on it." No. 47 of the journal of the same branch of the society is devoted completely to a Malay manuscript entitled "Hikaiat Shamsu'l Bahrain," which, however, has no claims to special interest, being of a common type.

The address delivered by the Hon. J. Ferguson, president of the Ceylon branch of the Royal Asiatic Society, gives an interesting sketch of past and present scientific work in the island. In natural science the most valuable recent publication is that of Prof. Herdman, on the pearl oyster fisheries, with supplementary reports on the marine biology by other naturalists. The mineralogical survey has led to the discovery of many novelties, including thorianite, the only thorium-bearing substance to be found in any British possession. It is much to be regretted that the local government has been unable to provide funds for the establishment of an observatory, the want of which is much felt by the shipping trade, and was obliged to decline the offer of Mr. A. R. Brown, one of the Cambridge school of anthropologists, to undertake a survey of the Veddas. The suggestion made by Sir H. A. Blake, on native authority, that the connection between mosquitoes and malaria was known to Susruta, a Hindu writer of the fourth century A.D., has been examined by Prof. Jolly, with the result that the term Masaka cannot be confined to the mosquito, but includes various other insects popularly believed to cause disease. In regard to membership, the society is in a sound position. In spite, however, of the president's optimism, we gather that the supply of papers is not so large as might be desired, and that some of the enthusiasm which has revived the sister society at Calcutta is needed at Colombo.

AGRICULTURAL EXPERIMENTS.

WISCONSIN Experiment Station Twenty-second Annual Report.—From the time of Thomas Andrew Knight onwards, horticulturists have remarked the effects of an excessive food supply on variability in cultivated plants, but one seldom hears of a case in which such pronounced results have followed excessive feeding as those which occurred in an experiment described by Mr. E. P. Sandsten in the twenty-second annual report of the Agricultural Experiment Station of the University of Wisconsin. To a batch of tomato seedlings growing in a greenhouse a mixed manure consisting of 800 lb. nitrate of soda, 600 lb. sulphate of potash, and 1000 lb. bone per acre was applied. The seedlings soon began to vary, with the result that out of ninety-six plants scarcely any two were alike. Some plants were dwarfed, others developed internodes of abnormal length; the leaves varied in size and shape; the blossoms were abnormal in form; the stamens were much modified, and in one case became "almost aborted"; the pistils, on the other hand, were greatly overgrown, and some of the plants produced seedless fruits. Two seedless types, a large- and small-fruited, were specially noticeable, and cuttings of these and of some of the other marked variations were made. These were subsequently grown in an ordinary soil, and produced plants which retained all their abnormal characters.

Variation in the Composition of Milk.—In Bulletin No. 11 of the Edinburgh and East of Scotland Agricultural College, Dr. Alex. Lauder gives some interesting par-

ticulars about the composition of the milk of a well-managed and well-fed herd of Shorthorn dairy cows. The herd, numbering twenty-two, was maintained for the purpose of supplying Rosslynlee Asylum with milk. The milk of each cow was weighed daily, and sampled weekly; the mixed milk of the herd was also sampled once a week. The investigation began in May, 1905, and lasted for a year. The cows were milked at 6.30 a.m. and at 4 p.m., and, as is always the case when the milking periods are unequal, the milk was found to be poorer after the longer than after the shorter interval. The morning milk averaged 3·15 per cent. of fat for the whole year, while the evening milk averaged 3·91 per cent. There was a marked difference in the milk of individual cows; one animal, for example, produced 655 gallons of milk during the year, containing 3·58 per cent. fat in the morning and 4·81 per cent. fat in the evening, while another produced 638 gallons, which contained only 2·96 per cent. fat in the morning and 3·5 per cent. fat in the evening. Until the middle of January the mixed milk of the herd always contained more than 3 per cent. of fat, but in spite of good management the quality then began to fall, and during the next three months the mixed milk contained less than 3 per cent. of fat eight times in the morning and four times in the evening; as the milk was sampled only once a week, it must, therefore, have usually contained less than 3 per cent. of fat in the mornings in February, March, and April. Although the cows were liberally fed, additional rations were tried for the purpose of improving the quality of the milk, and four animals were given 2 lb. linseed cake and 2 lb. oats per head per day. In accordance with experience, it was found that the addition of concentrated foods to rations already liberal, produced no improvement in the milk.

West of Scotland Agricultural College Reports on Experiments, 1906.—The seventh and eighth annual reports of the West of Scotland Agricultural College have been issued as a single volume. This volume contains reprints of four bulletins which have already been issued separately. Among the subjects dealt with are the uses of inoculating materials for leguminous crops. Several crops were treated, but the only positive results were obtained with lucerne. At two centres it was found that lucerne was much benefited by treatment with Hiltner's inoculating material. In the first case lucerne was sown on April 12 on land which had probably never grown this crop, and had certainly not done so for twenty-eight years. Part of the seed was treated and part untreated. Early in July the crop growing from treated seed began to show signs of improvement, and in August, when flowering, it stood 20 inches to 21 inches high, while the adjacent untreated crop was but 13 inches to 14 inches. It was noticed that the inoculating material only did good on land which was well supplied with phosphates and potash; on soil deficient in either of these, inoculation produced no effect. At the second centre lucerne had been growing for a year before it was treated, and it was noticed that a few nodules had developed on the roots, but the crop was far from vigorous. On May 28 some sand was inoculated, and this was sprinkled over part of the lucerne. On July 15 the lucerne was cut; the treated plot then yielded 56 cwt. and the untreated plot 54 cwt. per acre, so that inoculation had not been effective. Directly after mowing, however, an improvement in the treated crop was noticed, and this improvement became more marked as time went on, so that when a second cutting was made on September 25 the land which had been treated with Hiltner's culture produced 74 cwt. per acre, as against 30 cwt. from the untreated soil. These experiments were made in 1905, when, at the instance of the Board of Agriculture, similar experiments were made in all parts of the country; and the West of Scotland tests illustrate the general result, which was that inoculating material proved useful for a leguminous crop newly introduced into a district, but was seldom beneficial in the case of crops commonly cultivated. The nodule organisms of these are abundant in most soils. Several of the experiments recorded in this volume deal with the best time of year at which to apply manures. In the case of turnips, the conclusion is stated that superphosphate, basic slag, kainit, and muriate of potash are better applied in spring than in autumn; for hay, on the other hand, it is better to apply potash manures in autumn than in spring. For both turnips and potatoes it was found to be more profitable to apply farmyard manure in spring than in autumn.

ANTIPODEAN BIRD-LIFE.[1]

IN an illustrated pamphlet bearing the date 1903, and published at the Government Press, Wellington, Mr. R. Henry, who has for many years acted as caretaker of the bird-reserve on Resolution Island, furnishes a fund of interesting information with regard to the habits and life-history of the flightless birds of New Zealand, with notes relating to other species. As he himself remarks, if anybody ought to know what there is to be known about New Zealand birds it is the author, who has, *willy-nilly*, enjoyed exceptional opportunities of observing them. As might have been surmised, a large amount of space is devoted to the birds commonly known in this country as kiwis (Apteryx). It appears, however, according to the author, that this usage is not justified, the name kiwi belonging by right only to the grey species and its immediate relatives, while such species as *A. australis* and *A. oweni* are designated "roa" by the Maori. Very interesting are the author's observations with regard to the breeding habits of these birds, among which the cock assumes the office of incubation. As regards kiwis, it is stated that although they live in nearly the same situations as rowas, they prefer open ground, while the latter seek the densest shade of the forest. "Kiwis generally have white grubs in their stomachs, with things like big maggots, wire-worms, and all that class, while the roas depend more upon earthworms, water-insects, and berries." When a roa becomes conscious of the presence of intruders it alters its usual stealthy gait to a loud tramp. Is this, it may be asked, defiance?

A very strange statement is made about the kakapo, or ground-parrot, namely, that it breeds only once in two years. This, however, is not all, for it is stated that, in place of some individuals nesting in one year and others in the succeeding season, the whole of the birds will breed in one particular year, while in the following year none will do so.

Continuing his remarks on the habits of the kakapo, the author observes that, "months before the appointed breeding season the male is developing an air-sac in his throat which he can puff up like a drum, and which may act like a sounding-board to assist in making the curious drumming notes in the spring. This note is not unlike the boom of the bittern, but is repeated five or six times in succession, and can be heard at a great distance. . . . It appears as if the breeding season were controlled by the males, for when there is no drumming in the early summer, there are no eggs or young ones."

Another bird about which the author has a good deal to say is the weka rail, or wood-hen, and it cannot be said that he gives it a good character, mainly on account of its egg-stealing habits. One of these birds, although it had never previously seen a goose in its life, seemed to know by instinct that the eggs of the latter would be buried in the ground, and promptly proceeded to disinter them. Apart from moas and the nearly extinct Notornis, penguins are the last of the flightless birds to claim the attention of the author. He has, however, much to say regarding such species as black swans, paradise-ducks, grebes, moreporks, &c., and in the case of all these the ornithologist should find much to interest him in this little volume, which is certainly a storehouse of information with regard to the habits of New Zealand's birds. It may be hoped that the Government will not only see its way to maintain Resolution Island as a bird-sanctuary, but that it may establish other stations of the same nature

1 "The Habits of the Flightless Birds of New Zealand; with Notes on other New Zealand Birds." By R. Henry. Pp. 88; illustrated. (Wellington, 1903.)

"Glimpses of Australian Bird Life." Thirty-one original photographs direct from Nature, with Notes by R. Hall. Pp. 63. (Melbourne: T. C. Lothian, 1906.) Price 1s.

"Glimpses of Australian Bird-life" is a praiseworthy attempt to encourage the study of the avifauna of the island-continent among field naturalists. The photographs, although on a small scale, are for the most part excellent, while Mr. Robert Hall's brief explanatory notes are (as might be expected) very much to the point. One of the most interesting species depicted is the whip-bird (or coachwhip-bird), while from the point of view of excellence in technique, special mention may be made of the portrait of the so-called reed-warbler and its nest. R. L.

NOTES ON RECENT PETROGRAPHY.

STUDENTS of the processes of sedimentation and of flocculation in clays should not overlook the three papers on sands and sediments, by Messrs. Mellard Reade and Philip Holland, that have been published in the Proceedings of the Liverpool Geological Society. The original analyses of sediments given in the second paper (vol. x., part i., 1905), and in the third now issued (1906), are distinctly valuable. Some of the specific gravities stated for clays seem a little high; but it must be admitted that we possess as yet far too little knowledge of our commonest sedimentary deposits. In vol. x., part ii. (1906), p. 136, the authors point out that "the experiments have, we think, demonstrated the existence of a mass of matter of unsuspected granular minuteness distributed throughout the sedimentary rocks of the earth. . . . We have strong grounds for thinking that the distribution of the finest sediment, in the form of what we may call quartz-dust, is oceanic." The abundance of quartz grains in some rocks popularly classed as argillaceous, such as "slates of coarse texture" (p. 156), is of course already familiar to agricultural investigators.

Mr. H. W. Nichols, in describing new forms of concretions (Field Columbian Museum Publications, Geological Series, vol. iii., No. 3, 1906), usefully brings to the front Forchammer's determinations of magnesia in the skeletons or shells of marine organisms, which were originally published in 1849. Mr. Nichols supports these by analyses of his own (pp. 48–9), *Corallium rubrum* giving him 9·32 per cent. of magnesium carbonate. Forchammer's Mediterranean Serpula yielded as high a figure as 7·64 per cent. The Zoantharia examined give only from 0·35 per cent. to 0·54 per cent.

Messrs. Allen, Wright, and Clement have experimentally investigated the minerals of the composition $MgSiO_3$ (*American Journal of Science*, vol. xxii., November, 1906), and have produced artificially the two pyroxenic types, monoclinic and rhombic, and the corresponding two amphibolic types. At atmospheric pressure (p. 415), the monoclinic pyroxene, $MgSiO_3$, a rare form in nature, is found to be the product of crystallisation from solvents; the material used for this experiment may be any of the forms of crystalline $MgSiO_3$. All the other forms of magnesium silicate (p. 437) pass into the monoclinic pyroxenic form at temperatures between 1150° and 1300°, depending on the crystal-form employed. Enstatite crystallises at lower temperatures than the monoclinic pyroxene. The amphibolic types have been produced by a rapid cooling, which, as the authors point out, is not likely to be the prevailing cause of their occurrence in natural rocks.

Mr. H. I. Jensen, in dealing with the volcanic area of the East Moreton and Wide Bay districts, Queensland (Proc. Linnean Soc. of New South Wales, 1906, p. 73), describes a number of trachytes containing riebeckite, some of which form important plugs or domes. Trachytes, as well as basalts, are recorded from Gough Island, in the South Atlantic, by Messrs. Pirie and R. Campbell (Proc. Royal Physical Soc. of Edinburgh, vol. xvi., 1906, p. 258). Mr. I. G. Sundell (*Bull. Comm. géol. de Finlande*, No. 16, 1905), writing in English, or American, affirms the importance of cancrinite as "a very abundant and doubtless primary constituent" of the syenites of the parish of Kuolajärvi in N. Finland. His paper, like many others from various parts of the world, shows the strong influence already exerted by the Chicago system of classifying igneous rocks.

Mr. G. K. Gilbert (Bull. Geol. Soc. America, vol. xvii., 1906, p. 321) discusses gravitational assemblage in granite, citing striking cases from the Sierra Nevada, where large crystals of felspar and hornblende have respectively assembled in aggregates in granite. An example of banded granite, where bands rich in hornblende and mica alternate with others rich in felspar and quartz, suggests to the author successive sedimentation. Unconformities occur in the banding (p. 324), a dark band always forming the base of the upper series, and truncating obliquely the edges of previous bands. Mr. Gilbert puts forward the view, as a hypothesis, that a pair of bands represents a unit of deposition from the original magma, gravitation playing a *rôle* in the process.

Mr. R. A. Daly, of Ottawa, whose work in the field of igneous absorption and intermingling is well known, states his case of the Moyie Sill in the Purcell Range with effective lucidity in the *Festschrift zum siebzigsten Geburtstage von Harry Rosenbusch* (Stuttgart, Schweizerbartsche Verlagsbuchhandlung, 1906). His contribution is entitled "The Differentiation of a Secondary Magma through Gravitative Adjustment," and his argument for the assimilation of a felspathic quartzite-series by a gabbro-magma is supported by a number of chemical analyses. A granite zone intervenes between the gabbro and the overlying part of the quartzite-series, and the author holds that (p. 225) "there is clear chemical proof that the greater proportion of the elements in the granite could have been derived directly by fusion of the quartzite." The gabbro, in its onward passage, absorbed beds of quartzite, but (p. 228) "simultaneously gravitative adjustment has nearly restored the original composition, as the acid, assimilated material rose through the denser gabbro magma to the top of the sill." We need not subscribe as yet to Mr. Daly's view (p. 233 and previous papers) that the pure igneous magma in the earth's crust is of basic composition, since there may be a variety of pure magmas in a variety of localities; yet we believe that there is much soundness in his concluding sentence:—"The fact of 'consanguinity' among the igneous rocks of a petrographical province may be due as much to assimilation as to differentiation." G. A. J. C.

ARCHÆOLOGY IN ITALY.

THE final rejection by the Italian Government of Prof. Waldstein's well-advertised project for an international excavation of Herculaneum gives the Rome correspondent of the *Times* food for reflection with regard to the alleged Chauvinism of Italian archæologists, who will allow no foreigner to take part in Italian excavations, notwithstanding the fact, which they admit freely enough, that Græco-Roman antiquity is the property of the whole world, and not of Italy alone. While admitting that the postponement of the excavation of Herculaneum until such time as Italy can do it by herself does not much matter from the scientific standpoint, since "the treasures which lie beneath Resina are in safe keeping, and might remain undisturbed for centuries," the correspondent remarks that this is by no means the case with regard to other sites, which cry aloud for speedy excavation, for valuable evidence is in their case being destroyed daily by the "march of modern improvement." To do the work, Italy can muster neither sufficient money nor sufficient men, especially the latter. Yet she will not invite foreign aid, which would willingly and gratefully be given by archæological students all over the world. As the *Times* correspondent is obliged regretfully to admit, "The foreigner is at liberty to pay his *lira* for admission to museums and other places; he may even give a round sum for the completion of some work in which he is interested, as long as he does not wish to help in carrying it out himself; he may turn his talents to such use as advertising the achievements of Italian archæologists or translating their books into another language; he may show an intelligent and devoted interest, but it must be from a discreet distance. That, at least, seems to be the moral of all the recent relations between Italy and other countries in the archæological questions which have come to the front during the last twenty years or so. One would willingly believe it otherwise; one would gladly put a more literal and liberal interpretation on their professions of confraternity; but how is it possible

to do so unless Italian archæologists support their words by actual deeds? One simple fact outweighs all their written and spoken utterances. Nowhere in Italy is any foreign enterprise at work, and never has any foreigner been invited to give his time and his talents to what is, in their own admission, a common cause. If Italian archæologists would pay to other nations the graceful compliment of employing, now and then, their students as assistants; if those derelict excavations on the shore of the Gulf of Taranto—whose need is so pressing and whose secrets are so necessary to history—could be, even temporarily, confided to foreign institutions; then, and not till then, their assurances would carry weight."

PROGRESSIVE WAVES IN RIVERS.[1]

THE stationary waves produced by the interaction of a rapid stream with its bed have been the subject of several investigations. The author finds that by a special mode of vision described in the paper the simultaneous presence of waves progressing down-stream can be readily detected.

In a very shallow stream with a steep channel, the progressive wave becomes the principal and obvious, instead of a subordinate and obscure, feature. In this case the velocity of flow is much reduced by friction. The slightest excess of retardation at any point momentarily increases the depth there, and increase in depth (where the depths are small) increases the velocity, at any rate in the upper layer. Continuous motion is therefore impossible, and is replaced by a gushing flow. If the bed be of nearly uniform cross-section, the gushes take the form of regular transverse progressive waves. If, on the other hand, the cross-section of the channel be very uneven, there may be no lateral coordination, and the intermittence of flow is only detected by the rushing sound and the beating action of the water against an immersed body.

Measurements showed that the total velocity of these roll-waves was equal to the velocity of the current *plus* the velocity of a long wave in water of the observed depth.

All waterfalls tend to break up into conical masses called water-rockets, and in rare cases a fall may be seen which consists of a slow procession of well-separated "rockets" ranged in roughly horizontal lines. A case is described in which this beautiful appearance was due to the formation of roll-waves above the fall.

Roll-waves spontaneously arising in very shallow conduits occur in groups, and the growth of amplitude and wave-length was measured in the case of the conduit of the Grünnbach at Merligen, on the Lake of Thun.

Roll-waves in shallow mountain rivers due to heavy rains in the gathering-ground of the tributary streams are solitary, and, coming without warning before the turbid waters arrive, are dangerous to anglers, who are familiar with the phenomenon on the Tees, Ure, Swale, and other rivers. The uniform cross-section of the Tees near Barnard Castle, and of the Ure near Aysgarth, is peculiarly favourable to their formation and growth.

The cross-stream progressive waves observed by the author in the Whirlpool Rapids of Niagara are a secondary phenomenon arising from the varying amplitude of the familiar stationary waves, a variation which the author traces to its cause. When their interference occurs at the intersecting crest of two stationary waves there ensues one of those great leaps of water which present so splendid an appearance in these rapids. The author invites special attention to the points in which his explanation of these phenomena in Niagara Rapids differs from those hitherto current.

Tidal bores are the only form of progressive wave in rivers which had hitherto received much scientific attention. The author deals with the question of what determines the place of origin of the tidal bore in the River Severn, and what is the cause of its apparently capricious variation in magnitude. Briefly, the bore originates where the slope of the channel is steep, but in the *upper*, not the lower, part of the steep slope, because there is in the upper part no alternative channel among the sand-banks for the last-of-ebb and first-of-flood respectively to pursue, but at the end of a set of spring tides the flood has so far cut in the sand an alternative, straight channel that the height of the bore is reduced. An excess of land-water, on the contrary, so strengthens the ebb that it tends to make a deep, solitary, curved channel up which the flood must force its way, increasing the height of the bore.

[1] Abstract of a paper by Dr. Vaughan Cornish in the *Geographical Journal* for January.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

THE Western University of Pennsylvania has conferred the honorary degree of LL.D. upon Sir Robert Ball, Sir Robert Cranston, Sir William Turner, Sir William Preece, Mr. Marconi, Dr. Chalmers Mitchell, Dr. John Rhys, the Rev. E. S. Roberts (Master of Caius College, Cambridge), and Mr. Edwin Abbey.

A CONFERENCE on the teaching of hygiene and temperance in the universities and schools of the British Empire will be held at the Examination Hall, Victoria Embankment, on St. George's Day, April 23. The chairman at the morning session will be Lord Strathcona, and at the afternoon session Sir John Gorst.

THE annual exhibition of students' work will be held at the Borough Polytechnic Institute on Saturday, April 20, from 6–9.30 p.m. The workshops, laboratories, drawing offices, girls' trade school, domestic economy rooms, and other departments of the institute will be open for inspection, and practical work will be carried on during the evening.

THE *Times* correspondent at Ottawa reports that the medical building of McGill University, Montreal, was destroyed by fire on April 16. The museum, with its priceless specimens, is ruined, but a portion of the valuable medical library was saved. The loss is placed at 100,000*l*., of which 70,000*l*. is covered by insurance. The origin of the fire is unknown, but incendiarism is suspected.

THE accommodation provided at University of London, University College, for the schools of engineering and of architecture will be considerably extended before the beginning of the next session in October by the additional space which becomes available through the removal of University College School to Hampstead. The Andrews scholarships are offered for competition in May; one of these scholarships, value 30*l*., in science and mathematics, is tenable in the school of engineering.

A PARTY of students of zoology from the Birkbeck College spent part of their Easter vacation in Jersey shore-collecting during the prevailing low tides. More than one hundred and fifty species of shore-life were obtained, illustrating nearly all the animal phyla. The success of the visit was in great part due to the advice and guidance of Mr. J. Sinel, formerly director of the Jersey Marine Biological Station. A selection from the species collected formed a very interesting exhibit at the annual exhibition meeting of the Birkbeck Natural History Society, which was held on Saturday evening, April 13.

THE reports from the universities and colleges which participated, during the year ended March 31, 1906, in the annual grant of 100,000*l*. made by Parliament for "university colleges in Great Britain," and from the three colleges in Wales which receive a grant of 4000*l*. each, have now been published (Cd. 3409) by the Board of Education. Much instructive information can be gathered from the income and expenditure accounts provided by the various institutions. With an income of 42,819*l*., Birmingham University at the end of the year's working had a balance in its favour of 2557*l*. Leeds University, though it started the year with 1568*l*. in hand, after expending 45,744*l*. ended the year with 395*l*. only to the good. With an expenditure of 53,162*l*., Liverpool had 532*l*. in hand at the end of the year. Manchester, with an income of 59,155*l*., came to the close of the year with 131*l*. to the good. Sheffield, which in the year under consideration was still a university college, was with an income of nearly 25,000*l*. about 1500*l*. in debt at the end

of the year. Bristol, with a much smaller income, did not spend it all. Dundee just about made both ends meet. Bedford College, London, had a small deficit. King's College, London, with an income of 33,282*l.*, managed to save 618*l.* University College, London, spent rather more than its income. The college at Newcastle had a deficit. Nottingham had been adopting a saving policy with a view to future developments, and arrived at the end of the year with a good balance. Reading spent more than it received, and Southampton was in want of money. Though the conditions have been modified to some extent since the year with which the report deals, there is still the same careful and economical management required at all these colleges, and desirable improvements and developments have to be postponed for lack of funds. We hope it will not be long before the Government is able to provide more than 100,000*l.* for higher education, and that increased State aid will be supplemented by greater munificence on the part of our men of wealth.

A NEW era in the chemical department of the Scottish universities has been inaugurated by the erection of a chemical research laboratory at St. Andrews University by the munificence of Prof. Thomas Purdie, F.R.S., at a cost of about 9000*l.* Moreover, the 5000*l.* originally set aside by the University Court from the Carnegie trust

The Purdie Chemical Research Laboratory, University of St. Andrews.

quinquennial grant for buildings, &c., to aid in this work has, by a subsequent arrangement of the Court and the Carnegie trust, been constituted an endowment for the upkeep of the chemical research department. A teaching chemical laboratory had previously been presented to the University by the generosity of Mrs. Thomas Purdie, late of Castlecliffe. The former occupants of the chair, viz. Profs. Connel and Heddle, were distinguished in their way, viz., the former in regard to the dew point and other subjects, and the latter in mineralogy and the chemistry of minerals, but chemical research proper dates from Prof. Purdie's appointment in 1884, and has now been firmly established in the University. The substantial new building, which is seen in elevation in the accompanying illustration, provides still further facilities for post-graduate work. On the ground floor is a graduates' research laboratory with ten benches, each with high- and low-pressure water-taps, electric light and power, and there are also balance, operation, physical and dark rooms. Ventilation, light and heat are perfect, so that the workers are under the best possible conditions. On the second floor is the professor's laboratory for four workers, a library, museum, spacious lecture-room, and various preparation rooms. The progress of the University as a chemical research school has been rapid, for previous to 1884 the accommodation was altogether inadequate. Now the facilities for teaching and research are not behind those of any of the modern German institutions. Moreover, not only St. Andrews students, but other capable workers are welcomed. Working in conjunction with the professor or lecturer on organic chemistry, students qualify for various scholarships, *e.g.* the Berry, Carnegie, and 1851 Exhibition scholarship, the research degree of London University, and the D.Sc. degree. The school has especially been noted for its work in optical activity and the chemistry of the sugars, but other subjects of biological interest have also been dealt with.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society. December 6, 1906.—"The Chemistry of Globulin." By William **Sutherland.** Communicated by Dr. C. J. Martin, F.R.S.

The author's object in the present paper is first to establish simple formulæ for the more important of the experimental results obtained by Hardy and Mellanby, then to interpret these in their bearing upon the chemistry of globulin in connection with a theory of colloids, and finally to find the molecular mass (weight) of globulin.

By expressing the experimental results of Hardy and Mellanby in simple formulæ, it is shown that the solution of globulin and its precipitation take place under simple conditions of chemical equilibrium. For example, if p is the fraction of a globulin suspension dissolved in a salt solution the concentration of which is the fraction q of C that is required just to dissolve the whole of the suspension, we get equation (1) $p(1-q)=Aq(1-p)$, in which A is the ratio of a velocity of solution to a velocity of precipitation. Mellanby's discovery of the dependence of M/C on valency and ionic velocity is applied to MA/C, M being molecular mass, and it is shown that when temperature varies, not only does MA/C depend upon the viscosity of the solvent water, but also on a function of temperature given in an equation which expresses the part played by globulin. It is noteworthy that this function has a minimum value about 40° C., near the temperature of warm-blooded animals.

For the precipitation of globulin by excess of $(NH_4)_2SO_4$, an equation is established, namely, $p(1+p)=28{\cdot}8(c-0{\cdot}152)$, p being the fraction which the precipitated globulin is of the whole, and c the concentration of the $(NH_4)_2SO_4$ solution in grams per cubic centimetre.

Then follow formulæ for the remarkable precipitation of globulin by acids from solution in neutral salts. From these it appears that three compounds of globulin react in producing this precipitate.

Section iv. is devoted to a theory of the colloidal state, namely, that a colloid consists of molecules which are chemically united neighbour to neighbour by the action of valencies which are usually latent.

According to this chemical theory of the colloidal state, the term molecule ceases to have a useful meaning when applied to a colloid, so the term semplar is used to name that structure which is repeated like a pattern in three dimensions through a colloid. By suppression of the colloid-producing valencies of doublets, a mass of semplars is caused to fall into a collection of separate molecules. In illustration of the usefulness of this theory, it is applied to show the dependence of the coagulating power of an ion on its valence. It is then applied also to explain the remarkable fact that the amount of globulin dissolved by

a given salt solution from a globulin suspension depends on the concentration of the suspension. The action of the ions of a neutral salt in dissolving globulin is treated as only another manifestation of the same electrical effect which enables them to coagulate arsenious sulphide. This theory of the colloidal state leads to a theory of equation (1) and of the laws of A in it, especially that MA/C is proportional to the sum of the squares of the valencies of the ions of the electrolyte.

In Section v. the experiments of Hardy on the conductivities of globulin solutions are expressed by formulæ which admit of very simple interpretation, and connect these conductivities with those of ordinary electrolytes.

In Section vi. globulin is shown to have probably a molecular mass 40,000 and a basicity 2, the alternative being a mass 60,000 and basicity 3. Further experiments like those of Hardy on the ionic velocity of globulin and also on the coefficient of diffusion of globulin solutions would decide the matter, though doubtless various globulins differ in mass and basicity. A group, $C_{12}H_{20}N_3O_4$, related to polypeptides and peptones, is shown to be the predominant structure in albumins. The discrepant results of different experimenters on the precipitation of albumin by heavy metals fall into harmony when it is proved that they precipitated different integral numbers of a group such as this in combination with an equivalent of heavy metal.

February 7.—"Experiments made to determine the Conditions under which 'Specific' Bacteria derived from Sewage may be Present in the Air of Ventilating Pipes, Drains, Inspection Chambers, and Sewers." By Major W. H. **Horrocks.** Communicated by Colonel D. Bruce, C.B., F.R.S.

Most sanitarians at the present time believe that when sewage is in a state of putrefaction and gas bubbles, rising through it, are bursting at the surface, bacteria may be ejected into the air of sewers. It is also considered possible that when sewage has dried on the surfaces of pipes bacteria may be separated as dried particles and carried some distance by currents of air passing through the pipes. But it is not generally credited that the mere passage of infected sewage through a well-laid drainage system will also cause the ejection of specific bacteria into the air contained in the pipes. The experiments detailed show that:—

(1) The bursting of bubbles at the surface of sewage under artificial and natural conditions may cause the ejection of bacteria, which, if air currents are present, may be carried some distance.

(2) Specific bacteria dried on the ventilating pipes of a drainage system may be separated and carried by currents of air passing through the system.

(3) Specific bacteria may be ejected from *fresh* sewage flowing through a sewer under natural conditions, independently of the creation of bubbles and the separation of dried particles. The ejection of bacteria occurs, not only when use is made of naked microbes such as are obtained from growths on agar, but also when typhoid stools are employed as the infecting agent.

The results obtained, especially as regards the ejection of bacteria from fresh sewage, are of great importance, and indicate that the disconnection of a house-drainage system from a public sewer is sound in principle, and that it would not be wise to remove the disconnecting trap and ventilate sewers by means of house-ventilating pipes or soil pipes.

Royal Microscopical Society, March 20.—Dr. J. W. H. Eyre, vice-president, in the chair.—Some South African Tardigrada: J. **Murray.** The author was indebted for the materials for his paper to Mr. W. Milne, of Uitenhage, Cape Colony, who, from time to time in 1906, forwarded moss containing bdelloid rotifers from various parts of Cape Colony. In addition to the rotifers, which were abundant, the moss yielded many Tardigrada. Fourteen species were found belonging to the genera Echiniscus, Milnesium, and Macrobiotus. Eight out of the fourteen species are distinct from any previously known.—Notes on a peculiar habitat of a Chlorophyte, *Myxonema tenue*: A. D. **Hardy.** The *Myxonema tenue* is usually found in rapidly flowing water frequently attached to submerged parts of river-side plants, but more often to stones and dead twigs; it is also found in the locality in stone-paved gutters in which there is a rapid flow of water. The author also found it growing feebly in a small fish pond, about 10 feet diameter, where the water was nearly stagnant, but on some gold fish in the pond it grew luxuriantly, and the author thinks that some interest attaches to the adaptation of this stream-loving Myxonema, which, unable to thrive in stagnant water, yet flourished on moving objects where it obtained necessary water friction. It may be added that the effect of this algal growth on the fishes was their premature death.

Mathematical Society, April 11.—Sir W. D. Niven, vice-president, in the chair.—An introduction to the metrical geometry of space of n dimensions: H. **Bateman.**—A note on Perott's theorem: H. **Hilton.**—Poisson's integral and its relation to the proof of Fourier's theorem: Dr. E. W. **Hobson.**—The values of the parameters for which a definite integral can be zero: H. **Bateman.**

PARIS.

Academy of Sciences, April 8.—M. A. Chauveau in the chair.—The photography of the infra-red solar spectrum: G. **Millochau.** By the use of alcoholic solutions of malachite green, full details of the exact method being given, the author has been able to prepare plates of high sensibility in the infra-red region. By the use of these plates photographs have been taken of the region 0·750 μ to 0·950 μ, one Ångström unit having a length of about 0·1 mm. These plates show that the band A has the same structure as the band B. The line Z, previously described as a short band in the infra-red, has now been resolved into lines.—The surface engendered by a circular helix: Eugène **Barré.**—A problem of analysis intimately connected with the problem of cooling of a heterogeneous bar: W. **Stekloff.**—Orthogonal systems of functions and the equation of Fredholm: Frédéric **Riesz.**—The altitude of the Grand Pic de la Meije: Paul **Helbronner.** The mean result of the measurements is 3982·5 metres (summit of the signal), differing only by 4 metres from the earlier result of Durand.—The action of a magnetic field on ionised air in motion: A. **Blanc.** On the hypothesis that the mobilities of the ions are not modified by the magnetic field, an assumption shown to be accurate by direct experiment, it is found that the negative ions have a greater mobility than the positive ions, the ratios obtained varying between 1 and 1·6, the average of fourteen experiments giving 1·32.—The oscillations of a higher order (harmonics) in the electric spark: G. A. **Hemsalech.** The existence of harmonics in the electric spark is clearly demonstrated experimentally by photographic means, an enlarged reproduction of one of the photographs being shown. It was found that the harmonics are in great part the cause of the luminosity of the metallic vapour in the spark.—The constitution of the atom and the law of Colomb: H. **Pellat.** It was shown in a previous paper that to bring the current theory of the atom into harmony with experimental results either the atom must have a form approximating to a flattened disc or Colomb's law ceases to be applicable at intra-atomic distances. In the present communication it is proved that a flattened form of the atom would not be stable, and consequently Colomb's law must cease to be exact at the very small distances of the order of intra-atomic distances; the attracting force must increase less rapidly than the inverse of the square of the distance or the repulsive force more rapidly.—Some observations concerning the note of M. Pellat on the constitution of the atom: Th. **Tommasina.** M. Pellat has assumed that the atom as a whole is neutral from the electric point of view; if this hypothesis is not true, the further reasonings of M. Pellat fall to the ground.—An apparatus for measuring the flow of liquids: M. **Krebs.** A description of a simple apparatus giving at any instant the flow of a liquid in litres per hour. It has been successfully employed in measuring the consumption of petrol in trials of petrol motors.—Remarks on the preceding note: M. **D'Arsonval.** The apparatus is remarkable for its simplicity and exactitude, and will be of service in a great number of laboratory experiments.—Positive light: P. **Villard.**—The nickel-tin alloys: Léon **Guillet.** Referring to a recent

publication by M. Vigouroux on this subject, the author gives a *résumé* of work already published concerning the nickel-tin alloys by Guettier, Gautier, and himself.—Some properties of the alkaline protoxides: E. **Rengade.** At 400° C. these oxides are decomposed into the dioxide and the metal, the latter volatilising. Liquid ammonia converts them into mixtures of hydrate and amide. Hydrogen at 180° C. to 200° C. reduces the oxides of rubidium, potassium, and sodium, forming a mixture in equimolecular proportions of hydrate and hydride.—Contribution to the study of the oxybenzoates: Œchsner **de Coninck.**—Iodine derivatives of the methyl ethers of pyrocatechol: E. **Tassilly** and J. **Leroide.**—Sands and shingles of the Pas-de-Calais: Réné **Bréon.** A determination of the mineralogical composition of these sands and shingles shows that these minerals bear no relation to the rocks in the surrounding strata. They arise from old igneous rocks, the nearest deposits of which are 250 to 300 kilometres distant. For the rocks and shingle, the theory of ice transportation is a possible one, but this explanation can hardly apply to the transportation of many millions of cubic metres of sand, and the cause of the appearance of the latter remains unknown.—The artificial coloration of minerals: Paul **Gaubert.** In opposition to the views of Suida, the author is of opinion that the artificial coloration of fibres of chrysotile and other crystallised minerals is a purely physical phenomenon.—Tchernichewite, a new amphibole: L. **Duparc** and F. **Pearce.**—The presence of *Ustilago Maidis* on the adventitious roots of *Zea Mais* and of its *quadricolor* variety and on the biomorphoses which it presents: M. **Chiffiot.**—Observations on suprarenal fat: V. **Babès.**—The purification of sewage by turf filters: Henri **Pottevin.** An account of experiments carried out for several months on a single filter. The rate of filtration was 400 litres per square metre per day, and the purification effected, details of which are appended, was very satisfactory.—Contribution to the study of the food of the sardine: Casimir **Cépède.**—Characters of the intertropical atmospheric circulation: L. Teisserenc **de Bort** and L. **Rotch.**

DIARY OF SOCIETIES.

THURSDAY, APRIL 18.

ROYAL SOCIETY, at 4.30.—On Reciprocal Innervation of Antagonistic Muscles: Tenth Note: Prof. C. S. Sherrington, F.R.S.—Fatty Degeneration of the Blood: S. G. Shattock and L. S. Dudgeon.—(1) The Rate of the Assumption of Chloroform by the Blood during Anæsthesia: (2) Function of the Red Corpuscles in Chloroform Anæsthesia: Dr. G. A. Buckmaster and J. A. Gardner.—The Fermentation of Glucosides by Bacteria of the Typhoid-coli Group, and the Acquisition of New Fermenting Powers by *Bacillus Dysenteriae* and other Micro-organisms: F. W. Twort.

ROYAL INSTITUTION, at 3.—The Birth and Affinities of Crystals: Prof. Henry A. Miers, F.R.S.

LINNEAN SOCIETY, at 8.—On the Œcologic Functions of Stolons and Cleistogamous Flowers: J. C. Shenstone.—On the Œcologic Aspect of Constitutional Variation in Fruit-culture: A. O. Walker.—On an Aberrant Form of Coccidæ: Hugh Scott.—Some Results of Inoculation of Leguminous Plants: Prof. W. B. Bottomley.—*Exhibits*: Nepal Barley and other Cereals cultivated at High Altitudes in Tibet: Dr. George Henderson.—Photographs of Sections of Woods: J. A. Weale.—Lantern Slides of Witches' Brooms: J. Saunders.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Flexibles: with Notes on the Testing of Rubber: A. Schwartz.

CHEMICAL SOCIETY, at 8.30.—The Magnetic Rotation of Hexatriene, $CH_2:CH.CH:CH.CH:CH_2$, and its Relationship to Benzene and other Aromatic Compounds, also its Refractive Power: Sir W. H. Perkin.—Aromatic Azoimides, Part i., *p*-Hydroxyphenylazoimide: M. O. Forster and H. E. Fierz.—The Action of Hydrogen Peroxide on Potassium Cyanide: O. Masson.—The Action of Ethyl Oxalate on Thioacetanilide and its Homologues: S. Ruhemann.—Measurements of the Velocities of Saponification of the *l*-Menthyl and *l*-Bornyl Esters of the Stereoisomeric Mandelic acids: A. McKenzie and H. B. Thompson.—Indican: Preliminary Notice: A. G. Perkin and W. P. Bloxam.—Cupric Nitrite: P. C. Rây.—The Constituents of the Essential Oil of American Pennyroyal: Occurrence of a Dextro-Menthone: M. Barrowcliff.—The Action of Tribromopropane on the Sodium Derivative of Ethyl Acetoacetate: T. E. Gardner and W. H. Perkin.

OPTICAL SOCIETY, at 8.—Presidential Address. Physical and Engineering Uses of the Microscope: Walter Rosenhain.

FRIDAY, APRIL 19.

ROYAL INSTITUTION, at 9.—Nerve as a Master of Muscle: Prof. C. S. Sherrington, F.R.S.

SATURDAY, APRIL 20.

ROYAL INSTITUTION, at 3.—Studies in Magnetism: Prof. Silvanus P. Thompson, F.R.S.

THE ESSEX FIELD CLUB (at Essex Museum of Natural History, Stratford), at 6.30.—Annual Meeting.—On the Breeding of the Kite and Buzzard near Maldon in the 'Fifties and 'Sixties of Last Century: Miller Christy.—Memoranda on the Purple Sandpiper (*Tringa maritima*): Dr. J. Murie.—The Trees and Woodlands of Essex: J. C. Shenstone.

MONDAY, APRIL 22.

SOCIETY OF ARTS, at 8.—Detergents and Bleaching Agents used in Laundry Work: Prof. Herbert Jackson.

VICTORIA INSTITUTE, at 4.30.—Exploration in Asia Minor, as bearing on the Historical Trustworthiness of the New Testament: Sir William M. Ramsay.

SOCIOLOGICAL SOCIETY, at 8.—The Future of Voluntary Charity: C. J. Hamilton.

TUESDAY, APRIL 23.

ROYAL INSTITUTION, at 3.—Stimulation, Luminous and Chemical: Prof. William Stirling.

ZOOLOGICAL SOCIETY, at 8.30.

SOCIETY OF ARTS, at 4.30.—Social and Economic Conditions in Australia: Dr. John W. Hackett.

INSTITUTION OF CIVIL ENGINEERS, at 8.—*Continued discussion*:—The Pyrmont Bridge, Sydney, N.S.W.: P. Allan.—Swing Bridge over the River Avon, at Bristol: W. H. B. Savile.

WEDNESDAY, APRIL 24.

BRITISH ASTRONOMICAL ASSOCIATION, at 5.

SOCIETY OF ARTS, at 8.—Rubber Cultivation in the British Empire: Herbert Wright.

THURSDAY, APRIL 25.

ROYAL SOCIETY, at 4.30.—*Croonian Lecture* On the Essential Constituents of the Nucleus and their Relation to the Organisation of the Individual: Prof. J. B. Farmer, F.R.S.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Address by the President: T. Hurry Riches.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.

FRIDAY, APRIL 26.

ROYAL INSTITUTION, at 9.—New Illuminants: James Swinburne, F.R.S.

PHYSICAL SOCIETY, at 5.—Electrical Conduction produced by Heating Salts: A. E. Garrett.—The Influence of Pressure upon Convection Currents, and a Criticism of J. Stark's Relation between Cathode Fall of Potential and Temperature: W. S. Tucker.—Solenoids which are turned by the Earth's Magnetic Field: W. B. Croft.—Simple Apparatus for mechanically illustrating the Tangent and Sine Laws: J. A. Tomkins.

CONTENTS.