THURSDAY, JANUARY 4, 1899.

PHYSIOLOGY VERSUS *NATURAL SELECTION: AN UNNATURAL ANTITHESIS.*

Colour in Nature: a Study in Biology. By Marion I. Newbigin, D.Sc. (Lond.). Pp. xii + 344. (London: John Murray, 1898.)

THE authoress states in the preface that her object is "to set forth in systematic order the main facts at present known in regard to the Pigments and Colours of Plants and Animals," and especially to treat the physiological side of the subject, and bring together the scattered literature which deals with it.

The first three chapters are introductory, dealing with general questions of importance for the remainder of the work—such as the differences between pigmental and structural colours, and the classification of both these categories. Colours and pigments are then considered throughout the plant and animal worlds, the subjects treated in consecutive chapters being plants; Protozoa sponges and Cœlentera; worms; Crustacea and Echinodermata; Lepidoptera; insects in general and spiders; Mollusca and invertebrates generally; fish; amphibians and reptiles; birds (occupying two chapters); mammals and the origin of pigments. The concluding chapter "on the relation of facts to theories" contains a general summary and a brief exposition and criticism of various theories as to the origin of colour. The list of references, admitted to be incomplete, will nevertheless be useful, although it is to be hoped that in a future edition mention will be made of Colonel Swinhoe's complete paper "On the Mimetic Forms," &c., in the *Linnean Journal*, instead of to the brief abstract in the *Proc. Roy. Soc.*

The writer again and again protests against the interpretation of colour phenomena by natural selection, and implies that those who incline to accept this interpretation are satisfied with casual suggestions which they make no attempt to test. The present writer believes that the exact opposite is the truth, and that in the whole history of biological thought no theoretical suggestions have been so fruitful of extended and precise observations as those based upon this very hypothesis.

Whenever a writer ventures to suggest such an interpretation, it is assumed by opponents that he is satisfied to leave the matter at this point without the thought of any further investigation by way of confirmation. This is an assumption, and a most unfair assumption. Those who have found natural selection a sure guide to research, who cannot pursue all the varied lines which it indicates, are glad to offer the same inspiration to other workers. "A few magic words upon natural selection" (p. 24) are not intended to "dismiss" any problem in natural history, but rather to suggest lines of research by which it may be attacked.

It is interesting to note that this extremely critical attitude as regards natural selection is not accompanied by any special reticence in the use of other hypotheses. Thus, as regards birds and butterflies, "the fact of the exquisite structural coloration and a wonderful development of structures arising from the cuticle, suggests that the structural colours are merely a result of extreme differentiation of the cuticle, and therefore produced by the same cause which gave rise to this differentiation" (p. 11).

Again, on p. 155, the persistence of green pigments derived from the larval food into the ova (and, in fact, into the young which hatch from them) is quoted from the present writer; and the authoress then proceeds to suggest that the green colour found by Mr. F. Gowland Hopkins in the *Pierinae* is of the same kind. This unsupported suggestion is very probably sound, and had been independently arrived at by the present writer, who is also inclined to extend it to the green pigments, doubtless derived from the blood (hæmolymph), which are stored, as in the *Pierinae*, between the two wing membranes, and give rise to the bright green or sometimes blue-green bands or spots in certain *Nymphalinae* (*Colaenis dido*, *Victorina steneles*) and *Papilioninae* (*P. sarpedon*, &c.). Such a suggestion is reasonable, and may well lead to specially directed research; but a similar spur to inquiry, if based on the theory of natural selection, would have been held up to contempt by the authoress.

The freedom with which even flimsy and worthless speculation is indulged in, if only an explanation founded on natural selection can be thereby avoided, is well seen on pages 161 and 162, where the warning colours of *Heliconidae* and the mimetic or convergent *Pierinae* are briefly discussed. The writer suggests that the slow flight and warning colour of *Heliconidae* and their mimics are due to "the relatively low organisation which renders pigmentation by waste products possible, which makes brilliant optical colours impossible."

First, as to "low organisation," the Insecta are admittedly among the most specialised of animals; excepting the Diptera there are no more specialised insects than the Lepidoptera; among Lepidoptera the *Ithomiinae* (Bates' *Danaoid Heliconidae*, Trimen's *Heliconoid Danaidae*) are the most specialised, and the *Heliconinae* proper (Bates' *Acraeoid Heliconidae*) only less so.

Secondly, as to "pigmentation by waste products," Mr. Gowland Hopkins' observations prove that the pigments of the *Heliconidae* are *not* the same as those of the Pierines which resemble them. The latter alone have been shown to possess wing pigments of uric acid or substances allied to it.

Thirdly, as to brilliant optical colours being rendered impossible. There are numerous examples of iridescence in *Ithomiinae*, and some structural blues in the far less numerous *Heliconinae* proper, while in the *Danainae* which are closely related to the former the structural blues of many much-mimicked *Euploeina* are magnificently developed.

The writer is apparently desirous of rejecting an interpretation which explains an immense body of facts, and has led to the discovery of an immense number more, in order to substitute a crude suggestion which, for its mere statement, requires the distortion of many well ascertained facts.

It is only fair to add, however, that the writer recog-

nises and clearly points out the obvious difficulty that the resemblances in pattern are not to be explained by her hypothesis.

Similar bias is shown in the prominence given to unimportant and often partisan statements; while the original evidence on which an opposite conclusion has been based is neglected or barely alluded to.

Thus, referring to the variable coloration of caterpillars, we read on p. 147: "According to recent research, it is not so much the colour of the environment which directly affects the larvæ as the intensity of the light" (see Garbowski). To the conclusive experiments upon which an opposite contention is based no allusion is made, the bias of the writer permitting nothing more than a vague reference to "popular books besides those already mentioned." But, on the strength of the statement quoted above, we are treated with reflections upon the errors of a simple explanation in biology.

Again, on p. 325, in reference to the artifically produced variations in the colours of butterflies, we are told that "competent entomologists (*e.g.* Garbowski) are of opinion that the new colours have little or no phylogenetic importance," without the slightest indication that highly competent authorities have given very good reasons for an opposite conclusion. In fact, if the writer agrees with an authority, it is sufficient to quote his opinion without his reasons, and, above all, without any of the reasons which point in another direction.

The references to Piepers' easily answered and often superficial objections to the theory of mimicry (pp. 316–321) are given at considerable length, and the reader unacquainted with the subject might well suppose, from the writer's concluding remarks, that serious difficulties had been raised.

In a similar spirit the writer speaks of "the (by hypothesis) well-protected *Heliconidae*" (p. 149), thus assuming an assumption on the part of those who seek an interpretation based upon natural selection, and neglecting the considerable body of evidence, direct as well as indirect, which has been brought together.

The use of the contemptuous "so-called" occasionally recalls the jest about the "so-called nineteenth century."

The statement of the procedure of the Darwinian school (p. 306), in attempting to solve the problems of colour, is the merest travesty, quite unworthy of serious comment.

Apart from the obvious bias of the writer in dealing with natural selection, of which numerous other examples might have been adduced, the work is likely to be useful. The most interesting and valuable parts are those dealing with subjects which the authoress has herself investigated, such as the structural colours of birds' feathers. The book is, in fact, not a well-balanced and judicial account of the subject, "Colour in Nature," but an interesting exposition of those parts of her subject with which the authoress is in sympathy, other parts being either distorted or omitted. In the former category would doubtless be placed the interpretation of external colour, as the expression of internal structure, of which a single example is given on p. 226, and it is therefore remarkable that no reference is made to the numerous examples which the late Alfred Tylor was accustomed to explain in this manner.

The book is clearly printed, with few printer's errors, and the small number of simple illustrations sufficiently explain the writer's meaning. E. B. P.

THE GROWTH OF ANIMAL AND VEGETABLE ORGANISMS.

Experimental Morphology. By Charles Benedict Davenport, Ph.D., Instructor in Zoology in Harvard University. Part 2. Pp. xviii+281 to 508. (New York: Macmillan Company; London: Macmillan and Co., Ltd., 1899.)

THE second part of Dr. Davenport's work—the first part appeared two years ago and was noticed in NATURE, October 14, 1897—deals exclusively with the effect of chemical and physical agents upon the growth of animal and plant organisms. In the preface the author draws attention to the importance of the study of the conditions which affect growth. "The possibility of increasing the human race beyond limits that are not far off depends upon a better knowledge of the conditions of growth. The reader has only to consider that the world's supply of 2500 million bushels of wheat, 2000 million bushels of maize, 90 million tons of potatoes, and its untold millions of tons of beef, pork, and fish are reproduced each year by growth." This importance has recently been emphasised by the remarkable result of Sir William Crookes' researches into the statistics of the world's wheat supply as set forth in his presidential address at the Bristol meeting of the British Association, and the controversy to which that address has given rise. Dr. Davenport selects as his definition of growth "increase in volume," a definition which is by no means safe from criticism. Although we all think we understand what is meant when growth is spoken of, biologists have been by no means in agreement as to how exactly it should be defined. Thus, as the author points out, while Huxley spoke of growth as "increase in size," Sachs regards the volume increase as necessarily intimately associated with change of form, while Pfeffer takes the qualifying part of Sachs' definition, and defines growth as change in form only, and this is accepted by Vines, who adds: "accompanied usually by increase in bulk." To us this definition appears far more satisfactory, even if it is associated with the idea of development, than the more limited definition adopted by Davenport. In the animal organism especially is it difficult to exclude the idea of change of form in association with growth, nor does it seem reasonable to place a mere swelling due to imbibition of water or to distension with gas upon the same footing as a new formation of bioplasm.

The book before us is, however, almost entirely concerned with vegetable organisms, in which, no doubt, the imbibition of water plays a much more important part in the process of growth than it is apt to do in animals. And as a matter of fact the percentage of water in many animal embryos undergoes a steady decrease as development and growth proceed.

With regard to the effect of chemical agents upon growth, one of the most interesting parts of the work is that dealing with the supply of nitrogen to growing plants, whether it be offered to them in the form of a salt

(nitrate) added to the soil, or, as occurs in Leguminosæ, in the form of atmospheric nitrogen, fixed for their assimilation by the symbiotic bacteria at their roots.

Chemotropism, or the effect of chemical agents upon the direction of growth, and heliotropism (phototropism), or the effect of light upon the direction of growth, both receive their due share of attention. The effect of water upon growth is treated separately from that of other chemical agents, this amount of attention being accorded it on account of its immense importance—especially in plants—in the process. The effects of contact with solids and that of molar agents in general are duly considered, and the chapter devoted to them includes subjects so diverse as the results upon the growth of bacteria by violently shaking the vessel containing them, the tendency of twining stems and tendrils to grasp the solid objects with which they come in contact, the effect of wounds upon the growth of plants, and even the effect of flowing water in influencing the direction of growth. The effect of gravity upon the growth of sessile organisms (geotropism) and the results obtained by neutralising this effect by the employment of the klinostat is also considered, and illustrated by numerous diagrams. The effect of atmospheric electricity in increasing the rate of growth was supposed to be demonstrated by the experiments of Grandeau, who reared two similar plants—one in the open, and the other with an enclosure of wide-meshed wire netting—with a marked balance in favour of the one which was exposed freely to the influence of any electricity which might be present in the atmosphere ; but others have obtained negative or discordant results.

The effect of heat in influencing the growth of organisms is familiar to every biologist, and Dr. Davenport illustrates it by numerous tables and charts taken from observations upon both plants and animals. It is indeed impossible here so much as to enumerate all the different aspects from which the subject of growth has been studied, and to which reference may be found ; and although the book does not profess to be anything more than a compilation, and, in fact, contains no matter which is entirely original, it is that sort of compilation which will be of most use to the student of biology, as indicating to him where he may at once come across the work which has been done in each department of the subject of which it treats. That the information yielded should include everything upon so vast a subject is too much to expect in a book of less than five hundred by no means closely printed pages, and, in fact, one occasionally misses a reference to work of no little interest and importance, such as that of Ringer upon the influence of mineral salts upon the growth of tadpoles, and of Romanes upon the comparative effects of flash light and steady light in producing phototropism in seedling plants. Neither is the subject of the influence of drugs considered at anything like the length which its importance seems to deserve. Nevertheless, for the reasons indicated, and because the book is a painstaking and, on the whole, a successful attempt to furnish a connected account of an important branch of experimental morphology, it will be welcomed by the many workers who are devoting themselves to the pursuit of this interesting class of investigation.

A BOOK ON MOUNTAINS.

Die hochgebirge der Erde. Von Robert von Lendenfeld. Mit titelbild in Farbendruck 148 Abbildungen und 15 Karten. Pp. xiv + 532. (Freiburg im Breisgau : Herdersche Verlagshandlung, 1899.)

THIS is a most conscientious piece of bookmaking. The author appears to have read and made a summary of all the more important descriptions of the mountain masses of the globe. Beginning with a sketch of the physiography of mountains, their development and sculpturing, he passes on to describe them chain by chain. As he has himself travelled much, he can often speak from personal experience, while the numerous and generally excellent illustrations enable the reader to realise the different types of scenery. Reproductions of photographs are used in most cases, but occasionally, of course, copies of engravings, variable in quality, were alone available. Some, both of the one and the other, have done duty before, and a few perhaps may be more attractive to the general than to the scientific public. Pictures, for instance, of climbers in a mist seem more appropriate to a book of travels, and some of those representing mountain plants or animals are hardly such as to enhance the value of the book. Attractive also as are all Mr. E. T. Compton's sketches, we cannot but feel that in a treatise of this kind reproductions of photographs would have been better, for accurate delineation is sometimes sacrificed to artistic sensibility. This is especially true of the drawing of the Grivola on p. 128, in which we have not found it easy to make out the topography. These, however, are matters of opinion. The book contains a vast mass of information, brought down to the latest possible date, and collected with a thoroughness and accuracy truly German.

The book also exhibits one or two defects, which perhaps, like its merits, are related to its birth-place. In the treatment of the subject we are conscious of some want of lucid arrangement and of a comprehensive grasp. In regard to the former, a brief outline of the contents may perhaps best indicate our meaning. It begins with a short sketch of mountain building and sculpturing, followed by a glance at the characteristic flora and fauna : a subject so wide that any details can only be fragmentary, and we should have preferred to pass it by in a few paragraphs which stated the general principles by which the life distribution has been determined. The author then commences, at the seventieth page, his special descriptions with the mountains west of the Mediterranean, from the Atlas to the Pyrenees. Thence he passes on to the Alps, which are treated, perhaps not unjustifiably, at rather disproportionate length, and then in another section we jump from Sardinia and Corsica to the Apennines, run along the Carpathians to the Balkans, make a leap to the Caucasus, and finally land with the ark on Ararat. Next comes the radiating group of giant chains in Central Asia, of which some of the less known are very well described. In the next section, after a very brief glance at the northern mountains of Eurasia in general we are transported to Spitsbergen and Iceland, and then restored to the mainland in Scandinavia and the Urals. After that we wander to Central and Southern Africa,

taking flight at last for Arabia and the peninsula of Hindustan. Then, in a long section, we make the circuit of the Pacific together with a digression to Hawaii, and after jumping from Greenland to the Appalachians, and thence to Guiana, finally come to rest on the highlands of Brazil. We find traces, no doubt, of a geographical order in the above, but think that to have kept to continents, while carefully pointing out the relation to ocean basins, would on the whole have produced clearer ideas.

We also feel the want of a concluding chapter, giving a summary of the results which follow from a study of the details contained in the foregoing sections; the principles, if we may so call them, of mountain building and sculpture, and the connection between their forms and materials. The latter was sketched briefly, but accurately so far as it went, by Ruskin years ago in the fourth volume of "Modern Painters," and might now have been elaborated in more detail by Dr. von Lendenfeld from the mass of materials which he has collected. We may illustrate the want of inductive treatment by the case of Monte Rosa. The map, especially if slightly extended eastward, would have given the author an opportunity to discuss an interesting problem leading up to general principles. What causes the extraordinary gap between Monte Rosa and the Strahlhorn? The range of the Mischabelhörner seems to be cut off at the southern face of the latter, while another range, running from the west, terminates even more abruptly in the eastern and northern faces of Monte Rosa. In the intervening gap, some four miles wide, nothing on the edge of the great snow-field rises higher than the hump of the Cima de Jazzi itself, obviously terminating a ridge which extends eastward from the Riffelhorn. What is the explanation of this ridge—also cut off abruptly like the others, and of the gap itself? The map suggests to us a solution of the mystery. Beneath a precipitous descent, seldom less than 6000 feet vertical, lies the head of the Macugnaga valley. Here, as in many other cases in the Alps—it is probably equally true of the Théodule gap west of the Breithorn—the denuding forces have acted with greater potency on the Italian side of the watershed, and they have actually quarried away the mountain centre from which these great ridges once radiated and replaced it by the great amphitheatre into which the Macugnaga glacier now descends.

But while venturing on these criticisms we are thankful for what the book gives us, especially for a glossary to help the unlearned and for an excellent index. We lay it down with something like envy. It is one of a series illustrative of the Earth; it is well and almost profusely illustrated, excellently printed, and its price is 14 marks. We presume then that works of this nature find in Germany a sale sufficiently large to make them remunerative to publishers. But would any English firm be adventurous enough to undertake such a series, or even to publish the volume before us? We fear not. Our German cousins value education more than we do, and apparently desire mental food more solid than halfpenny newspapers, penny dreadfuls, shilling shockers, or even novels with a purpose.

T. G. BONNEY.

OUR BOOK SHELF.

Beginselen der Scheikunde. By Dr. M. C. Schuyten. Pp. 109. (Antwerp: Van Ishoven, 1899.)

THIS is an elementary text-book on qualitative analysis, which aims also at imparting some of the fundamental principles of chemistry. A short introduction explaining the difference between physical and chemical change is followed by a list of the more important elements (iron is omitted) with their symbols. From this we pass on to a brief account of some fourteen elements, which are to furnish material for experimental investigation. The author then selects the unfortunate case of copper and sulphur to illustrate the difference between a mixture and a compound. It is needless to say that a more illogical and false illustration could scarcely be conceived. 6·3 grams of copper powder and 3·2 grams of sulphur are mixed together. The student must puzzle out for himself why these precise quantities are taken. Having satisfied himself by the help of a pocket lens that both substances are still present when they are shaken up, the mixture is heated. The blue-black mass which results is now, we are told, a chemical compound consisting of 63·12 parts of copper and 31·83 parts of sulphur, when the author must be fully aware that it is a non-homogeneous mixture of cuprous and cupric sulphide and free sulphur. One is tempted to suggest another example of the same order. Take 1 lb. of sugar and ¼ lb. of butter, and mix them together. The butter and sugar may still be observed with a lens. Proceed to heat them until the required consistency is obtained. The substance is no longer sugar and butter. Consequently, the resulting toffy is not a mixture, but a compound made up of the original ingredients in the proportions taken.

Passing over this unsatisfactory start, the system laid down by the author has much to recommend it. Before the student begins systematic analysis, he is set to perform experiments on the preparation of simple compounds, as well as to study such general reactions as oxidation reduction, the action of acids on metals, &c. The text is interspersed with notes of interrogation, and, in addition, a few questions are appended to each lesson.

Where the book fails is in its attempt to condense a large amount of information into a small compass, and in the lack of sufficient experimental details and adequate illustrations of apparatus.

A beginner, who had no further help than this book affords, would meet with difficulties at every step. No doubt the author's object is to place something in the student's hands which will supplement his own laboratory teaching, and from this point of view its publication may be justified.

Student's Edition of a Standard Dictionary of the English Language. Edited by James C. Fernald. Pp. viii + 915. (New York: Funk and Wagnalls Company, 1898.)

The Standard Intermediate School Dictionary of the English Language. Edited by James C. Fernald. Pp. viii + 533. (New York: Funk and Wagnalls Company, 1899.)

BOTH these dictionaries are based upon Funk and Wagnalls' Standard Dictionary. The student's edition gives the orthography, pronunciation, meaning and etymology of upwards of 60,000 words and phrases. It is furnished with appendices of proper names, foreign phrases, faulty diction, disputed pronunciations and abbreviations, as well as with a number of useful tables, including those of the chemical elements, metric weights and measures and many others. The student's dictionary also contains some 1225 pictorial illustrations. The school edition provides brief and accurate etymologies, and is furnished with as many as 800 pictures. Both volumes are beautifully printed and serviceably bound.

Though the books have only recently been placed upon the British market, they have attained a wide popularity in America, and we shall be much surprised if their attractiveness does not lead to their becoming favourites in this country.

It is always interesting to compare dictionaries, and some of the results of a comparison of those before us with one largely used in English schools will not be out of place. The first word, the meanings of which were placed side by side, was *steelyard*. In the school volume under notice was found "a simple device for weighing, consisting of a scale beam, counterpoise, and hooks," while the book with which it was compared gave "a balance for weighing bodies, consisting of a single weight shifted backwards and forwards on a graduated beam." But it is only fair to add that a small cut, of a not very intelligible kind, illustrates the American definition. The second word looked up in both volumes, this time using the student's edition of the Standard Dictionary, was *nebula*. In the dictionary under review is to be found:—(1) "Any luminous cloud-like object in the sky, as a distant star cluster; (2) A supposed gaseous body of unorganised stellar substance"; that in the familiar dictionary on our table:—(1) "An appearance as of light gauzy cloud amongst the stars, usually only seen through a telescope, often resolvable by a powerful instrument into clusters of stars; (2) A white spot or opacity in the cornea." Neither of the definitions is altogether satisfactory, for a nebula is not a star cluster any more than an amœba is a star-fish.

The new volumes have, however, several commendable characteristics, and will doubtless find a place in schools.

Outlines of Bacteriology. By Dr. L. H. Thoinot and E. J. Masselin. Translated by W. St. Clair Symmers, M.B. Pp. 318. (London: C. Griffin and Co., Ltd., 1899.)

THIS little volume, bound in leather, is evidently calculated to stand hard wear, and is put together in the hopes of becoming a bacteriologist's *vade mecum*. It differs from many such compressed manuals by the introduction of numerous quotations from the original memoirs; these extracts would have gained in value had the source been acknowledged in all cases instead of in certain instances only, one of the principal advantages of such references being to encourage the intelligent student to consult such memoirs for himself, and so extend his knowledge of the subject beyond the necessarily confined limits of a small text-book.

The authors are medical men, and it is for the medical student that the book has been written, and for this purpose it appears to be admirably suited; industrial bacteriology is not touched upon, and we think, therefore, the title is somewhat misleading, inasmuch as the authors deal with but one branch of bacteriology. It is clearly printed and copiously illustrated.

Lehrbuch der Experimental Physik. By Adolph Wüllner. Fifth edition, vol. iv., part 2. Pp. xii + 530. (Leipzig: Teubner, 1899.)

A TREATISE on physics which, by the issue of the above part, has now completed its fifth edition must evidently have been found useful; and it may safely be said that this edition will be found still more useful than its predecessors. The book has been fully revised and considerably enlarged; the additional matter representing the more recent advances in physics. The section which now lies before us treats of the propagation and perception of light, interference, diffraction, and polarisation phenomena and theories.

The thirty additional photographs in this edition are mainly owing to the advances in the electromagnetic theory of light, and to the increase of our knowledge with regard to the relations between light and magnetism (Zeeman effect, &c.) These and indeed all the parts of the book are treated with great lucidity, thoroughness, and accuracy. We may call particular attention to the chapters dealing with polarisation; they specially please us. Those diagrams which represent three-dimensional phenomena in the plane of the paper do so in such a manner that the intention of each is evident at a glance; and the mode of dealing with the optical properties of the crystals selected for illustration of the general theory is such as to give a very complete view of the cited cases, and strikes us when contrasted with the treatment in certain other text-books which might be mentioned. Altogether, although the volume shares the fault of so many German books—viz., that it is not always free from dryness—we recommend it heartily as a thoroughly sound and modern text-book suitable for the use of the senior students in our university colleges. A. W. P.

Proceedings of the Eleventh Annual Meeting of the Association of Economic Entomologists. (*Bulletin* No. 20, New Series, U.S. Department of Agriculture: Division of Entomology.) Pp. 111. (Washington, 1899.)

THIS publication includes a series of useful and interesting articles on injurious insects, by Profs. Howard, Marlatt, Felt and other well-known entomologists. Fortunately, injurious insects seem to have their day of destructiveness, and then cease to do much mischief; at least, for a time, owing to natural or artificial checks. Thus, respecting the much-dreaded San José Scale, Prof. Marlatt writes: "It is not especially feared to-day in California, and, in fact, it is looked upon by some of the largest fruit-growers (as I am informed by Prof. Washburn) as having been of positive advantage, the yearly treatment of trees having necessitated a system of regular short pruning, which has greatly improved the quality of the fruit, and much lessened the expense of gathering." He, therefore, argues against undue alarm and excessive preventive measures respecting sudden and perhaps temporary insect attacks. Prof. Howard prints a translation from the Russian, by Dr. Fireman, of a paper by Porchinski, respecting the destruction of Tabanidæ by pouring kerosene into the pools to which they resort to drink. Other articles deal with caprification in California; the destruction of hairy caterpillars by birds; the progress of the never-ending campaign against the Gipsy Moth in Massachusetts, &c. W. F. K.

Elementary Dynamics. By W. M. Baker. Ch. xix. Pp. 251. (London: George Bell and Sons, 1899.)

ALTHOUGH necessarily similar in subject matter to the many existing treatises on this subject, the above little work will recommend itself by many convenient minor originalities. The descriptions are exceedingly minute and clear, and are in most cases followed by more worked-out typical examples than usual.

In addition to a set of examples at the end of each chapter, there is a useful compilation of more difficult problems at the end, selected from past examination papers. The scope of subject included has been chosen chiefly for the benefit of students preparing for Woolwich and Sandhurst, or reading for scholarships at the Universities.

Handbook of Physics and Chemistry. By H. E. Corbin and A. M. Stewart. Pp. vi+424. (London: J. and A. Churchill, 1899.)

WITHOUT attempting any originality of style or subject matter the authors of this work have culled from the many authoritative sources the requisite information necessary for students preparing for the First Examination in physics and chemistry of the Conjoint Board of the Royal Colleges of Physicians and Surgeons. The book will also be useful to those working for the Pharmaceutical Society and the Royal Veterinary College, the syllabuses prescribed by these institutes being fully covered.

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.*]

Contemporary Meteor-Showers of the Leonid and Bielid Meteor-Periods.

PART I.—*Co-Leonid Showers.*

As a large proportion of the November shooting-stars observed and mapped in 1899 on and near the two chief shower-nights, of November 14th and 15th, were *non-Leonid* meteors emanating from various contemporaneous centres of much less conspicuous star-showers of that month, than the eagerly expected but unfortunately not witnessed great spectacle of the *Leonids* themselves, it may furnish a useful clue to some of the foreign-looking or unconformable meteors' sources of which several bright examples were no doubt mapped by observers in the many able watches kept for the recently expected shower, to mention some radiant-points which were noticed here to be particularly active in about twelve hours of tolerably productive meteor-watching, lasting one or two, to three hours, on each night of November 6th, 8th, 10th, 12th and 13th, in clear dark sky, before the moon had acquired sufficient strength to hide the smaller meteors. Mr. Denning also watched for about four hours on the nights of the 10th, 11th and 13th, seeing four *Leonids* and twenty-four other meteors; and among nine unconformable ones of which he sent me path-positions, three accorded in direction with radiant-points of my present list, and one of these, on November 10th, as well as a second meteor on that night, was simultaneously mapped here, enabling real paths of these two meteors to be concluded from the observations, as represented in this Table.

bright *Leonid*, at 13h. 33m.,[1] seen here in the half-hour till 2h. a.m. on the morning of November 15th, when the sky for a short while was clear before thick fog and clouds intercepted all view of the sky for the rest of that night and through all the night of the 15th, with only a very partial break's exception for an hour preceding daybreak on the morning of the 16th, when nothing meteoric was seen, was the only view that I could here obtain of any well marked phase of brightness or abundance which the shower was expected to display, and which it did actually display with some small intensity elsewhere, on its two chief predicted nights.

While no rapid rate of appearance of the *Leonids* was yet noted here in the clear half-hour till 2h. a.m. on November 15th, I have learned from my brother, Sir W. J. Herschel, that at Littlemore, near Oxford, he observed, with a small party of watchers, quite an abundance of *Leonids* on that morning, in clear sky, between 1h. 15m. and 6h. 15m. a.m. The total list recorded there in those five hours was 62 *Leonids* and 40 *non-Leonids* or ordinary meteors. To the number of the *Leonids*, besides, should be added six or eight not charted, from their coming too rapidly in one or two minutes at 5h. 25m., and in five minutes after the appearance, at 5h. 40m. a.m., of the brightest meteor of this watch, which will be referred to more particularly below. Including those additions, the numbers of *Leonids* noted in the successive hours before, and half-hours after moon-set at 16h. 50m., were

Hours ending at	14h. 50m.	15h. 50m.	16h. 50m.
Numbers of *Leonids*	6	8	10
And Hourly rates..	6	8	10

Half-hours ending at	17h. 20m.	17h. 50m.	18h. 15m.	(25m.)
Number of *Leonids*	14	25	7	(in. 25m.)
And Hourly rates..	28	50	17	

The sky was generally clear, and extremely clear in the one dark hour after moon-set. The hourly rates then show a

TABLE I.—*Real Paths of an* ε-Taurid, *and of an* ι-Aurigid *Shooting-star, doubly observed at Bristol and Slough, on November 10th* 1899.

Hour G.M.T.	Apparent Magnitude.	Height in B.S. Miles, at Beginning.	Height in B.S. Miles, at End.	Radiant-point. α δ	Length of Path (Miles); and Duration (Seconds).	Observed, and (Theoretical Parabolic) Speed, Miles p. sec.	Appearance.
h. m. 13 16	2–4	58; over 5 miles S.E. from Cheltenham.	46; over 5 miles S. by E. from Evesham, Worcestershire.	° ° 55+4 ε *Tauri* S., 15° W. alt. 42°.	17½; 0·8	22 (21½)	Uniformly bright, orange-yellow; no sparks or streak.
13 37	4	77; over 1 mile E. from Godalming, Surrey.	47; over 3 Miles W. from Chertsey, Middlesex.	72+30 ι *Aurigae* Due S., alt. 68°.	33½; 1·4	24 (29½)	Near radiant, at Slough, slow, tapered; yellow, with streak-like, red, tapered, spark-tail.

The first true *Leonid* seen here appeared at the close of a short very clouded watch of 30m., at 5h. 59m. a.m., on November 13th; at least as bright as *Sirius*, since it shone through clouds which hid all stars except those of Leo's Sickle, from which its course was directed.[1] In the earlier part, however, of that night, and during all the preceding night of November 11th, the sky here had been completely overcast; but Mr. Denning saw two small *Leonids* and three other meteors in 35m., at Bristol, after 14h. 50m. on the latter night. Two third magnitude *Leonids* were seen here on the following morning of November 14th, among four meteors mapped in a nearly clear hour after 4h. a.m., and Mr. Denning noted a small *Leonid* with two other meteors in about 20m., on that morning, after 5h. a.m.; but the few tracks seen till then showed no great activity yet of the looked for meteoric exhibition. A single sudden increase; but a very sudden rise occurred also in the second half of that dark hour (from 28 to 50 *Leonids* per hour, very soon arrested then by gradually increasing daylight), much too abrupt and sudden an increase, it seems obvious, to be at all possibly ascribed to fading lunar twilight. These observed rates in the moonless sky seem thus pretty certainly to show that a maximum of the meteor-stream was either fast approaching and very near and imminent, or may perhaps even have been just attained, when a close was put by daylight to my brother's good view of the shower and to his carefully recorded notes of this *Leonid* display's appearance. The proportion of the number of *Leonids* to that of ordinary shooting-stars seen in the watch at Littlemore, 6 or 7 : 4, nearly resembles, although it did not quite attain the proportions noted at Romsey, Hants, and at the University of Pennsylvania, U.S., on the

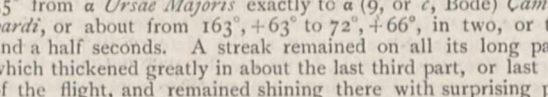
[1] This path was approximately from 99°, + 19° to 83°, + 15°; about 15° in ⅔ second.

[1] This 1st magnitude *Leonid's* path was from 113°, + 37° to 93°, + 39½; 15° in ⅔ second, leaving a greenish-white streak all the way for about 2 seconds.

following morning of November 16th, which, as reported in the *Times* of November 17th, were both about 2 : 1.[1]

One of the forty unconformable or *non-Leonid* meteors seen at Littlemore, which appeared at 5h. 40m. a.m. on November 15th, was so extremely bright that it could only be termed conventionally an "ordinary" shooting-star, since it was not only brighter than Sirius and than all the other fixed stars, but it left behind it a light streak along its path, the terminal part of which remained visible for five minutes. The general hue of the meteor was yellow, inclining to orange, and it described a path of 35° from α *Ursae Majoris* exactly to α (9, or *c*, Bode) *Camelopardi*, or about from 163°, +63° to 72°, +66°, in two, or two and a half seconds. A streak remained on all its long path, which thickened greatly in about the last third part, or last 12° of the flight, and remained shining there with surprising persistency, while on the earlier part of the track it quickly faded out. The light-wisp shortened gradually from behind, its front end remaining constantly near α (or *c*) *Camelopardi*; and when it had shrunk to about 8° in length, it grew slightly sinuous, as if windwafted, and its last visible light-trace at the end-point of the flight had drifted about half a degree northwards, altogether, or sideways from the streak's direction, when it disappeared. The first and final appearances which the streak presented near the star α, or Bode's *c Camelopardi*, are shown as they were represented by a sketch, in the adjoining Figure (Fig. 1).

Like multitudes of streak-leaving meteors which in the morning hours, on all nights of the year, stream from the neighbourhood of the earth's apex near the east horizon, this bright



Streak of the Meteor of 5h 40m a.m., November 15th, 1899, as seen at Littlemore, near Oxford.

FIG. 1.

meteor's path diverged from no conspicuously well known ordinary radiant-point of the *Leonid* epoch, but shot from far east of *Leo*, and must have passed about over the northern part of Oxfordshire from some radiant-point not far above the E. by S., or E.S.E. horizon among the stars of *Comae Berenices*, or near ζ *Virginis* and *Spica* which had then just risen in the E.S.E. Should it have been recorded elsewhere, therefore, descriptions of its apparent path at other places to compare with this one would be of special interest and value, as with only one exception, of a centre of five swift meteors leaving streaks, observed by Mr. Denning on the morning of November 16th–17th, 1885, at 190°, +21°, near *q*, or 35 *Comae*, in the southern portion of the constellation [1] (pretty close to which point, through 194°, + 23°, the present meteor's path-line passes backwards), no radiant point of marked activity near the yearly shower-date of the *Leonids*, appears, in Mr. Denning's splendidly comprehensive "General Catalogue of Radiant-points,"[2] to have been hitherto recorded in that quarter of the sky.[3] The altitude of 39° of the latter radiant-point, and its moderate distance, only 45°, from the beginning of the meteor-path, are not entirely inimical to this radiant point's adoption, as although the apparent path was very long for a rather steep-sloped descending real one, it should be noticed that the meteor passed nearly overhead and therefore in such near view at Littlemore that a great apparent length of path may on that ground alone be very readily accounted for, and the thickening and persistence of the streak in only the latter portion of the flight, favours the presumption of a pretty steep descent into the atmosphere, rather than a supposition that the real path was nearly horizontal. The observed speed of flight, 15° or 16° per second, is also too insecure a measurement to serve as an exact or very reliable criterion between a higher and a lower radiant-point position; but as it was not more than half the apparent speed with which one of the *Leonids* would seem to dart along,—about 30° per second,—in a similar position relative to its radiant-point and to the horizon, the slower real meteor-speeds of both the α-ζ *Virginids* and the *q-Comids*,—30–35 miles per second,—owing to their radiant-points' greater elongations from the earth's apex, as compared with that of the *Leonids*, about 43 miles per second, are evidently represented pretty nearly, although as usual in estimates of durations of flights and of apparent path-speeds, only with moderate exactness, by the observed, not very rapid angular velocity of the meteor's motion.

[1] Until 3h. a.m. on the 16th, the weather in the United States of America had been in general very unfavourable for meteor-watching; but from about that hour onwards until daybreak, good numbers of meteors, 102, 64, 59 and 30, were seen at Philadelphia, Harvard College Observatory, Bayport on Long Island, and Chicago; and at Denver, as reported in the *Times* of November 18th, the *Leonids*, after beginning to appear at 1h. a.m., were not very numerous until about 4h. a.m.; 63 were then counted in a quarter of an hour. The number of meteors seen at Romsey, in Hampshire, was 60; and at the Observatories of Madrid and Treptow (Stettin, North Germany), also, good numbers of meteors on the morning of the 16th were recorded. A period of considerable activity of the *Leonid* meteor-stream seems thus to have very distinctly presented itself on each of the two probably predicted mornings, for the shower's return, of November 15th and 16th. A lively shower of 80 or 100 *Leonids* seen on the morning of the 15th by Messrs. Tikhoff and Lespieau in the first of the two balloon ascents made by the astronomers of Meudon and the French Aeronautical Society, on the two foretold shower nights, and a very interesting description by Mr. W. H. Daw, in the *English Mechanic* of November 24th, of a rapid shower of 40 or 50 *Leonids* seen in exceedingly clear sky on Hampstead Heath, in about 40m. between moon-set and daybreak on the earlier one of those two mornings, both perfectly confirm the description given above of a considerably bright *Leonid* display just before daybreak on the morning of November 15th. It must, however, have then very speedily collapsed; for at Princeton, New Jersey, U.S., only about 20 *Leonids* were seen, in clear sky, from soon after midnight (about 5h.–6h. a m., G.M.T.), until 5h. a.m. (10h. a.m., G.M.T.), by Professor C. A. Young, on the morning of November 15th; ("Popular Astronomy," December 1899, vol. vii. p. 543:—assuming that, in that account of a transitory good view of the *Leonids*, the date of rain and clouded sky given as the "night of Monday–Tuesday, November 14th–15th," may be corrected to November 13th–14th; and that by "Tuesday night," when the sky cleared up soon after midnight and about 20 *Leonids* were seen at Princeton, must no doubt be meant, as the description is regarded here as having been evidently intended to imply, the night of November 14th–15th).

[1] The shower is included in Mr. Denning's excellent list of 50 ordinary meteor showers contemporary with the period of the *Leonids* (which will soon again be more particularly referred to), as No. 43, at 190°, + 21°.

[2] "Memoirs of the Royal Astronomical Society," vol. liii. pp. 203–292.—The 278 showers' numbers in this List, and in its introductory "Index List" of all the showers' average positions and stellar designations, are quoted in the Tables and general matter of this letter, by the symbol D('99), with the showers' successive numbers.

[3] In a letter from Mr. Denning of November 25th, I am informed that he has been able to compute this meteor's real path from some additional observations sent to him by meteor-recording correspondents from Yeovil in Somersetshire, and from Woburn in Bedfordshire, which accorded very well with the data furnished by the above account at Littlemore. These observations he found to be consistent with the supposed direction of flight from the radiant point near *q* or 35 *Comae*, and to give a real path which also exactly corresponds with the above conjectured geographical position of the track; while the vertical height and the length of path agree with the usual results for very bright and slantingly descending meteors. The following are the particulars, in detail, obtained by Mr. Denning, of the meteor's real path.

Height, in miles, at		Length of Path and Velocity.	Radiant Point.		Parabolic Meteor-speed.
Beginning	End.		α	δ	
71 miles over 4 miles south of Buckingham.	42 miles over 3 miles south of Shipston-on-Stour, Warwickshire.	46 miles in 2¼ seconds; 20½ miles per second.	193°	+ 27°	36 miles per second.
			7° S. of East, altitude 42°; near *q Comae*.		

The observed duration, of about 2¼ seconds, at Littlemore, gives, as here shown, a real speed, 20½ miles per second, so much slower than the presumptive one of either 36 or 30 miles per second, which should belong to parabolic-moving meteors proceeding from this radiant-point or from one near *Spica*, that the measure of duration and of apparent swiftness or slowness of the meteor's flight was really, as surmised above, in this meteor's case as in so many others, not an exact enough *datum* to be helpful towards a desired, but delicate discrimination of the meteor's radiant-point by astronomical considerations.

A good view of the meteor obtained by Mr. F. H. Wright, in Northamptonshire, is described in the *English Mechanic*, vol. lxx. p. 406, December 15th, 1899; Mr. Wright confirms the great visible duration of the meteor's light-streak, by stating that it appeared to change its position slowly from its original line of flight towards N.W., appearing first to be 5° or perhaps more in length, and that after being watched for four minutes, when it was still visible, it appeared to be directed more nearly towards N.E. The point where it "burst, midway between *Castor* and *Capella*," satisfactorily confirms Mr. Denning's determination of the real height and place of the meteor's end-point; and as regards the earlier portion of the real track which it pursued, although nothing precise enough to establish the radiant-point exactly, was supplied by the general description that the direction of flight was towards N.W. (more nearly in reality towards due W.),—yet this point's real position near *q Comae*, had already been certainly determined, and excellently well-defined at that position, by the exact apparent direction of the meteor's course, in Bedfordshire, supplied to Mr. Denning by Mr. W C. Tetley.

The important calculations of the perturbations of the *Leonid* meteor-stream by the major planets since the year 1890, recently published by Dr. A. Berberich, of Berlin,[1] in which the effect of those perturbations to alter the form of the stream's orbit and hence the distances from the sun, at their nodes, of those parts of the stream which the earth would encounter, respectively in November of the years 1898 and 1899, led that distinguished German astronomer to the conclusion that inward deflections towards the sun of 0·0163 and 0·0048 earth's orbit-radius, or of about one and a half, and half a million miles respectively, would be produced in the two meteor clusters at their nodes, by the special perturbations exerted upon them respectively by the major planets; and as the orbit of Tempel's comet of 1866, which they may be supposed to have been nearly following, passed already at its node, in January of that year, at 0·0065 earth's orbit-radius, or 604,000 miles inside the earth's orbit, the offing distances of these two clusters' centres on the inside of the earth's track when the earth passed near them in November, 1898 and 1899, would be respectively about two million and one million miles, if they pursued the same orbit as the comet had in 1866, before undergoing the exceptionally strong perturbations; while in their previous revolution they would have been but little more than half a million miles inside the orbit of the earth; and if the meteor clusters passed through in 1866 and 1867 were also moving along the comet's orbit then, and sufficed to produce imposing meteor-showers when the earth approached to within about half a million miles from their stream-centres, it need certainly excite no wonder if no meteor-showers of extraordinary brightness should have happened to occur on the November dates of 1898 and 1899, when the earth approached no nearer than to two million and one million miles from the meteor-current's centre

But Dr. Berberich's investigation really showed what marked differences of effect are produced by the planetary perturbations on different portions of the long meteor-stream, so that instead of any parts of it now following exactly the same orbit as the comet, it must all have become waved and sinuous along a mean orbit path; and no prediction of the showers probable intensity at a new return can be at all based certainly on an apparent centrality and on great brightness of its just previous periodical appearance. The succession of fine showers of 1799, 1832–3, and 1866–7 appears to have been interrupted for the present by some such deformations impressed by past perturbations, during nearly twenty centuries, on the meteor-current. But these may be replaced next year, with equal probability, by new and contrary ones in the portion of the stream which the earth, it may be hoped, will pass through more centrally than seems to have occurred this year, in November, 1900. It may also still be somewhat premature to regard the strength of the November shower as having fallen this year beyond all traces of resemblance below its anticipated brightness, until detailed reports may still for a long time be expected from many anxious meteor-watching stations in the Antipodes, like the great observatories of Australia and the younger, but yet very well equipped meteorological and astronomical observatory at Hong Kong.

The following were the times of observation, (Table II.), and the radiant-point results, (Table III.), of my recent morning views, in clear sky, of 69 *non-Leonid* and five *Leonid* shooting-stars seen in the 12hrs. watch on November 6th–16th. The 74 meteors were for the most part small, only about twenty having surpassed third magnitude stars, and none having exceeded the brightest fixed stars in brightness. Only six or seven unconformable meteors, besides one *Leonid*, left momentary light-streaks; two from the radiant at κ, and two from radiants near π or ρ *Leonis*, and two more from the radiant near the equator at p, 29 *Monocerotis*. A greenish-streaked, 1st magnitude meteor from this latter point, on November 8th, had, in fact, so perfectly the appearance of a true long-pathed, swift *Leonid*, as quite to deceive me, at first, into a supposition that it must surely be a fine and very early harbinger of the coming meteor-shower, until its path was mapped and traced back to its real *Monocerotid* centre.

With the exception of a κ *Leonid* on the morning of November 14th, the thirty-eight meteors grouped under the five *co-Leonid* radiant centres in Table III. were all seen among sixty-four ordinary shooting-stars on November 6th–10th; the four remaining ordinary meteors added to the list in broken watches in the following very clouded star-shower nights, having all belonged to very feeble showers from other ordinary centres. But the five *Leonids* seen then in a few restricted glimpses of the sky, gave a pretty exactly defined radiant-point, which, though obtained from several different nights of observation, might yet, it was thought, be esteemed accurate enough, and of sufficient general interest to be included in the Table.

The paths were all projected on a chart of stars laid down for the epoch A.D. 1900, on the extraordinarily accurate gnomonic polar net drawn to single degrees of right-ascension and declination about a centre of projection in declination 45°, by Prof. Lorenzoni, and published at the astonishingly low price of 0·4 *lira* (about 4*d.*) per large "double-crown"-sized sheet of exquisitely printed zincographic engraving, at the Meteorological Observatory of Fontaniva, Venice, for the use of Italian and other shooting-star observers. The radiant-point positions were thus very accurately extracted, and the unusual precision of the gnomonically ruled map seems to have been very strikingly illustrated by the smallness of the areas from which the tracks referred back to each of the radiant-points diverged. The radii of these circular areas drawn round each radiant, as a centre, of just sufficient width to include the most distant of the path lines regarded as belonging to that radiant, are shown in the third column of the Table. But they sometimes overreached the proper smallness of a focal region, when only one or two very outlying path lines occurred, as happened in the plotted set of ξ *Taurid* paths, among an otherwise well centred group of path-directions. The concluded centre-places were compared with two radiant-lists published by Mr. Denning; one of fifty ordinary meteor-showers visible at about the same time with the *Leonids* (or, about a week later, also with the *Bielid* meteors),[1] and the other his extensive "General Catalogue" above referred to. The first and fourth columns of the Table give the Numbers in those two Lists, of separately accounted "*Co-Leonid*" streams, and of more or less long-enduring ordinary meteor-systems, or "shower-series," with which the present set of showers appeared to be identical; and the average positions of the latter "shower-series," as given with their running numbers in the catalogue, in the "Index-List" of Mr. Denning's "General Catalogue," are added in the fifth column of the Table to the preceding column's Numbers in that General Catalogue, or its Index-List. The agreements found, very closely confirmed the two lists' positions, excepting in the case of the main stream of *Taurids*, which, as I hope to recur to hereafter in a communication of some notes on large *co-Leonid* and *co-Bielid* meteors to supplement this letter, appears on this occasion to have proceeded from a rather outlying centre, rather nearer to α than to ϵ *Tauri*.

A shower centre at ξ, *o Tauri*, very prominent in October and November, apparently reaches its maximum on November 2nd, when Mr. Denning noted its place very exactly, in 1886, by a considerable shower of seventeen meteors, at 55°, +9°. One member of this stream, it has been already mentioned, with a radiant-point at 55°, +4°, was doubly observed at Bristol and Slough this year, on November 10th; and another as early as September 17th, in 1898, by Mr. A. King, at Leicester, and here, brighter than stars of the first magnitude, with a radiant-point at 57°, +7°. The shower was well defined this year by many tracks, very near its mean position in Mr. Denning's "General Radiant Catalogue," although no place seems to have been accorded to it in the select List of Fifty Showers visible at the same time with the *Leonids*. The p, q, or "30 *Monocerotids*" (No. 3), which form a rather weaker shower-series of similar duration to the ξ, or "*e Taurids*," and which furnished a few bright streak-leaving meteors this year from close to their mean centre in the "General Radiant Catalogue," are also missing from, and are no doubt properly passed over in the special *co-Leonid* List, as they not only formed a less plentiful shower than the ξ *Taurids*, in these watches, but they were also not all quite so certainly assignable as were the great majority of the ξ, *o Taurid* tracks, to their adopted centre.

Among many recorded radiant-points near *Leo's* Sickle, only that near κ *Leonis* was found to be distinctly active, presenting itself very sharply before any true-directed "γ *Leonid*" meteor-paths were charted; and though only a slender shower of slightly streaked and rather sparingly bright meteors, it must doubtless produce on ordinary *Leonid* shower nights some of the swift shooting-stars resembling *Leonids* which in yearly watches for the great shower's return, are sometimes seen diverging from a little north of *Leo*. On the morning of November 14th, 1877, a marked abundance of apparently just

[1] *Astronomische Nachrichten*, No. 3526, October; and *The Observatory*, vol. xxi. p. 446, December, 1898.

[1] *Astronomische Nachrichten*, No. 3513; August, 1898.

TABLE II.—*Times of Watch at Slough, November 6th–16th, 1899; Numbers of Meteors seen, and State of Sky.*

Date 1899, Nov.	Times of Watch, G.M.T. From	To	Duration of Watch.	Numbers of Meteors seen. *Non-Leonids*	*Leonids.*	Apparent Magnitudes. >1	1	2	3	4	5	Hourly Rates of Total Meteors.	Moonlight; and State of the Sky; &c.
	h. m.	h. m.	h. m.										
6	14 0	17 0	3 0	27	—	—	2	4	4	7	10	9·0	No moon; quite clear.
8	13 40	15 40	2 0	18	—	—	3	2	3	7	3	9·0	No moon; very clear and bright.
10	13 0	15 30	2 30	19	—	2	—	1	5	8	3	7·6	No moon; clear, but luminous with thin haze.
12	17 30	18 0	30	1	1 = Sirius	1	—	—	1	—	—	4·0	No moon; very hazy and half overcast.
13	13 30	15 15	1 45	1	—	—	—	1	—	—	—	0·6	¾ moon setting, at first; clear till 14h.; but gradually overcast at last.
13	15 45	17 0	1 15	2	2	—	2	—	2	—	—	3·2	No moon; hazy, and ½ clouded. Two small Leonids, a bright κ *Leonid*, and do. ζ *Draconid*.
14	13 30	14 0	0 30	—	1	—	1	—	—	—	—	2·0	¾ moon hid 4–5th mag. stars: clear till 14h., afterwards overcast until Nov. 16th, 5h. a.m.; in 1h. then, sky $\frac{1}{10}$th clear, no meteor seen.
16	13 30	14 15	1 0	1	1	—	—	—	2	—	—	2·0	Full moon bright; clear in two short intervals; one meteor seen in each.
	14 30	14 45											
	Totals ...		12 30	69	5	3	8	8	17	22	16	8·5;	average hourly rate in clear, moonless sky, on November 6th–10th.

TABLE III.—*Radiant-points of* 37 *out of* 64 Non-Leonid *Meteors seen at Slough on November 6th–10th; and of Five* Leonids, *and one* κ-Leonid *among ten Meteors, on November 12th–16th*, 1899.

Number in Mr. Denning's Co-Leonid Radiant-list, 1898.	Observed Place of Radiant, in Polar Position, and by neighbouring bright Star. α δ	Radius of Circular Radiant Area.	Corresponding Place and Number, (D('99)), in Mr. Denning's "General Catalogue," 1899. D('99) No.	Position α δ	Numbers of Meteors Mapped.	Dates of Observation of the Meteors; 1899, November.	Apparent Magnitudes of the Meteors.	Average Apparent Length of Path.	Average Apparent Speed; Degrees per Second.	Reference Numbers to the Notes, below.
	° ° 52 + 8 ξ, *o Tauri*	4½	49	53·2 + 7·6 *e Tauri*	10	6666, 888, 10, 10, 10.	4, 1, 2, 3, 4, 2, 1, >1, 4 6	12·8	14·2	1
	68 + 17 α *Tauri*	3	53	59·7 + 20·3 (Sub-position, 63 + 22.)	6	666, 8, 10, 10	4, 5, 4, 3, 4, 4	7·1	9·4	2
13	—			ε *Tauri*						
	121 − 1 *p*, and 29 *Monocerotis*	2	96	121·5 − 2·1 30 *Monocerotis*	5	6, 88, 10, 10	5, 1, 4, >1, 5	12·8	22·1	3
31	134 + 67 σ *Ursae Majoris*	2½	105	135·0 + 66·7 σ *Ursae Majoris*	5	666, 88	5, 3, 5, 5, 3	8·0	15·2	4
33	143 + 29 κ *Leonis*	1½	108	142·0 + 28·4 μ *Leonis*	7	666, 88, 10, 13	2, 4, 6, 4, 3, 1	11·4	27·6	5
	150 + 23 γ, ζ *Leonis*	2	115	151 + 22·3 γ, ζ *Leonis*	5	12, 13, 13, 14, 16	>1, 3, 3, 1, 3	11·8	21·4	6

Notes to the above six Showers; regarding the general appearances of their Meteors.

No. 1. ξ, *o Taurids*:—Rather long-pathed, evenly bright, yellow, or orange, star-like meteors; with slight spark-tails, but leaving no streaks. One, on November 10th, as bright as Sirius, near the south horizon, burst in mid-course with a yellow spark-cloud, projecting a fragment to the right, and itself pursuing a deflected path onwards to sudden disappearance; like the annexed sketch (Fig. 2). This meteor may have been either a ξ, o, or an ε *Taurid* (from 63°, + 22°), as the path-line prolonged backwards passed nearly through both those radiant-points. About half a minute after its appearance, an equally bright, white, *Sirius*-like *p Monocerotid* shot rapidly, 8° in 0·6 seconds, to very near the north-west horizon across *Lacerta*, leaving a fugitive white streak. These two were the only *non-Leonid* meteors seen in my watch, as bright as *Sirius*; and as they belonged to two entirely distinct meteor-streams, it was a curious coincidence that they should both present themselves, with great resemblance in appearance, within half a minute of each other.

No. 2. α *Taurids*:—Yellow star-like meteors, with sometimes intermittent and rekindling light; no streaks or sparks.

No. 3. *p Monocerotids*:—Swift, yellowish-white, *Leonid*-like meteors, leaving tapered, greenish-white streaks.

No. 4. σ *Ursae Majorids*:—Rather swift yellowish, stellar meteors, without sparks or streaks. An early member, apparently, of this meteor-stream was seen this year on October 5th; when among some meteor-paths mapped in two simultaneous watches, a 2nd magnitude shooting-star was noted here, and at Farnborough (Hants, 15 miles S.S.W. from Slough) by Mr. J. H. Bridger, at 10h. 55m., the two path-descriptions of which were in perfect geometrical accordance, and indicated the meteor's real path and radiant-point with much exactness. By the two mapped path-lines' backward intersection, a little way in rear of both the tracks, the latter point was at 138°, + 64°, close to this present shower's centre at 134°, + 67°, and to σ, τ *Ursae Majoris*. The meteor traversed 14 miles in 0·7 second, from 51 miles over a point near Leighton Buzzard, Bedfordshire, to 44 miles over Little Hampton, near Princes Risborough, Bucks, from a direction N.N.E., altitude 30°; and the speed of 20 miles per second fell much short of the shower's proper parabolic meteor-speed then, of 37 miles per second. But from the shortness of the base-line, affording but little parallactic displacement of the apparent paths, the concluded real height and length of path can scarcely be regarded as very dependable, and the duration of flight, 0·7 second, recorded here, may also very possibly have been somewhat overrated.

No. 5. κ *Leonids*:—Very swift, yellowish-white tapered meteors, leaving slight, white streaks.

No. 6. γ, ζ *Leonids*:—Swift, white or yellow, tapered meteors. (Mostly seen through mist; but one of 1st magnitude, seen in clear sky on November 14th, left a tapered, greenish-white streak for 2 seconds).

these *κ Leonid* meteors was thus observed by Mr. T. W. Backhouse at Sunderland,[1] who found a pretty exact radiant-point near *μ Leonis*, at 146°, +26°, of seven "Leonids," one as bright as Jupiter, leaving a streak for three seconds, and the rest small; seen with eight other meteors in 1h. 20m. of clear sky during some hours' watch before daybreak on that morning. By an apparently just similar deception, in the bright shower of *Leonids* mapped and assigned here to various *foci* on the morning of November 15th, 1896, a pretty compact region of divergence was noticed north of *Leo*, in *Leo Minor*, of four or five meteor-paths, at about 155°, +35°,[2] as apparently composed of "Leonid stragglers." But at 154°, +40°, D('99) 118, there is a strong enduring shower-series of *μ Ursids*, first well recorded in November by Mr. Denning at 155°, +36°, from about twenty swift white meteors on November 26th–29th, 1876,[3] and observed in late years very frequently on the *Leonid* dates of November 10th–17th, within a few degrees of that position. As it is found to present itself also as an active stationary shower during the preceding and following months of October and December, no very cogent reasons, it would seem, can be admitted to exist for describing this shower's meteors, or those of the contemporary shower near *κ Leonis*, for want of better designations, as stragglers or erratic members of the main meteor-stream of the *Leonids*.

One or two tracks seen here, and some mapped by Mr. Denning, on November 6th–11th, appear to have proceeded from known radiant centres south of the Sickle-stars, near *o* and *π Leonis*; but with these scarce exceptions no signs of swift-flighted meteors crossing *Leo* from south-eastern centres in *Hydra* and *Virgo* could be noticed with the brightness and abundance which those contemporary showers sometimes present on the yearly shower-nights of the *Leonids*. The main body of the ordinary meteors seen in these earlier nights' watches were pursuing leisurely, mostly short, but sometimes lengthy random

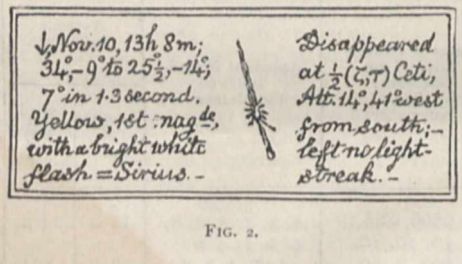


FIG. 2.

courses from many scattered radiant sources of more or less well-known positions among the constellations overhead, and in the north, west and south quarters of the sky. Of all these slow-paced systems, amounting in Mr. Denning's special list to thirty or forty centres of very undiversified looking meteor-flights, only one overhead radiant-point at *σ Ursae Majoris*, and the two south-westerly showers of the *α–ε* and *ξ–o Taurids* were marked abundantly enough by meteor-paths to be perfectly identifiable. A number of other centre-points absorbed the rest of the recorded tracks in single, or at most in two or three connected flights, too few to fix their radiants' real places certainly during the far too restrictedly short starlight time of my three or four fine nights' watch to show more of those scantily-escorted flights or lonesomely projected flashes, and to disclose their focal points and stellar features of appearance properly.

From their persistencies, however, enabling them to be reckoned as belonging to the *Bielid* meteor-period, a projection which I made last year of about 220 observations obtained by different observers in former years, since 1861, of meteors of that yearly period, November 20th–30th,[4] exhibited more fully than the less numerous observations made on earlier November nights this year could do, the relative strengths at that epoch (and therefore probably also in a nearly similar manner at the ten days earlier period of the *Leonid* displays), of several of these zenithal and western streams contained in Mr. Denning's Select List of Fifty ordinary *co-Leonid* Showers. To extend accordingly the illustrations which longer observations would have yielded, of the large array of ordinary showers included in Mr. Denning's Mid-November Radiant List a little further than the limited acquaintance, only with a few of them which this year's observations furnished, it may be useful to supplement this present partial review by a further position-list and some particular descriptions of several ordinary meteor-showers of the Bielid meteor-period, which were found to have been either transiently active or steadily productive during a long series of years, in those rather more comprehensive meteor-path projections.

A. S. HERSCHEL.

1 "British Association Reports," 1878, pp. 320, and 329.
2 NATURE, vol. lv. p. 175.
3 "British Association Reports," 1877, pp. 164, 167.
4 Prepared about this time last year for Dr. A. Hnatek, of Vienna, who has presented to the Vienna Academy of Sciences (*Sitzungs-berichte der kaiserlichen Akademie, Mathem.-Naturw. Classe*, Bd. cvii., Abth. ii.; December, 1898), an elaborate investigation both of the Bielids' radiant-point and of those of ordinary meteor-showers visible at the same time with the Bielids, from a widely amassed collection of meteor-observations for the period November 20th–30th, including among those made in Austria and supplied to him with numerous paths recorded at the Observatory of Vienna by Dr. Weiss, and in addition to similar contributions from Profs. Schiaparelli and Nyiland, and to many paths recorded in the works of Dr. Schmidt, some published by Von Littrow, which were made at the Observatory of Vienna as long ago as the year 1837.

The Royal Society Catalogue and Psychology.

IN the original classification of the sciences for the purposes of the projected Royal Society Catalogue of Scientific Literature, Psychology was given an independent place. Recognising this, the International Psychological Congress at Munich, in 1896, appointed an English committee to do what they could to further the scheme in the name of the Congress. Following this, Dr. G. F. Stout, editor of *Mind*, then at Aberdeen, now at Oxford, was asked by Prof. Michael Foster to prepare a schedule for psychology. Dr. Stout sought the collaboration of the present writer, who represented the *Psychological Review* and its annual catalogue the *Psychological Index*. In the meantime, at the suggestion of Prof. Foster to the present writer, the question had come up in America as to the advisability of suspending our Index (which is now common to the *Zeitsch. f. Psychologie*, Berlin, and the *Année Psychologique*, Paris), with the preliminary understanding that if the Royal Society Catalogue issued an adequate list in psychology, it would be advisable to suspend the publication of the Index and support the Catalogue. Dr. Stout submitted the schedule he had prepared.

After a long period, in which no communication of any kind reaches Dr. Stout—nor has it yet!—the printed report of the conference of last June informs us that psychology has been classed under physiology, and the present writer learns from Sir M. Foster that the psychological schedule is to be cut up—if this action be finally confirmed by the Royal Society—and fractions of it inserted where place can be found for them under physiological headings.

Understanding that there is still a chance to reconsider this action, I venture as one of the joint proprietors and editors of the *Psychological Index*, whose existence is in question, and also in behalf of the reputation of psychology, to say:—

(1) If this action relegating Psychology to Physiology is carried out, the *Psychological Index* will continue to be issued and its subscribers retained.

(2) In that case some action is highly probable on the part of the International Congress of Psychologists meeting in Paris in the summer, seeing that they endorsed the former course of the Royal Society in giving the subject an independent schedule. At that congress the representatives of the French and German bibliographies mentioned are also to be in conference, with a result that may readily be foreseen.

(3) The present writer thinks he represents the competent opinion among psychologists in saying that the day is past for this sort of ignoring of the claims of one department of scientific knowledge at the instance of another. This was amply shown by the attitude of psychologists toward Prof. Richet's *Bibliog. Physiol.*, in which a similar treatment of psychology is carried out by one who attends psychological congresses and allows himself to be made prominent in them. It is interesting to know that Prof. Richet has been an active member of the Royal Society Conference.

Psychology is knowledge of the mind, not of the body—whatever method it may adopt to solve its peculiar problems—and to class it under physiology is about as reasonable as to class it under *cheese*—on the ground that cheese is sometimes green, green is a colour, and colour is a mental state!

It may be added that no criticism of the Royal Society

Committee is intended; but it is to be hoped it will adhere to its original classification. J. MARK BALDWIN.
Oxford, December 18.

The Stockholm Fisheries Conference and British Fishery Investigations.

FROM Mr. H. M. Kyle's letter in your issue of December 14, it is clear that he is ignorant of the present position of the British Government with regard to fishery investigations. The great obstacle in the way of such investigations, as every one who has taken any part whatever in their organisation is aware, has always been the want of adequate funds to carry on the researches. The investigations, if properly conducted, are very expensive, involving not only the employment of highly-trained naturalists, but also the equipment of laboratories on shore and of sea-going ships capable of visiting the fishing grounds. The latter item is so costly, that no vessel capable of keeping the sea has yet been systematically employed for scientific fishery work in British waters.

On account of the expense, there is little likelihood of investigations upon an adequate scale being attempted without the use of public money. This is recognised by the Government, and money has been spent by H.M. Treasury for biological and fishery researches in three different directions. In England the Marine Biological Association of the United Kingdom, which was started by private effort in order to promote (to use Prof. Huxley's words) "researches leading to the improvement of zoological and botanical science, and to an increase of our knowledge as regards the food, life-conditions and habits of British food-fishes and molluscs," received in 1885 a Government grant of 5000*l.* towards the cost of the erection of the first laboratory at Plymouth, and has since received an annual grant, which from 1892 has been 1000*l.* Altogether some 13,000*l.* of Government money has been spent, in addition to an equal amount derived from private sources.

In Scotland the Fishery Board receives from the public funds a yearly sum for scientific investigations which amounts, I believe, to about 3000*l.*; whilst in Ireland a single sum of 2,500*l.* has recently been granted to assist the fishery investigations of the Royal Dublin Society.

We may now examine in more detail the position of each of the three bodies entrusted by the Government with the expenditure of money for fishery work in England, Scotland, and Ireland respectively.

At the time of the foundation of the Marine Biological Association, the Government, in making the first grant of money, placed upon the Association the responsibility of doing for England work of the kind done in Scotland by the scientific department of the Fishery Board. Encouraged by the support received from public and private sources, the Association proceeded to lay down the necessary machinery for carrying out both scientific and economic work, and a sum of 12,000*l.* was spent in building and equipping the Laboratory at Plymouth as a first step in that direction.

The foundations of the Association were laid upon a liberal scale, involving the expenditure of a considerable capital, but the superstructure remained to be built. The subsequent yearly financial support was not on a scale commensurate with that given to the Association on its foundation, and it has never been possible to make full use of the machinery provided. By far the greater portion of the income of the Association is necessarily devoted to expenses of establishment and organisation, and only a small sum remains for the employment of naturalists to conduct investigations. The funds have never reached a figure which would render the maintenance of a sea-going vessel with which to reach the fishing grounds a question which could be practically considered. Having regard to the money at its disposal, the Association may fairly claim to have produced a body of work which in quality will compare with that done by any similar organisation elsewhere. It must not be supposed, however, that one man can produce the work of six, and it has never been possible to employ at Plymouth more than one naturalist devoting his attention to fishery work.

When, five years ago, the Council did me the honour of appointing me to the executive office of the Association, I undertook the duties of the post knowing that the justification for the yearly expenditure in maintaining the Laboratory in a state of efficiency lay, not in the amount of work which could be immediately produced, but in the fact that a solid foundation had been laid, which was capable, with an increased income, of producing a very large amount of valuable work. Further experience has confirmed this view, and I have also been forced to admit, perhaps reluctantly, that the only practical method by which the necessary increase of income can be obtained is by the development, on the part of the Government, of the fishery branch of the work. That the work of the Association was never intended to be confined to what can be done at Plymouth is shown not only by its name and the avowed objects of its promoters, but also by the fact that for a number of years the Association maintained a naturalist and kept open a laboratory at Grimsby for the study of North Sea fisheries. The investigations made by Mr. Holt and Mr. Cunningham in this connection will, in usefulness, rank with the best fishery work which has been done in the North Sea, and it was due only to lack of funds that these investigations could not be continued.

Turning now to the Scottish Fishery Board, it will be admitted that, so far as its scientific investigations are concerned, a similar condition of things exists, in a less pronounced degree. For years an urgent appeal for a steamer capable of keeping the sea has been a constantly recurring feature in the Reports of the Board, and the scientific superintendent will be the first to agree with me in saying that the scientific staff is by no means numerically strong enough to carry out the investigations upon the scale which their importance and difficulty demand.

In Ireland, where the Royal Dublin Society is working in close connection with the fishery inspectors, and is supported by Government money, it has also been impossible to provide a proper vessel, and Mr. Holt is working single-handed, except for occasional volunteer help, although he has accommodation for a number of naturalists.

All past experience has shown that the British Government is very reluctant to spend money upon scientific investigations of any kind, and at the present time it is practically certain that any increased expenditure in this direction will be limited in amount. It is of the utmost importance that what money is spent should be put to the best possible use. Under the circumstances described, and considering the amount of public money which has already been expended on organisations and establishments, all of which are awaiting development to produce their full return of work, I cannot see any justification for asking the Government, as a next step, to provide a considerable sum for a new organisation with a new laboratory, which to judge by all that has happened in the past would soon find itself as unable as its predecessors to adequately carry out its schemes, from the want of proper financial support.

The first demand should be for such a slight reorganisation of existing bodies as will bring them into working contact, a rearrangement which could be brought about with little if any increase of expenditure, and a proper provision of ships and naturalists for carrying out the investigations. When this has been obtained the co-ordination of British investigations with those of neighbouring countries will be a matter of no great difficulty, and one which, in my opinion, can be carried out with no such expenditure for organisation as that suggested by the Stockholm Conference.

As Mr. Kyle has seen fit to introduce matters of a somewhat personal nature into his letter, I may, perhaps, be permitted to say that I make no pretence whatever of being a specialist in fishery investigation, my scientific work having for the most part lain in other directions, nor is it my intention to attempt to alter this condition of things. Should the Government see fit to largely develop the work of the Marine Biological Association on the lines I have indicated, I fully realise that they will wish to have in the executive post a specialist in fishery matters, and this is an eventuality which I am prepared to meet. I should also add that the opinions expressed in this letter are entirely of a personal nature, and I am quite unaware whether or not they would be shared by a majority of the members of the Council of the Association. E. J. ALLEN.
The Laboratory, Plymouth, December 16, 1899.

Dr. W. Kobelt and the Mediterranean Fauna.

THE second part of Dr. W. Kobelt's "Studien zur Zoogeographie" has been in my hands since its issue, viz., about a year ago, and I have had ample time to become fully acquainted with its

merits and its defects. The subject is one which has a singular interest to me, for I have been working out the fauna of Italy and its dependent seas, especially in relation to Vertebrata, for the last five and twenty years, and have formed a collection in which about 38,000 specimens (25,000 being fish) represent the vertebrate fauna of Italy and the seas which surround it. I soon found that although strong in Mollusca, Dr. Kobelt was weak in the knowledge of other classes of animals, and that along with solid fact" his book also contains a number of grave inaccuracies. Now I am very busy, and find that life is far too short to allow the waste of time caused by polemics; I usually, therefore, avoid them, and should certainly have passed over Dr. Kobelt's errors and omissions had not your reviewer's remarks in No. 1570 of NATURE (page 99) rendered it imperative that I also should ask you to allow me to make a few remarks. NATURE has now fully undertaken the noble task of keeping scientific investigators up to the mark as regards the general progress of knowledge, and it is not fair that it should unwittingly propagate error. Now of the several chapters of Dr. W. Kobelt's book, the poorest and the worst is by far the one (*viertes Kapitel*) which he has devoted to "Das Mittelmeer," the classic ground of the renowned labours of Edward Forbes and of so many before and after him. How ever could a German living in the land of bookworms and patient labourers in bibliography write such a chapter, and come amongst other incorrect and incongruous conclusions, to that pyramidal error that the abyssal parts of the Mediterranean are azoic? Good and learned Dr. Carpenter said something similar about twenty years ago, after the fruitless dredgings of the *Porcupine* and *Shearwater*, but he lived to know that he had been mistaken, and we discussed the very subject together at a dinner at his own house in June 1883.

It was on August 5, 1881, that I sent an express across Asinara to Porto Torres, North Sardinia, bearing a letter to the editor of NATURE in which I gave the first account of the discovery of typical representatives of the North Atlantic deep-sea fauna in the abyssal area off North-west Sardinia; on that occasion specimens of *Polycheles* (Willemœsia), *Brisinga* and *Hyalonema* had been secured with the trawl (NATURE, August 18, 1881, p. 358). A few days later, from depths between 3000 and 1500 metres, I got two new forms of Macrurid fishes, so characteristic of the abyssal fauna, viz., *Chalinura mediterranea* and *Hymenocephalus italicus*; of the former the two specimens then caught are as yet the only ones known. This was the first deep-sea campaign of the *Washington*; we were all new to such work, and yet a few weeks later, at the meeting of the Third International Geographical Congress at Venice, I was able to lay before the savants there assembled a preliminary report, in which the existence of a deep-sea fauna in the Mediterranean, similar to that of the North Atlantic, but evidently with some special features, was fully proven. Our greatest depth was then 3624 metres, between Sardinia and Sicily; thence we dredged up fourteen living animals: an Anomourous Decapod, an Annelid, and several singular small Holothuroids, as yet unstudied. The two following summers, about a month each year, were dedicated to thalassographic researches in the Mediterranean by the Italian man-of-war *Washington*, but the trawl was hardly ever used at the greater depths. The authorities of the navy, and I am sorry to add also those of the Lincei, appeared to have lost all interest in that fertile field of research. Years after, a little deep-sea trawling was done by the Austrians round about Crete; they got some good abyssals, amongst which *Bathypterois*, the singular tentacled fish; they also found the greatest depth yet recorded in the Mediterranean, over 4000 metres. The enlightened Prince of Monaco has also given a trial to some of his wonderful deep-sea traps, always with good results, but his systematic abyssal researches have all been outside our "Mittelmeer" hitherto.

I have never lost any opportunity since 1881 of doing my level best to promote the continuance of those thalassographic and especially abyssal researches, which had been so well begun by the *Washington*; my last appeal was made to the Third Italian Geographical Congress, which met at Florence last year, my proposals were adopted unanimously in the proper section, and I am beginning to hope that they may soon have a practical result.

I have not the slightest doubt that the abyssal fauna of the Mediterranean is a rich one, in which not a few novelties will turn up. I have already in my Italian collection about seventy species of typical abyssal fish—Elasmobranchs and Teleostei—and have, besides those already mentioned, described some very singular forms hitherto unknown, and apparently peculiar, such as *Bathophilus* and *Eretmophorus*.

After all this you will admit that it is rather sad to read in NATURE of November 30, 1899, that "the Mediterranean, as is well known, sinks in places to profoundly abyssal depths; the actually greatest depth appears to be 4400 metres; but here no living organisms have been found. It is purely azoic; the reason for the want of life is, according to the author, the want of oxygen and the abundance of carbonic acid." I should like to see the above assertion proved.

I may add that Dr. Kobelt, who is a specialist in Malacology, appears to be unacquainted with the abyssal molluscs which I dredged up from great depths in the Mediterranean, and which were described (several as new) shortly after by my lamented friend, J. Gwyn Jeffreys. And at p. 105 of his book he says that *Nephrops norvegicus* is not found in the Mediterranean. Now in 1881 I dredged up specimens from depths of 765-823 metres, in that sea, off the west end of Sicily.

Dr. Kobelt has a grim way of disposing of the Cetacea of the Mediterranean. These are much better known than he appears to be aware; I know positively that thirteen species occur, four being *Mystacoceti*; none are peculiar, and could hardly be expected to present that case, but it is of singular interest that the common porpoise (*Phocaena communis*) is certainly absent from the Mediterranean, and said to be common in the Black Sea. Our seal (*Pelagius monachus*) is nearly peculiar to the Mediterranean and Adriatic, where *Phoca vitulina* never occurs. This hardly looks like "an impoverished gulf of the Atlantic," as Dr. Kobelt is pleased to style our "Mittelmeer" as regards mammals. And, turning to terrestrial mammalia, what of the Mediterranean barrier *re* Muflons (*Ovis musimon*) in Corsica and Sardinia; *Cervus corsicanus*, with the same peculiar distribution—these mammals are found in a wild condition nowhere else—and *Cervus dama*, wild only in Sardinia? I will allow the *Inuus ecandatus* as an importation, but hardly as a native product of the "Rock" of Gibraltar!

Certainly I can hardly commend Dr. Kobelt's book to the serious student of zoo-geography; and I cannot help a bitter reflection when I come to compare mentally the favourable review it has had in these pages, where a few weeks earlier a volume, of which one of the co-authors may be styled the father of zoo-geography, and is emphatically one of the most meritorious of England's zoologists, was treated in a very different style (*vide* NATURE, No. 1549, vol. lx., p. 217).

HENRY H. GIGLIOLI.

Royal Zoological Museum, Florence,
December 8, 1899.

PROF. GIGLIOLI appears to blame me for a too favourable review of Dr. Kobelt's recent book. In that review I pointed out some errors, as I thought, of inference as well as of omission; I still think however that Dr. Kobelt has produced an usefully elaborate and painstaking work, and therefore beg for a short space wherein to reply to such of Dr. Giglioli's criticisms as affect my own review.

Dr. Giglioli justly comments upon the fact that many deep-sea animals have been dredged in the Mediterranean. But, as I understand him, Dr. Kobelt does not deny this; he merely observes that the abyssal fauna of the Mediterranean is not special to that sea. Dr. Giglioli himself remarks upon the occurrence of "typical representatives of the North Atlantic deep-sea fauna," which is in accord with what Dr. Kobelt says. That there are some forms peculiar to the Mediterranean does not necessarily invalidate the justice of Dr. Kobelt's generalisation. I do not read Dr. Kobelt as saying that "the abyssal parts of the Mediterranean are azoic." How could I, considering that he gives (p. 115) two lists of deep-sea Mollusca? I understood him to mean that one particular locality of 4400 metres in depth happened to be so. In this matter I simply referred to Dr. Kobelt's statement. I neither dissented nor assented. Dr. Giglioli is no doubt right in asserting that the whales of the Mediterranean are not only not peculiar but could not be expected to be. But if the number with which he is acquainted (13) represent the entire Cetacean fauna of that sea, then Dr. Kobelt is most emphatically right in speaking of it as an impoverished gulf of the Atlantic. THE REVIEWER.

THE ECLIPSE EXPEDITION AT VIZIADURG.

I.

SO much of the material acquired to science by the observations of the last total eclipse of the sun in India has now been published by the Royal and other Societies, that I now propose to give in the columns of NATURE a connected account of the work done and arrangements adopted at Viziadurg.

Four of us left London in the R.M.S. *Lusitania* on December 10, 1897, and that vessel reached Colombo on January 4, 1898. As we steamed into the harbour, about 1 a.m. on the 4th, the first ship we passed was Her Majesty's ship *Melpomene*, many lighted, white painted, her hull appearing phosphorescent in the dark night. Long before the *Lusitania* was moored, Lieut. Colbeck, R.N., of the *Melpomene*, and an officer of the Customs Department were on board, and such complete arrangements had been made that a few minutes after the mails had been put into one lighter, the instruments, which had been brought on deck the day before, were being delicately handled into another. There was therefore no sleep for any of us that night, and early in the morning Captain Chisholm-Batten, R.N., of the *Melpomene*, came on board. Shortly afterwards the eclipse party, with all their gear, were transferred from the mail steamer, after taking leave of Captain Veale and his officers, to the cruiser.

It did not require a keen observer to find out, after a very short time on board, that the Melpomenes had made up their minds to emulate the doings of their comrades on the *Volage*, in connection with the Varanger Fjord eclipse of August 1896, and also that this was in part due to the keen interest taken by Captain Chisholm Batten in all things scientific. He very soon put exactly the same question to me that Captain King-Hall had done two years before on the *Volage*, and I gave him the same reply. He said, "If you will explain to the ship's company what is wanted I will call for volunteers, and then we will see what can be done." I did as I was told.

We left Colombo at 5 p.m. on the same day. On the morning of the 5th (Wednesday) we sighted Cape Comorin, and in the early evening I explained, by means of lantern slides thrown on a screen under the bridge by an eighty-candle glow-lamp, the kind of work done during an eclipse, and how the ship's company of the *Volage* had organised themselves in 1896. When my talk was over, Captain Batten called for volunteers. To my delight and astonishment, and I must say rather alarm, about 120 officers and men at once stepped forward. Now that, of course, meant incessant school till the moment of the eclipse. However, we were all quite prepared for it, although it was evident that the Eclipse party of three had their work cut out for them.

The next delightful thing I found was that three or four of the officers of the ship were just as competent to give instructions on the various lines of work to be attempted as my assistants and myself were, so that the teaching was put into a very big commission.

FIG. 1.—The Fort

This was an intensely interesting day to me, for while arrangements for the eclipse of 1898 were thus advancing, the *Melpomene* was following the sea-track of the flagship *Glasgow*, which carried the expedition of 1871. Cannamore was first passed, and later on Baikul, where my station was seven-and-twenty years ago. Heigh ho! Why is one not always young and full of energy, and why should the power of doing dwindle as one knows better what to do? But that is another story.

We began our drills the same night. An important part of the work was to get an idea of the outlines of the corona, and for that purpose I had taken out several discs which would hide the more luminous lower parts of it in order to shield the observers' eyes, so that they would be in the best possible position to note the delicate tracery outside. In addition to that, a large party had volunteered for drawing the corona, so we started drawing competitions; we had marks for form and for colour of the corona. For this purpose the ship rigged up a magic-lantern by means of one of the incandescent

lights. We found a capital screen on deck in the shape of one of the casings; drawings and photographs (coloured) of the corona were thrown on the screen and copied under eclipse conditions. What do I mean by eclipse conditions? I mean this: experience shows that when the eclipse begins you must tell everybody how many seconds are left, otherwise they will lose time by trying to find out for themselves; if the eclipse is going to last 170 seconds, at the instant of totality we tell them so. After 10 seconds we say, "You have 160 seconds more"; after 20 seconds we tell them they have 150 seconds more, and so on, in as encouraging a way as we can. We adopted this plan in our practising.

The next thing which delighted me was, that not only was every rating in the ship represented two or three times over in the volunteers, but that almost all the men who volunteered to make these drawings had colour-boxes. Where they get them from I do not know, but colour-boxes they had. In the examination we gave 10 marks for colour and 10 for form; several of them got 18 out of a possible 20 marks. I mention that because it gives an idea of the thoroughness with which every part of the work was done.

It was a little over a day's run from Baikul to Viziadurg, where, on the 7th, Captain Batten, after a fine sweep into the bay, chose his station at 3 p.m. navy fashion, that is, pilotless, over the anchor shown on the chart. Soon after this the native pilot, in a boat which had hugged the southern shore, and had, perhaps, for this reason been unnoticed in spite of a tattered blue ensign with a lion in one of the corners, came on board, and after him a boat full of gorgeously-apparelled native officials accompanying Mr. Bomanji, Collector of the district of Ratnagiri, in which Viziadurg is situated, among them an overseer of the Public Works Department, who was on the spot in charge of some most excellent masons and carpenters, picked men from Ratnagiri as we later ascertained, and plenty of material for the construction of the necessary concrete bases and huts.

Mr. Bomanji came on board to report the arrangements which had been made for the expedition by the Government of India. As these were not quite completed, it was necessary for the first few days to return to the ship every evening, but afterwards Mr. Fowler, Dr. Lockyer, and myself took up our quarters at the Dak bungalow inside the fort, close to the instruments. Meals were provided at the Collector's camp, which was also inside the fort.

A party was landed at the fort on the afternoon of our arrival, Saturday, January 8, to inspect the site suggested by Mr. Bomanji, and it was at once evident that it would satisfy all requirements, provided the fluctuations of temperature of the great masses of masonry composing the fort had no disturbing influence on the steadiness of the air. In order to investigate this point a $3\frac{3}{4}$-inch telescope was set up, and observations of the surrounding landscape, and, at dusk, of various stars, were made, from which it appeared that the atmosphere was sufficiently steady for the observations.

We found a considerable number of coolies was also present to do such work as carrying packing cases, sawing wood, clearing the camp, &c.

In the fort was also a police guard sent from Ratnagiri. The camp was watched both by day and night so effectively by them that no damage to any instrument was reported.

Description of Viziadurg.

Viziadurg, we found, is practically concentrated in its fort. A former collector of the district, Mr. Sinclair, had been good enough to send me a photograph of it. On landing, after the collector's visit, we found that the real thing is certainly far more extensive than the photograph suggested, and more than this, the building and its history are both of very high interest. The fort dates from the fourteenth century, but it was much strengthened in the sixteenth, when the towers and triple walls, the well-preserved ruins of which now encircle it, were added. These towers number twenty-seven; they rise to 100 feet, and, like the massive walls, are built of large blocks of stone, now coloured dark red, and almost black in places. The walls enclose about twenty acres, and within this space are habitable buildings, two wells, and a water reservoir, formerly lined with lead at the bottom and to about 10 feet up the sides, larger than the largest of the celebrated tanks at Aden. From the beginning of the sixteenth century the fort was the headquarters of piracy in the Indian seas. Kanhoji Angria, the admiral of the Maratha fleet, became a renowned corsair, and at his death was ably succeeded by his son, Julaji Angria. These gentlemen seemed to have had it all their own way. They respected no flag, captured many ships, sacked the coast towns, and, worst of all, repelled several expeditions sent against them by the English, Portuguese and Dutch. Julaji only finally surrendered in 1755 to a force of twelve men-of-war with some forty small native armed vessels, commanded by Admiral Watson, supported on land by an army of eight hundred European and six hundred native troops, under Lieut.-Colonel (afterwards Lord) Clive. Angria's fleet was destroyed, fifteen hundred prisoners were taken, and eight Europeans rescued. Two hundred and fifty cannon and eight brass mortars were found, and besides, stores and valuables worth 125,000*l*. After this the fort came under the Peshwa's government, and his admiral, Anandrav Dhulop, establishing himself therein, commenced a successful career, enriched himself, and added much to piratical science, until finally the British took possession of the district in 1818.

If the final cause of the pirates of Viziadurg was, as it seems to have been, the formation of an Eclipse camp, even to providing unexpended bombs for clock weights, the fact that they built the fort exactly where it is, commanding a harbour finer than that familiar to their-to-be *confrères* of Penzance, was evidently also connected with the present visit of the *Melpomene*. Equally sheltered from the fiercest blasts of both the south-west and north-east monsoons, the anchorage is as safe as it is convenient; but it must not at once be taken for granted that under these conditions the water surface is always smooth. The goddesses of meteorology have their smaller as well as their greater festivals, so that what the monsoons are to the year the land and sea breezes are to the day. The sea breeze sets in about noon with marvellous regularity, and is at its height about sun-down; as the night advances everything becomes calm, and at ten o'clock even the rattle of the jalousies in the windows of the fort has entirely ceased.

Precautions and Preparations.

While considering the desirability of establishing a station at Viziadurg, a friend of great Indian experience was loud in his praises of the Konkan as a health resort. He expressed his astonishment that yachtsmen, who generally know what is good for them, so constantly neglect to spend some winter months on a coast so delightful in many ways. Our experiences entirely justified my friend's views. Of course, great precautions have to be taken when so much work has to be done in the sun; but my Baikul experience told me the conditions are much better at Viziadurg than they are in South Canara. The sun's rays were almost always tempered by a breeze; the temperature at 8 a.m. was often about 70 degrees, and on shore 85 degrees was reached later on in the day.

Next morning, Sunday, January 9, the instruments were landed absolutely without the slightest difficulty. With reference to this a few words may be said concerning the

preparations for an Eclipse Expedition, since few people have any idea of the labour involved or of the precautions to be taken. In the first place, all the instruments to be taken out must be adjusted for the place chosen for observation; that is, the so-called "Polar axis," on which each instrument turns, must be directed to the position which will be occupied by the pole star at the Eclipse station. Thus, while in London the axis points in a direction of 51½ degrees from the horizontal, in India this direction was about 16½ degrees. The instruments must then be made to work under these new conditions, and each position of all the optical portions which produces the best results must be marked most carefully, either by screwing down or by lines of white paint, so that each can be exactly replaced at the station. Then comes the taking down and packing. On this point I got a lesson in 1882 at Siout, in Egypt, which I shall never forget. It was a question of getting a stand, weighing about 3 cwt., of an equatorial telescope into the Khedive's yacht. There was no tackle, and the thing was got on board by the Egyptian authorities flogging a giant Soudanese up a plank with the stand on his back. Since then, in all the expeditions I have had to do with, all stands have been built upon the spot by filling a wooden and paper model with concrete; and, further, no packing case has weighed more than 60lb.; this enormously simplifies boat service. All mirrors and plates must be hermetically sealed up, parts of different instruments must not be mixed together in the packing cases, and all cases containing pieces of the same instrument must have the same index letter. As a result of this system we took to Viziadurg eighty cases, on which the skilled packers employed at the South Kensington Museum expended infinite care; they were all small and numbered and lettered, so that they could be easily landed the moment the sites for the several instruments were settled. The local labourers, under the efficient superintendence of the Public Works Department, had no difficulty in sorting the cases.

It was important to erect the huts as soon as possible, not only to shelter the instruments but the observers from the sun. Among the precautions taken in the camp I may mention that 10-feet square screens of excellent matting made locally and stiffened with bamboo were temporarily erected to the sunward of every working party, both at morning and evening. When it was necessary to go on with the work at mid-day, the same screens were supported over the workers by bamboos. As each instrument was erected it was permanently protected in the same manner. With these precautions, and with such a climate, no one was sick.

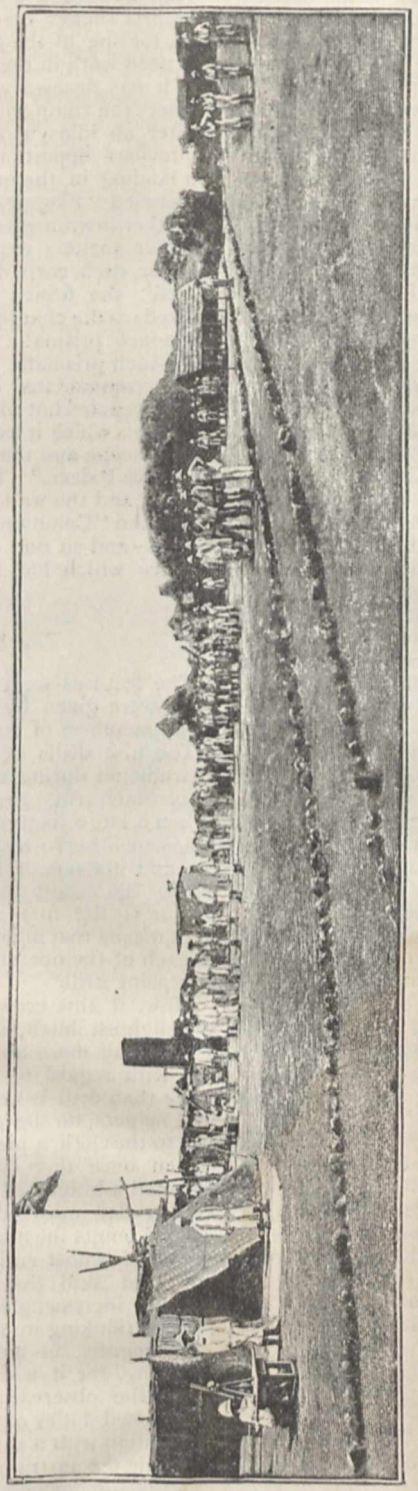


FIG. 2.—General view of camp.

The concrete pillars for the instruments were begun the day we landed. The men were brought on shore in the early morning in order to do the drills and erect the various instruments and all sorts of other work which turned up; but we had to knock off in the middle of the day in consequence of the extreme heat. It was very convenient for us that the *Melpomene* could lie at such a short distance from the camp that it did not take more than a quarter of an hour for the various parties to get to work. A signal station was at once established, so that, as at Kiö in Lapland, we could at once communicate with the ship in case anything were wanted.

In camp the work was incessant from sunrise to midnight, excluding the break in the middle of the day.

The instruments were set up as soon as their bases were ready. Mr. Fowler and Dr. Lockyer were enabled to report all the fixed instruments and huts, eight in number, erected and all but the final adjustments made after six days' work. Constant clear skies enabled all the adjustments to be made without difficulty, and by January 17 all the instruments were ready.

Life on Shore.

It became necessary on Tuesday, January 11, to transfer our quarters from the ship to the shore, as the erection of the instruments was by that time advanced to such a stage that it was possible to test the various adjustments by observations of stars. This change of front was accompanied by some difficulty, for many telegrams had been received telling us, now that this, now that that, was the shore arrangement which had been approved by the authorities, in one case of the Supreme Government, in the other of the Government of Bombay. The officials of the Bombay Government, in spite of letter from home of old date stating the exact opposite, were firmly convinced that independently of the supply of material for huts, the organisation of the camp and all the astronomical night-work on shore was a question of a tiffin basket; that it was rather exhilarating than otherwise in the climate of India to remain on shore with the aforesaid basket till one o'clock in the morning, and reach it again at sunrise.

They were also of opinion that a man-of-war of some three thousand tons could lie practically alongside the fort; that there was sleeping and other accommodation in a third-class cruiser for any number of shore hands; and finally, that it was open to anybody to walk on board and claim it.

The phantasmagoria of telegrams ceased on Saturday, and Captain Batten, who had insisted on sending his steward on shore to look after us, was now no longer dependent on the wardroom mess for his meals. As we had no servants and could not get any, he sent two Seedie boys to look after us and see to the lamps at night, which they did most satisfactorily. I was once more in the land of pantomime, and again came to the conclusion that after all spoken language may be a needless survival. The Collector, camping out some little distance away from the observatory, was now our host, and we had to thank him for unceasing forethought and kindness. We lunched and dined with him, and he supplied me with an interpreter, which facilitated matters greatly.

It took us some time to get through all Customs formalities, and the difference between Ceylon and Bombay methods we found curious. At Colombo, before the *Lusitania* had come to her moorings, Mr. Halliday, an officer of the Customs Department, came on board with a letter from Mr. Lionel F. Lee, the principal Collector of Customs, offering all possible assistance in landing and trans-shipping baggage and instruments. The Bombay officials were evidently of the opinion that the *Melpomene*, instead of coming from her station at Calcutta, had arrived straight from home full of contraband. The local official followed me round the camp with a bundle of forms, until at last, in despair, I informed him that, to my regret, I did not know the precise value of each article of wearing apparel brought out, but that all trunks could be opened for inspection on landing, and I would make any payment he might demand.

Our quarters in the fort were not without interest. They were in a building much more modern than the fort itself, and consisted of two rooms and a verandah on the first floor, approached by external stone steps. The ground floor, a little below the general level, we devoted to a dark room and a general store-room for the more delicate parts of the instrumental equipment. In each of the upper rooms, which were white-washed, with sanded floors, there was a bedstead, a chair and a tub; and after all, what more does one really want? I should add that there was also a looking-glass of much more gorgeous make, which did good service by blocking a door of which the fastening had given way. Further, in one of the bed-rooms there was a small table, now used for gastronomic and now for astronomic purposes. But the real furniture, both of rooms and verandah, were the pictures on, or rather in its walls. I mean the views from the windows when the jalousies were opened, especially some little time before sunrise and after sunset. I have never seen such effects of gorgeous, indescribable colours. Why was Lippmann not there to catch these colours, unknown in Europe—the fierce contrasts between the water and the land; between the beautiful river valley and the open sea; between the hard outlines of the gloomy ramparts below and the delicate landscapes which seem to float above them in the gloaming; and, finally, between the pure white of the *Melpomene* and the blue water on which she floated—a blue which at certain times of the day put the blue of the Mediterranean into the shade!

Of mosquitoes there were none; indeed, the absence of insect life was remarkable; of snakes we saw few, though the region has a very bad reputation, so bad that in 1876 the sum of 441*l.* was expended in killing 141,000. Of course, precautions were taken. Dr. Lauder Brunton and Prof. Fraser were good enough to provide me with he latest things in remedies, including *serum anti-veneux*, which I handed over to Dr. Nolan, who posted up full instructions as to their use; but as this is a matter where prevention is better than cure, leggings by day and lamps by night were used by everybody.

And now a few words about the growth of the camp. The first shelter erected was for the use of the signalmen, for one of the guiding principles has been that no one need work in the sun unless he likes, and at the very first it was necessary that there should be signalmen to connect the camp with the ship. In relation to this first shelter, an idiosyncrasy of the blue-jacket, which I had a previous opportunity of studying at Kiö, came out. On landing in the morning I found this shelter already christened "Flaggies Villa"; the sailors on the staff of the other instruments were not going to be outdone, and as their shelters went up one got the idea of a village fair, for each carried a sign as I have previously mentioned: the 6-inch equatorial, of which Prof. Pedler arrived to take charge on the 13th, was the "Town Hall"; the 9-inch prismatic camera lived in "Mainsail Hall"; the 6-inch prismatic camera under Mr. Fowler's charge was accommodated in the "Central Hotel." The very much occupied hut which covered the cœlostat and the instruments which it feeds with light, that is, the integrating spectroscope and the two coronagraphs, was named the "Empire Palace." The whole fort was named "Batten's Camp," and the wall on which the discs were placed was called the "Common Hard"—the ship hailed from Portsmouth—and so on. In three or four days there was not a place which had not a name, and a very good name too.

The Lectures and Drills.

The lectures went on steadily from January 5 to 17. They were given by many of the ship's officers as well as by members of the Expedition.

The first drills of the work to be done at the chief instruments during the eclipse took place on the 13th. This statement, perhaps, requires some explanation. When a large instrument is brought out so great a distance to observe a fleeting phenomenon it is natural to try and get out of it the greatest possible amount of work. To secure this the greatest possible division of labour is the first and indeed the chief requirement. This means that many heads and hands must be employed in each of the operations necessary, and this spells drill, unceasing drill.

Now, if this crowd does not work together without the slightest hitch, failure is certain. I do not think I need say more as to the necessity for constant drill, but with regard to the complete operations something more than drill is necessary. With about 120 observers and helpers, on the principle of cutting the coat according to the cloth, a pretty large programme is permissible. When once this is settled, and the volunteers have selected a branch of the work in which they think they can render most efficient help, instruction as to the special points must be imparted. This was done without stint and almost entirely by the officers, and with such a will and skill that my own superfluity on the stage became increasingly obvious day by day. While this set one thinking in one direction along lines not untinged with regrets, in another there was great cause for rejoicing, for it will be a grand day for solar physics when the observations of eclipses will be among the recognised duties of a ship, such as the present one, on the station with a sufficient crew to tackle it.

While the instruments were being set up, one of the chief things accomplished was to organise the whole effort, so that when things were ready everybody could work together. As the number of volunteers was so large, I pointed out to Captain Batten, who had volunteered to aid in a special branch of the work, the

importance of his taking charge of the whole camp and giving all the necessary orders for conducting the operations during the general rehearsals and the eclipse itself. He eventually agreed to this, and the procedure and time signals were arranged between us. To me, an old eclipser, it was a beautiful thing shortly afterwards to see the splendid drill commenced in eclipse form, along all lines, going on to the sound of the bugle.

It was found that with such a large number of volunteers we could practically undertake almost every kind of work which had ever been attempted during an eclipse. The observers were divided into twenty-two groups, each in charge of a responsible person.

The groups of observers were as follows :—

(1) Time.
(2) 6-inch prismatic camera.
(3) 9-inch ,, ,,
(4) Integrating spectroscope.
(5) 6-inch equatorial.
(6) Coronagraph.
(7) Discs.
(8) Sketches of corona without discs.
(9) 3¾-inch equatorial.
(10) Observations on stars.
(11) Shadow-bands.
(12) Meteorological observations.
(13) Hand spectroscopes.
(14) Prisms for rings.
(15) Polariscope.
(16) Landscape colours.
(17) ,, cameras.
(18) Shadow phenomena.
(19) Kinematograph for eclipse.
(20) Kinematograph for shadow.
(21) Contact observations.
(22) Observations on natives, animals, &c.

NORMAN LOCKYER.

(*To be continued.*)

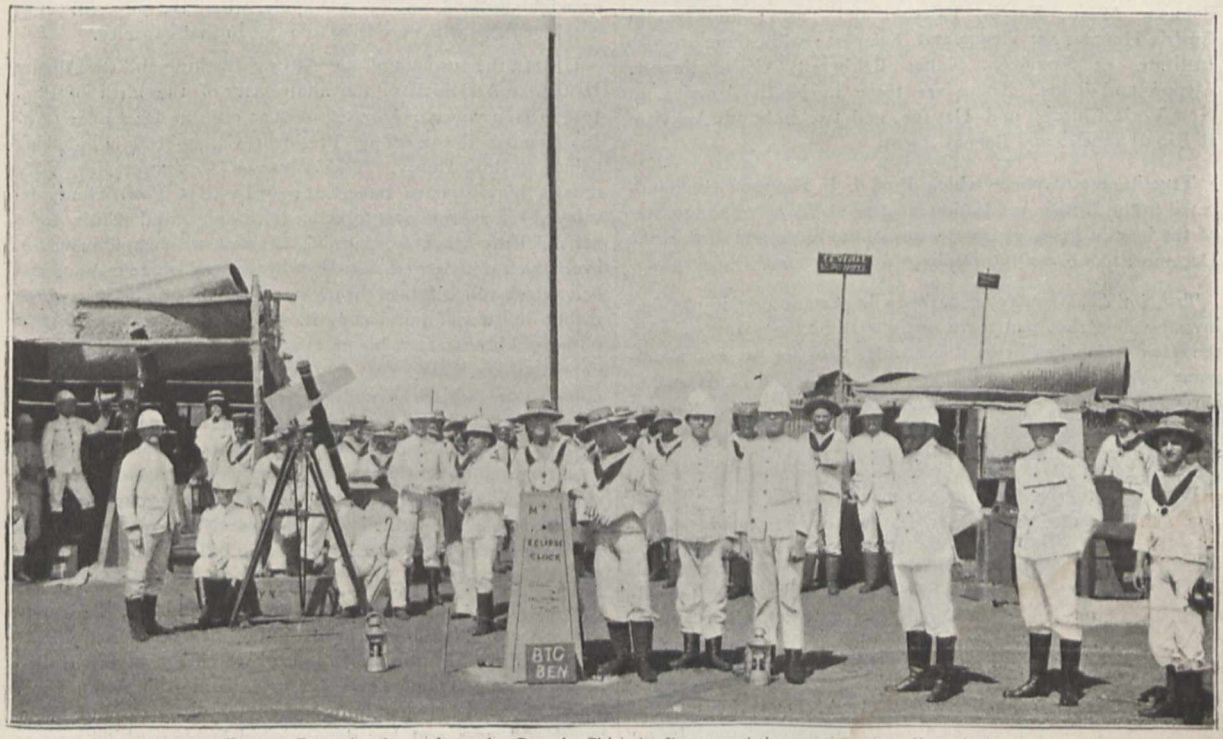


FIG. 3.—Preparing for a rehearsal. Captain Chisholm-Batten and time-party at the eclipse clock.

NOTES.

THE list of "New Year's Honours" includes the following names of men distinguished by their scientific attainments:—The dignity of a peerage has been conferred upon Sir John Lubbock, Bart. Dr. Lauder Brunton has received the honour of knighthood. Captain Abney has been promoted to a Knight Commandership (K.C.B.) of the Order of the Bath, and Major-General Festing has been created a Companion of the same Order (C.B.). Dr. Patric Manson, medical adviser to the Colonial Office, has been appointed a Companion of the Order of St. Michael and St. George (C.M.G.).

A WELL-ATTENDED meeting of the members of the Palæontographical and Ray Societies was held at the Geological Society's Apartments, Burlington House, on Tuesday, December 19; the Rt. Hon. Sir John Lubbock, Bart., M.P., President of the Ray Society, in the chair. The object of the joint meeting was to present to the Rev. Prof. Wiltshire, the hon. sec. of both the above-named societies, his portrait in oils, an illuminated address, and a cheque for 138*l.*—the balance of the sum subscribed after defraying expenses—in recognition of the services rendered by him to these societies and to palæontology and zoology during a period of more than thirty years. The portrait was executed by Miss Atkinson; the illuminated address by Miss G. M. Woodward. Among those present were Dr. Henry Woodward, F.R.S., President of the Palæontographical Society, the Rt. Rev. Bishop Mitchinson, Master of Pembroke, Oxford, Prof. T. McKenny Hughes, F.R.S., and Prof. W. J. Lewis, the Rev. R. A. Bullen, the Rev. G. F. Whidborne, V.P. Pal. Soc, the Rev. H. H. Winwood, Dr. W. T. Blanford, F.R.S., Mr. John Hopkinson, Prof. T. Rupert Jones, F.R.S., Sir Owen Roberts, Dr. D. H. Scott, F.R.S., Mr. F. W. Rudler, F.G.S., and Mr. A. Strahan; many ladies were also present. The presentation address was made by Sir John Lubbock, and the Rev. Prof. Wiltshire responded. Speeches were also made by Dr. Woodward, Prof. T. McKenny Hughes, Rev. G. F. Whidborne, and the Rev. H. H. Winwood; 132 subscribers took part in the testimonial.

A CONGRÈS d'Histoire des Sciences will be held in connection with the Paris Exhibition. As the development of all branches of scientific knowledge will be considered, the Congress will be of wide interest. Prof. Paul Tannery is the president of the

organising committee, and Dr. Sicard de Plauzoles is the secretary. The official address is 10 boulevard Raspail, Paris.

PROF. MILNE-EDWARDS has been elected vice-president of the Paris Academy of Sciences for this year.

THE eighth Pasteur Institute existing in France was opened at Lyons on Monday, the seven others, in order of seniority, being Paris, Algiers, Tunis, Montpellier, Marseilles, Bordeaux and Lille. In connection with this, the *Times* points out that there are six Institutes in Russia, at St. Petersburg, Moscow, Samara, Kharkof, Warsaw and Odessa; five in Italy, at Bologna, Milan, Naples, Palermo and Turin; and two in Austria-Hungary, at Vienna and Budapest; while there are also Institutes at Saragossa, Malta, Bukharest, Constantinople, Aleppo and Tiflis. There are three in North America, at New York, Chicago and Havana, and two in South America, at Rio de Janeiro and Buenos Ayres.

THE important paper which Prof. J. J. Thomson communicated to the British Association meeting at Dover, on the masses of the ions in gases at low pressures, has been published in the December number of the *Philosophical Magazine*.

THE ion is now playing such an important part in physical investigations that many are anxious to become familiar with the work which has brought electrolysis to its present standpoint. An interesting article on electrolysis and the theory of ions has been communicated to *La Revue des deux Mondes* by M. A. Dastre, in which our readers will find the history of the subject fully stated.

WE regret to see the announcement that Sir James Paget, Bart., F.R.S., died on Saturday last, at the age of eighty-five.

THE *Times* states that the Paris Observatory will henceforth in all its publications reckon the day from midnight to midnight, the hours being numbered from 0 to 24. This system of time reckoning has been adopted in our *Nautical Almanac* since 1891.

WE learn from *Science* that Dr. G. A. Dorsey, curator of anthropology, Field Columbian Museum, accompanied by an assistant and the Rev. H. R. Voth, have gone to the Pueblo of Oraibi, Arizona. The object of the expedition is to secure additional ethnological material for the Museum, to witness the winter solstice ceremony just past in order to get suggestions for new groups, and also to start a systematic and somewhat extended excavation in order to strengthen the archæological exhibit from this interesting region. The expenses are covered by Mr. Stanley R. McCormick, of Chicago, who has placed 5000 dollars at the disposal of the Museum in addition to the 10,000 dollars already expended on the Hopis.

THE *Daily Chronicle* recalls that a London paper of the first week of 1800 alluded to the then recent hot disputes in France and England respecting the beginning of the nineteenth century. According to the paragraph, the famous Joseph Jérôme Lefrançais de Lalande, who then occupied the Chair of Astronomy in the University of Paris, had taken an active part in the controversy, and he had pronounced in favour of January 1, 1801. His decision had been generally accepted as correct on both sides of the Channel. The newspaper referred to remarks: "The same ridiculous question was agitated in 1700." So does history repeat itself.

AT the last meeting of the British Astronomical Association, Mr. Maunder made a statement with reference to the arrangements that are being made by the Association for the proposed expedition to Spain and Algeria to view the solar eclipse of May 28. Subject to a sufficient number of passages being actually taken before January 31, the Royal Mail steamer *Tagus*, or a sister vessel, will be engaged, and will start from Southampton on Friday, May 18, at 6 p.m., calling at Cadiz and Alicante, and arriving at Algiers at 6 a.m. on Thursday, the 24th. The vessel will stay there until after the eclipse, leaving at 6 a.m. on Tuesday the 29th, and calling at Alicante, Gibraltar, and Lisbon on the way to Southampton, which will be reached at 7 a.m. on Monday, June 4. It is hoped the members of the Association would divide themselves into three groups—those observing the eclipse (1) in the interior of Spain; (2) at Alicante or neighbourhood, and (3) in Algeria, where the ship will act as hotel for those who may wish to use it in that capacity.

UNDER the auspices of the Albany Institute and the Albany Historical Art Society, the anniversary of the birth of Prof. Joseph Henry was celebrated in that city on December 17th. In opening the meeting President Colvin paid a glowing tribute to Prof. Henry. The *Electrical Review* of New York reports him to have remarked:—"In 1831 Prof. Henry developed his system of magnetic telegraphy, and within these halls (Albany Academy) placed a telegraph wire a mile in length, over which signals were sounded by the self-same magnet and bell which you will hear to-night. The telegraph was now a reality—he would not patent it. Thus here began a greater phase of his character, his unselfishness and his devotion to the public welfare. We are now brought face to face with that noble nature, which as college professor, as director and developer of Smithson's magnificent bequest to the American people, as counsellor of the United States Government in its most important scientific and technical works, as a discoverer in many branches of science, made him great among our greatest—faithful, noble and true." An illustrated account of Henry's work appears in the *Scientific American* of December 23.

PROF. S. W. STRATTON, of the University of Chicago, has recently been appointed Inspector of Standards, Bureau of Weights and Measures. In accepting this position (remarks *Science*) Prof. Stratton takes immediate charge of the United States Office of Weights and Measures at a most opportune time. This Office has long had in its custody the national standards of length and mass, and has done much valuable work for science and the arts, which has been the logical outcome of this custody. Within the last two years the Office has taken up vigorously the matter of standards for electrical measurements, has acquired apparatus and made special studies, and is now ready to do valuable work along that line. It is especially well equipped for measurements of resistance of the highest degree of accuracy.

THE thirty-first volume of the *Zeitschrift für physikalische Chemie* just issued forms a pleasing novelty in scientific publication. This Jubelband, which is published as a whole and not in parts as usual, is dedicated by his pupils to Prof. J. H. van 't Hoff, to celebrate the twenty-fifth anniversary of his taking the degree of Doctor of Philosophy at the University of Utrecht. The introduction to the volume, by Prof. Ostwald, consists of a short biography of the distinguished Dutch Professor, and an appreciative *résumé* of his far-reaching discoveries, together with a complete list, compiled by Dr. E. Cohen, of his published researches. The authors of all the papers are old students of Prof. van 't Hoff, and each paper is written in the author's own language, with the exception of the Polish and Swedish contributors, so that German, English, French and Dutch are represented. As there are twenty-six papers in all, it is hardly possible to give a summary of them here, but the diversity of the subjects treated serves to show the many-sided originality of the author of the modern theory of solution. An excellent portrait of Prof. van 't Hoff in heliogravure is included in the volume.

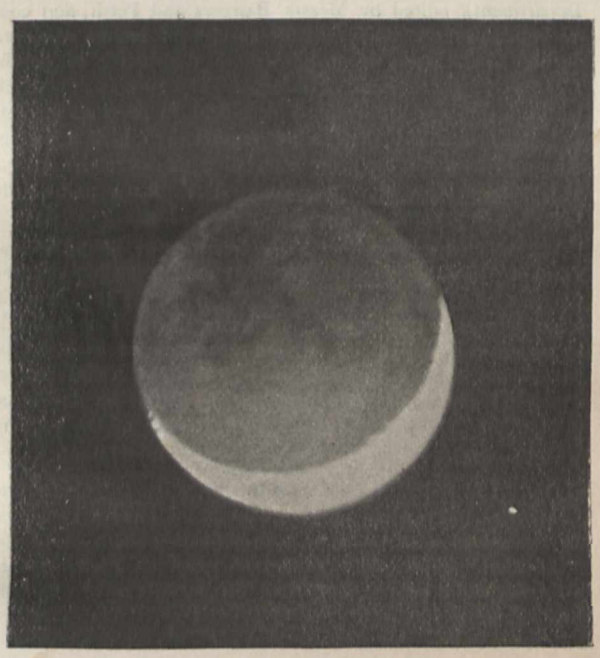
DR. ROBERT WALLACE has republished as a separate leaflet his letter to the *Times* of November 29, on the African horse-sickness. The disease is a malarial fever produced by a minute fungus which grows during the summer on the *veldt*, but whether in water, on the soil, or as a parasite, is not yet ascertained. Although not contagious, it is contracted by animals exposed to the night air, especially in damp situations. The disease appears annually, but only in certain seasons attains alarming proportions. Its serious character may be gleaned from the statement that some 95 per cent. of the animals afflicted succumb. And unfortunately no effectual system of inoculation has yet been discovered to check its ravages. Certain precautions are, however, mentioned, which render horses less likely to be attacked; and we believe that horses fed on dry fodder, like those of the British cavalry, stand a better chance of escape than grass-fed animals.

AT a recent meeting of the Society of Arts, Mr. F. G. Aflalo read a paper on the necessity for legislative regulation of sea-angling. It was urged that angling from piers on the British coast resulted in a very appreciable diminution of the numbers of certain species of fishes, such spots being favourite feeding-grounds for fish of several descriptions. It was not that each boy that fished did much harm by himself, but the total catch by the entire army of boy-fishers must be very large indeed. And there is one very strong reason why legislation in regard to restoring under-sized fish to the sea should be enforced against the angler rather than against the steam-trawler. This is that while most of such fish are irretrievably injured by the trawler, the majority of those captured by the hook, if carefully removed, are little or none the worse for their temporary sojourn in the air. It is admitted that a large destruction of small fish takes place through trawling; but the only remedy for this would be to stop the industry altogether. On the other hand, the return of small fish captured by the hook to the water is a comparatively easy matter to enforce. The general sense of the meeting supported the author's views.

THE greater portion of the December issue of the *Zoologist* is taken up by the continuation of Mr. Distant's paper on mimicry; the illustration of "active mimicry" forming the subject of this section. Among many instructive examples, we may call attention to one very curious case. During the last decade gardens in Hamburg have been extensively planted with the white-leaved variety of the maple, and the common white butterfly has now accustomed itself to select that shrub on which to settle. Had Hamburg been a *terra incognita*, observes the author, there is little doubt that this practice would have been recorded as a striking instance of passive mimicry. Although not coming under the head of mimicry, we may mention that an analogous change of habit is taking place among many of the Argentine birds, which formerly built on the ground, but, as planting increases, are beginning to nest in trees.

WE learn from the U.S. *Monthly Weather Review* for September last, that the important international cloud work of the Weather Bureau, on which Prof. F. H. Bigelow has been engaged for several years, is now completed, and will be published in the annual report of that department for 1898–99. It will be remembered that about the middle of the year 1896 several meteorological services co-operated in taking a series of simultaneous observations on the height and motion of the ten standard types of clouds which have been defined by the International Cloud Committee, and that the observations were continued for at least a year. Those undertaken by the Weather Bureau were divided into two classes: (1) Those made by means of two theodolites placed at the end of a long base-line. These give the absolute height, velocity, and direction of motion of individual clouds at Washington. (2) Those made with nephoscopes at fourteen stations over the districts east of the Rocky Mountains, giving the relative velocity and direction of motion. The discussion of the data will show the distribution and average height of each type of cloud for every month, and the depth of the zone or horizontal belt in which each type may occur. A very important subject of investigation has been the determination of the direction and velocities of the horizontal motions of the air in each of the eight principal levels, on all sides of the areas of high and low barometric pressures as they move over the United States. This gives definite information regarding storm components, and will enable us to look more closely into the various theories of cyclones and anti-cyclones; it is stated that an attempt to interpret the analytical equations of motion has led to a different idea of the circulation in storms from that commonly taught by meteorologists.

SEVERAL drawings and reproductions of photographs of "the old moon in the young one's arms" are given in the *Bulletin* of the French Astronomical Society for December, 1899, with an article upon the subject of earth-shine, or *la lumière cendrée* as it is termed in France. Curious views have been held as to the reason why the whole dusky ball of



our satellite can be seen near the time of new moon. Posidonius thought that the moon was a diaphanous body, and that the rays of the sun passing through it caused the dull appearance observed. Tycho Brahe suggested that the appearance was produced by the illumination of the moon by Venus, and it was left to Leonard de Vinci to discover the real cause, namely, the reflection by the moon of sunlight reflected from the earth. The accompanying illustration of the phenomenon is from a photograph obtained by M. F. Quénisset.

APPENDIX III. to the Kew *Bulletin of Useful Information* for 1899 consists of a directory of the staffs of the Botanical Departments in these islands, in the colonies, and in India.

THE discovery of several lines in the infra-red spectrum of argon or of some associated gas is announced by Messrs. R. Nasini, F. Anderlini, and R. Salvadori in the *Atti dei Lincei* viii. (2) 10. The spectrum, of which a photograph is given was obtained from the residual gas of one of the fumaroli of

Vesuvius, but as it is stated to be perfectly identical in this region with that of argon obtained from air, and this again with the spectra of gases from other fumaroli of Vesuvius, from the rocks in the proximity of the crater, from the Grotta del Cane, from the Acque Albule of Tivoli, from the Bulicame del Viterbo, and from the carbon dioxide emanations of Pergine in Tuscany, the authors think that these lines belong to argon or to some gas accompanying argon in the air. The wave-lengths of the new lines are estimated by exterpolation to be 798, 803, 814, 832, 845, and 857·5, and Signor Anderlini has been able to see the first three lines in the Grotta del Cane gas. It is claimed that the lines in question have not been observed by Crookes, Kayser, Eder, Valenta and others.

IN the *Agricultural Gazette of New South Wales* for September, 1899, are several papers of more than local interest; especially one on the timber trade of New South Wales, by R. Dalrymple-Hay; protective inoculation against anthrax, by Dr. F. Tidswell, and entomological notes for 1898, by W. Froggatt. The last is illustrated by several excellent plates of insects destructive to timber.

WE have received *Bulletin* 175 (July, 1899) of the Michigan State Agricultural College Experiment Station (Entomological Department), edited by Messrs. Barrows and Pettit, and containing notes on about twenty species of insects observed during 1898, including a new moth destructive to peach, *Depressaria persicaeella*, Murtfeldt. The species now dealt with are different from those described in previous reports, and it is intended that future reports shall give a further selection, until all the more interesting or destructive insects of the State have been discussed. The greater part of the figures in this report are original.

WE are glad to notice that the first number of the second series of *The Library* contains a short section dealing with the progress of science, and some helpful notes for librarians on scientific works recently published. The selection of books is by no means complete, nor is it as representative as could be wished, but there seems no reason why this very useful part of an exceptionally interesting magazine should not be developed in future numbers. An excellent photogravure of Dr. Richard Garnett forms a suitable frontispiece to this first number.

DR. J. SANDERSON CHRISTISON'S little book "Crime and Criminals" has reached a second edition. It has been enlarged by the addition of an appendix containing analyses of the "Luetgert" case, which caused so great an excitement in America, and other noted crimes. The book is almost entirely made up of a series of articles on "Jail Types" which originally appeared in the *Chicago Tribune*. The photographs of actual criminals illustrating the volume will be of interest to students of criminology.

THE current number of the *Berichte* contains an important contribution by Dr. R. Scholl to the theory of the constitution of the fulminates. Of the numerous formulæ put forward since the first attempt of Kekulé, the simplest is that proposed by Scholl, and afterwards taken up by Nef, in connection with the views of the latter on divalent carbon, namely, that fulminic acid is carbyloxim, C : N.OH. The fact discovered by Nef, that the mercury salt of nitromethane on standing is partially converted, with loss of water, into mercury fulminate, is in good agreement with the above simple constitution. Further experimental support to this view is now given by Dr. Scholl in the present preliminary note, in which he aims at transferring the oximido group to a stable hydrocarbon radical. Silver fulminate and benzene react together in presence of aluminium chloride, forming benzaldoxim. The conditions necessary for securing good yields require very careful attention, and differ considerably from those generally favourable to the Friedel and Crafts reaction. Thus, with dry materials and freshly prepared aluminium chloride the yield was very bad; but the use of a commercial chloride gave good results. It was then found that the presence of a certain amount of moisture was necessary to obtain good yields, the highest being obtained when a mixture of pure, freshly prepared $AlCl_3$ and crystallised $AlCl_3.6H_2O$ was employed. These results are thus of interest from two points of view, the Friedel and Crafts reaction and the constitution of the fulminates.

THE additions to the Zoological Society's Gardens during the past week include a Black-backed Jackal (*Canis mesomelas*) from South Africa, presented by Mr. J. E. Matcham; a Mozambique Monkey (*Cercopithecus pygerythrus*) from East Africa, a Suricate (*Suricata tetradactyla*) from South Africa, two —— Chelodines (*Chelodina*, sp. inc.) from Australia, three Speckled Terrapins (*Clemmys guttata*) from North America, two Black-headed Terrapins (*Damonia reevesi unicolor*) from China, deposited.

OUR ASTRONOMICAL COLUMN.

HOLMES' COMET (1899 II.).—M. H. J. Zwiers gives a new ephemeris for this comet in the *Astronomische Nachrichten*, No. 3610. The object is getting so faint, however, that an abridgement for every fourth day only is given here.

Ephemeris for 12*h. Greenwich Mean Time.*

1899.		R.A. h. m. s.	Decl. ° ′ ″
Jan. 4	...	2 10 23·50	... +41 52 40·2
8	...	12 59·30	... 41 25 46·8
12	...	15 58·86	... 41 0 58·5
16	...	19 20·23	... 40 38 16·2
20	...	23 1·71	... 40 17 38·4
24	...	27 1·76	... 39 59 2·0
28	...	31 19·04	... 39 42 23·0
Feb. 1	...	2 35 52·32	... +39 27 36·6

ORBIT OF EROS.—Signor E. Millosevich, of Rome, has communicated to the *Astronomische Nachrichten*, No. 3609, an ephemeris for facilitating observations of the minor planet Eros during the coming opposition at the end of the present year. The ephemeris extends over the period 1900 September 1–1901 January 31, the positions being computed from the following elements:—

Elements for Epoch 1900 *October* 31·5 *Berlin Mean Time.*

$M = 304\ 23'\ 59''.7$
$\pi = 121\ 9\ 22.0$
$\omega = 177\ 38\ 41.6$
$\Omega = 303\ 30\ 40.4$
$i = 10\ 49\ 38.9$
$\varphi = 12\ 52\ 48.2$
$\mu = 2015''.12740$ (period 643·14d.)
$\log a = 0.1638027$

THE SOLAR PARALLAX.—In *Comptes rendus* (vol. 129, pp. 986–993), M. Bouquet de la Grye furnishes the result of his discussion of the facts obtained by the various French expeditions sent out to observe the Transit of Venus in 1882. The reports hitherto published of the expedition have only dealt with the form of the planet's disc and the question of photography. The calculations of the solar parallax from the times of contact of the planet with the sun's limb have occupied several years. The author states that the external contacts are influenced by the size of the objectives of the observing telescopes, but the internal contacts do not show any such connection. Using Halley's method, and combining the observations from the several stations in all possible groups, he finds that:—

From observations with large telescopes $p = 8''.7996$.
,, ,, ,, small ,, $p = 8''.8068$.

and gives *mean parallax* $= 8''.80$ from the visual observations of French parties. A full discussion of the measures of the photographic records obtained will be presented shortly.

PRIZES PROPOSED BY THE PARIS ACADEMY OF SCIENCES FOR 1900.

THE Grand Prix des Sciences Mathematiques will be awarded in 1900 for an improvement, in any important point, of our knowledge of the number of classes of quadratic forms of two unknowns with entire coefficients; the Bordin Prize (3000 francs), for the development and improvement of the theory of surfaces applicable to the paraboloid of revolution; the Francœur Prize (1000 francs), for discoveries useful to the progress of pure or applied mathematics; the Poncelet Prize (2000 francs), for any similar work published during the last ten years.

In Mechanics: the Extraordinary Prize of 6000 francs will be given for any work increasing the efficiency of the French navy; the Montyon Prize (700 francs), for the invention or improvement of instruments useful to the progress of agriculture, the mechanical arts or sciences; the Plumey Prize (2500 francs), for improvements in steam engines or any invention contributing most to the progress of steam navigation.

In Astronomy: the Lalande Prize (540 francs) is offered for the most interesting observations, or work most useful to the progress of astronomy; the Damoiseau Prize (1500 francs), for a memoir on the theory of one of the periodic comets of which several returns have been observed; the Valz Prize, for the author of the most interesting astronomical observation made during the year; the Janssen Prize (a gold medal), for the most important discovery in physical astronomy; and an anonymous prize of 1500 francs, as an encouragement to the calculators of the minor planets, especially those discovered in the Nice Observatory.

In Statistics: a Montyon Prize of 500 francs, for a memoir on questions bearing on French statistics.

In Chemistry: the Jecker Prize (10,000 francs), for organic chemistry, and the Wilde Prize (4000 francs).

In Mineralogy and Geology: the Vaillant Prize (4000 francs) will be awarded in 1900 for a rigorous determination of one or more atomic weights, or for the study of alloys.

In Botany: the Barbier Prize (2000 francs) is intended to recompense whoever makes a valuable discovery in the medical, surgical, or pharmaceutical sciences, or in botany, in relation to the art of healing; the Desmazières Prize (1600 francs), for a memoir on the cryptogams: the Montagne Prizes (1000 francs and 500 francs), for work on the anatomy, physiology, development, or description of the lower cryptogams; and the Thore Prize (200 francs) to the author of the best memoir on the cellular cryptogams of Europe (algæ, mosses, lichens, or fungi), or on the anatomy of any species of European insect.

In Anatomy and Zoology: the Savigny Prize (975 francs), in aid of young travelling zoologists not receiving Government aid, more especially those occupying themselves with the invertebrates of Egypt and Syria; the Da Gama Machado Prize (1200 francs), for the best memoir on the coloured parts of the tegumentary system of animals.

In Medicine and Surgery: a Montyon Prize, for any discovery useful in the art of healing; the Bréant Prize (100,000 francs), for a specific antidote against Asiatic cholera, or for such a discovery of the causes of Asiatic cholera that those causes may be suppressed and the disease stamped out. The interest on the capital sum will be awarded for a rigorous demonstration of the existence in the atmosphere of materials capable of propagating epidemic diseases; the Godard Prize (1000 francs), for the best memoir on the anatomy, physiology, and pathology of the genito-urinary organs; the Parkin Prize (3400 francs), as a recompense for researches upon either the curative effects of carbon and carbon dioxide, or for the effects of volcanic action upon the spreading of epidemic diseases; the Bellion Prize (1400 francs), for works or discoveries especially profitable to the health of man; the Mège Prize, for a study of the causes which have favoured or retarded the progress of medicine; the Dusgate Prize, for the best work on the diagnosis of death, and on the means of preventing premature burial; the Lallemand Prize (1800 francs), for work on the nervous system; and the Baron Larrey Prize (1000 francs), for the best work treating of military medicine, surgery, or hygiene.

In Physiology: a Montyon Prize of 750 francs is offered annually; the Pomat Prize (1400 francs), for a determination of the principal anthropometric data; the Martin-Damourette Prize (1400 francs) and the Philipeaux Prize (890 francs), for work in experimental physiology. In Physical Geography, the Gay Prize (2500 francs), for the application to a portion of France, or a portion of the Alpine Chain, of the analysis of the geological circumstances which have determined the actual conditions of relief and hydrography.

Of the General Prizes, the following may be awarded in 1900: the Arago Medal, the Montyon Prize (unhealthy trades), the Cuvier Prize (1500 francs), the Tremont Prize (1100 francs), the Gegner Prize (4000 francs), the Delalande-Guérineau Prize (1000 francs), the Jérome Ponti Prize (3500 francs), the Tchihatchef Prize (3000 francs), the Boileau Prize (1300 francs), the Houllevigne Prize (5000 francs), the Cahours Prize (3000 francs), and the Saintour Prize (3000 francs).

GEOLOGY OF JAMAICA.[1]

THIRTY years have elapsed since the publication of the "Reports on the Geology of Jamaica," by James G. Sawkins and others, with an appendix by Robert Etheridge; a work published as one of the "Memoirs of the Geological Survey." In the work before us Mr. Robert T. Hill deals anew with the subject, his observations being based upon surveys made for Alexander Agassiz; and he has evidently spared no pains to investigate the geology and physical geography of the island in a thorough manner in accordance with modern knowledge. It is interesting to find him referring to the early paper written by De la Beche for the Geological Society in 1828 as "more in harmony with the conclusions to be presented by us than the subsequent and more extensive reports of the official surveys which supplanted them."

Mr. Hill considers that Jamaica presents a more favourable opportunity for detailed geologic investigation than any other tropical area. Highways, bridle-paths, and railways intersect the land in various directions, to say nothing of the coast-cliffs. Hence there is no lack of geological sections, and the author has had great advantages over those who preceded him. He remarks that the earlier researches "failed to solve the essential problems of the succession and age of the strata," and that the literature of no other region, especially that relating to palæontology, "presents so many erroneous conclusions." Curiously enough the author attributes this stratigraphic confusion, not to incompetence, but "to an act of Providence." It is well known that the original Director of the Jamaican Geological Survey, Lucas Barrett, was drowned in a diving-dress, and it is pointed out that the endeavours to interpret his opinions were the chief sources of subsequent erroneous conclusions. The stratigraphical errors were largely those of correlation, for it is admitted that otherwise the official reports were full of valuable data.

The author now starts afresh in naming and classifying the formations, using geographical terms, rather than those of a lithological or palæontological nature. The island is made up of Cretaceous, Eocene, Oligocene, Pliocene, and younger deposits, together with intrusive rocks. In adopting geographical names it would have been well, if possible, to have avoided the use of those names which are not original to the island, but are familiar elsewhere; to speak of the Jerusalem, Richmond, and Falmouth beds of Jamaica is at least unfortunate. So far as they go the Yallahs, Catadupa, and Manchioneal beds sound more appropriate, and the same may be said of the Bogue Island formation.

Evidence is given to show that locally the Cretaceous, Eocene and Oligocene formations were stratigraphically continuous, and we have a succession upwards from detrital to oceanic deposits. The higher Eocene beds contain *Cerithium*, *Lucina*, and Rudistes.

The white limestones of the Jamaican series are shown to represent several distinct ages, from Cretaceous to Recent, but the main mass belongs to the Oligocene. This mass forms the large plateau region which is really a dissected plain, rising in places to 3000 feet. It is known as "the cock-pit country," on account of the numerous swallow-holes, which vary from shallow circular basins to sink-holes 500 feet in depth. They are characterised by a bright red clayey soil, a residue from the dissolution of the limestone. Dykes of diorite and granitic rock penetrate Cretaceous, Eocene and Oligocene strata. The coastal deposits include various gravels, marls, and reef-beds of later Tertiary and Recent ages.

[1] "The Geology and Physical Geography of Jamaica: Study of a Type of Antillean Development." By Robert T. Hill, *Bull. Museum Comp. Zool. Harvard Coll.*, vol. xxxiv., 1899, pp. 256; with 41 plates. (Cambridge Mass.)

The author discusses at some length the changes of physiography in tropical America, in their bearing on the history of the West Indian Islands. In Jurassic times there is evidence of a great expansion of land from the Rocky Mountains eastwards in North America, and over the north-eastern part of South America. "It is probable that the continental mass as a whole, practically equivalent in area to the present one, occupied a position slightly east of its present locus." The American fossiliferous marine Jurassic belonged to the Pacific area, and may have extended as far to the east as Havana. No evidence is recognised for establishing land connection between the islands and North and South American lands in Post-Jurassic time. The first evidence of Antillean lands is found in eruptive rocks of late Cretaceous time, when it is probable there were marine volcanoes. The land débris constituting the Eocene strata proves the pre-existence of extensive Cretaceous land-areas. In late Eocene and early Oligocene times there was a profound regional subsidence, and 3000 feet of purely oceanic deposits were accumulated. A great uplift occurred in late Oligocene or Miocene times, and subsequently many minor movements of elevation and depression have taken place.

In an appendix some Cretaceous and Eocene corals from Jamaica are described by Mr. T. Wayland Vaughan.

H. B. W.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

UNDER the will of Mr. James Brown Thomson, of Kinning Park, Glasgow, the University of Glasgow will receive 10,000*l.*, and the Glasgow Technical College, 2000*l.*

MR. W. H. DERRIMAN, assistant lecturer in physics at the Technical College, Huddersfield, has been appointed to a similar post in University College, Liverpool.

Science states that Dr. Jokichi Takamine, of the University of Tokio, Japan, known for his researches on digestive ferments, is at present on a tour of inspection of the larger educational institutions of the United States. He has been sent by the Japanese Government to examine the scientific work and methods of American universities.

AN English Educational Exhibition will be held at the Imperial Institute on January 5-27. The exhibits will comprise students' work, and will refer to primary, secondary, technical, and higher education of both sexes. A series of lectures and conferences on educational subjects and demonstration lessons will be held at the Imperial Institute during the Exhibition. Particulars of the chief science conferences have already been given (p. 189).

THE *University Correspondent* has published its annual crop of amusing mistakes made by schoolboys in answers to examination questions. The following answers, selected from many similar ones, show how easy it is for pupils to receive inaccurate and confused impressions when given didactic instruction, and also how essential it is that examination questions should be explicit:—When would you expect an eclipse of the sun to take place? In the night.—The sun never sets on English possessions, because the sun sets in the west, and our colonies are in the north, south, and east.—The exports of Ceylon are peculiar to any other part of the world. The chief are piano steamers (sc. P. and O. steamers).—A cubic foot of water weighs 64 lbs. : .·. a squate foot of water weights 16 lb., and a foot of water weights 4 lb.—The three principle parts of the eye are the pupil, the moat, and the beam.—A mariner's compass is a little poast stuck up in the sea, and when people want to know the way, the ships go and look at it.—Many other instances might be given, but those quoted are sufficient to show that there is much room for improvement in the teaching of scientific subjects while such hazy ideas exist in the minds of schoolboys.

SCIENTIFIC SERIAL.

Symons's Monthly Meteorological Magazine, December, 1899.—The aims of meteorology. This is a brief synopsis of a "Report on the Meteorology of Maryland," prepared by direction of the U.S. Weather Bureau. The article on special observations and investigations enumerates twenty-nine heads under which observations are made. While all are useful in different ways, any single service dealing with one-third of them would have little energy left for the improvement of the important work of weather prediction. Mr. Symons considers that the perusal of the work, consisting of about a hundred pages, is not merely instructive as a guide to the future, but also very useful as a record of past progress.—Kites and meteorology, by W. A. Eddy. This is a statement, in chronological order, of the various occasions on which kites have been used in meteorological investigations, from those in 1749, by Wilson and Melvill, near Glasgow, and in 1836 by Admiral Bach in Hudson Strait, in sending up thermometers, to those very successful experiments made in recent years at the Blue Hill Observatory, by means of the Eddy and Hargrave kites.—The same number also contains some interesting notes on damage by lightning, injurious effects of fog on plants, and unusual snow crystals.

SOCIETIES AND ACADEMIES.

EDINBURGH.

Royal Society, December 19, 1899.—Prof. Duns in the chair.—Dr. J. Souttar McKendrick, of Glasgow, read a paper on the zymolysis of tissues, physiological and pathological. After a short bibliographical sketch of the nature and action of enzymes as they exist in the digestive juices, with their methods of extraction, and mention of the observations of Nasse, Brucke, and others who had attempted to demonstrate the presence of ptyalin and pepsin in muscle, the author described in detail his method of procedure. He made glycerine extracts of between sixty and seventy tissues of the rabbit, child, adult, and those obtained post-mortem, and with each tissue extractive he endeavoured to demonstrate the presence or absence of enzymes similar in their action to ptyalin or amylopsin, pepsin, trypsin, inversin and rennin. A series of extractives were also made from certain pathological tissues, namely, carcinomata, sarcomata, tissues from an eclamptic, &c. The results pointed to the presence of pepsin, or a substance analogous to it, in all the tissues, physiological and pathological; to the presence of a diastatic ferment in most of the tissues; to the absence of tripsin except in the pancreas; to the absence of a milk curdling ferment except in those tissues in which it is known to exist; to the absence of an inversive ferment. Malignant tissues were found to have proteolytic and diastatic properties. Though rabbit's blood contained no diastatic enzyme, eclamptic blood contained such an enzyme in large amount; and all eclamptic tissues yielded extracts with markedly diastatic properties. The author in conclusion advocated the similar examination of the blood in all obscure diseases and of carcinomatous and sarcomatous growth.—Prof. Mitchell communicated a paper on the cooling of a body in a steady blast of air, Part II. In the later experiments the air currents had been varied from 10 to nearly 1000 metres per minute, and the temperature had been carried up to 120° C. Newton's law of cooling under these conditions was found to hold with great accuracy, and Newton's original statement, imperfectly quoted by most writers, completely verified. The rate of cooling was shown to be proportional to the difference of temperature for a given strength of blast, and to be proportional (for a given temperature) to the strength of blast up to a value of about 450 metres per minute, but to fall off from the law of proportionality for higher values. This was explained as a result of unsteadiness in the air current at these higher values.—Dr. Mahalanobis described a new form of myograph, which consisted essentially of a T-shaped lever, pivoted so as to admit of horizontal movements free from the influence of gravity. The instrument was suitable for obtaining myograms of isometric and isotonic contractions of muscles, and most of the ordinary experiments on fatigue, tetanus, &c. The momentum of the lever during contraction of the muscle was approximately counterbalanced by the slight increase of tension in an elastic band, thus securing a fairly isotonic condition of the muscle.—Dr. C. G. Knott drew attention to the fact that Prof. Swan, of St. Andrews, had in 1859 constructed and used the form of photometer commonly associated with the names of Lummer and Brodhun, who described it in 1889. Swan's own description and figure will be found in the *Trans.* R.S.E., vol. xxii., 1861.—Prof. Tait, in a note on the claim recently made for Gauss to the invention of quaternions, showed that what Prof. Klein, both in the *Mathematische Annalen* and in his (and Sommerfeld's) treatise *Ueber die Theorie des Kreisels* ascribed to Gauss was not the Hamiltonian quaternion

at all, but a particular and very limited kind of strain, which consisted of a simple rotation combined with an isotropic expansion, and thus involving four constants only. Klein and Sommerfeld's attempted identification of Gauss' operator with Hamilton's quaternion indicated a curious misapprehension on their part of the real essence of a quaternion.—Dr. C. G. Knott, in a paper on the same subject, gave a detailed criticism of the section in Klein and Sommerfeld's treatise devoted to the discussion of the theory of quaternions.

PARIS.

Academy of Sciences, December 26, 1899.—M. van Tieghem in the chair.—M. H. Milne-Edwards was elected Vice-President of the Academy for the year 1900.—Note on the work contained in the volume of the "Annales de l'Observatoire de Paris de 1897," by M. Lœwy. This volume inaugurates a new series of *Annales*, differing from preceding volumes both in the nature of the work carried out and the form chosen for publication.—On the radiation of radio-active bodies, by M. Henri Becquerel. There would appear to be a fundamental difference between the radiations of radium and polonium salts, in spite of their similar photographic action, as the polonium radiations placed in a magnetic field show no influence of the same order as observed for radium.—Experimental cultures on the adaptation of plants to the Mediterranean climate, by M. Gaston Bonnier. The object of these researches was to find out if plants taken from temperate climates to the Mediterranean could so modify their form and structure as to adapt themselves to their new surroundings. Experiments were carried out with a large number of different species, and nearly all showed, even after one season, notable differences in form, the stems becoming more ligneous, even stems of one year's growth, the leaves larger and thicker with the veins more strongly marked.—Researches on the tautomerism of benzoyl-benzoic acid, by MM. A. Haller and A. Guyot. From its mode of formation from benzene and phthalyl chloride, benzoyl-benzoic acid would appear to have the constitution of an oxylactone, and this view is confirmed by the formation of diphenyl-phthalide from its chloride. But, on the other hand, in many reactions both the chloride and acid exhibit undoubted ketonic properties. It thus appeared to be interesting to see if the tautomeric modifications of this acid could be obtained as methyl ethers. Methyl-*o*-benzyl benzoate was accordingly prepared by five different methods, direct etherification by hydrochloric acid, interaction of methyl iodide and the silver salt, interaction of benzoyl-benzoic anhydride and sodium methylate, action of sodium methylate upon acetyl-benzoyl-benzoic anhydride, and upon benzoyl-benzoic chloride. In all cases the same ether was produced, which would appear to be the true ketonic ether, $C_6H_5.CO.C_6H_4.CO.(OCH_3)$.—Remarks by M. Albert Gaudry, upon a work of M. Erland Nordenskjold.—General Gallieni was elected a correspondent for the Section of Geography and Navigation.—Observation of the eclipse of the moon of December 16, 1899, with the photographic equatorial at Toulouse, by M. Montangerand. Experiments with plates of different degrees of sensitiveness showed that panchromatic plates give better results with a total than a partial eclipse.—Observations of the new planet EV (Charlois), made at the Observatory of Besançon, by M. P. Chofardet.—Organisation of the daily registration of the entire chromosphere of the sun at the Observatory at Meudon. First results, by M. H. Deslandres.—Remarks on the preceding communication, by M. J. Janssen.—On the employment of triphase currents in Radiography, by M. Delézinier.—On the discontinuities produced by the brusque expansion of compressed gases, by M. Paul Vieille. Diaphragms of collodion were constructed capable of standing a pressure up to twenty-seven atmospheres. By the sudden rupture of this diaphragm, an explosive wave was set up, the front of which was more symmetrical than when explosives are used. The mean velocities of propagation of the wave were measured at different distances from the diaphragm. Velocities could thus be obtained of over 600 metres per second, greater than the velocity of sound.—On some phenomena presented by iron, by M. Galy-Aché. The results of the experiments upon a very pure sample of iron are in accord with the views of Osmond and Werth, that there are two allotropic varieties of iron, α-iron, stable at the ordinary temperature, and β-iron, stable at high temperatures.—On the changes in volume accompanying the hardening of hydraulic cements, by M. H. Le Chatelier. The contraction was measured by sealing up the cements in the bulb of a thermometer containing water. The absolute contraction after six months was between 4 c.c. and 5 c.c. per 100 grams of cement. There was at the same time an apparent expansion, sufficient in some cases to burst the bulbs of the thermometers.—On the temperature of transformation of the two varieties, quadratic and orthorhombic, of mercuric iodide, by M. D. Gernez. The transformation-temperature is 126°. The temperature of 75°, found by M. Wyrouboff, is due to an error caused by his working *in vacuo*.—New experiments upon the activity of manganese with respect to the phosphorescence of strontium sulphide, by M. José Rodriguez Mourelo.—On molybdenum silicide, by M. E. Vigouroux. Silicon combines directly with molybdenum in the electric furnace, forming Mo_2Si_3, which is obtained pure with difficulty. It burns in chlorine at 300°, giving silicon tetrachloride and molybdenum perchloride.—On molybdenum disulphide, by M. Marcel Guichard. Of the various methods suggested for the preparation of molybdenum disulphide, two only are satisfactory, the fusion of potassium carbonate and sulphur with molybdenum dioxide, and heating sulphur to a high temperature with ammonium molybdate. The first method gives a crystalline product, the second an amorphous one. By the action of heat a new sesquisulphide is formed, further particulars of which will be given in a subsequent note.—The action of nitrous acid upon the leucobase $C_{18}H_{24}N_2$, by M. A. Trillat.—Heat of neutralisation and acidimetry of cacodylic acid, by M. Hénri Hibbert. Cacodylic acid is a feeble monobasic acid, being neutral to helianthine and monobasic to phenol-phthalein.—The hydrate of sodium dioxide and the prepration of hydrogen peroxide, by M. de Forcrand.—On the anhydrous sesquichlorides of rhodium and iridium, by M. E. Leidié. The double chloride $Rh_2Cl_6 6NaCl$. (with $3H_2O$ or $18H_2O$), heated in a current of dry hydrogen chloride up to 440° C gives a mixture of Rh_2Cl_6 and NaCl from which the latter can be removed by washing with water. The hydrogen chloride may advantageously be replaced by chlorine if the double salt is previously dried at 105°-110° C. The corresponding iridium chloride is best obtained by heating $Ir_2Cl_6 6NH_4Cl$ in chlorine at 440° C.—The biochemical oxidation of propylglycol, by M. André Kling. Following up his previous work on this subject, the author has now proved that the reducing body formed by the oxidation of $CH_2(OH)CH(OH)CH_3$ is acetal, $CH_3.CO.CH_2OH$.—On the preparation of the carbazides. Action of the hydrazines upon the phenolic carbonates, by MM. P. Cazeneuve and Moreau. By the interaction of phenyl carbonate and phenyl-hydrazine a good yield of carbohydrazide is obtained. Similarly hydrazine hydrate gives carbazide, $CO(NH.NH_2)_2$. The method appears to be capable of general application.—Combinations of lithium chloride with ethylamine, by M. J. Bonnefoi. From the dissociation pressures of the compounds $LiCl.C_2H_5(NH_2)$, $LiCl.2C_2H_5(NH_2)$, $LiCl.3C_2H_5(NH_2)$, the heats of dissociation are calculated by Clapeyron's formula to be 13·72 cal., 11·09 cal., and 10·50 cal. These numbers were also measured directly in the calorimeter, and found to be 13·83 cal., 10·98 cal., and 10·57 cal. respectively.—On narceine, by M. Emile Leroy. Measurements of the heats of hydration, combustion, and formation of narceine and its salts.—On the evolution of mineral matter during germination, by M. G. André.—On the estimation of the halogens in organic compounds, by M. Amand Valeur. The determination of the halogens in organic compounds can be carried out very rapidly and accurately in the calorimetric bomb, provided that a suitable quantity of naphthalene is burned at the same time. For chlorine and bromine, strong ammonia is placed in the bomb, and this liquid analysed volumetrically either by Mohr's or Volhard's method. The whole analysis can be finished in half an hour. For iodine the ammonia is replaced by potash solution. Tetra-iodo-ethylene, containing 95·5 per cent. of iodine, gave very good results by this method.—On some effects of electric discharges upon the heart of mammals, by MM. J. L. Prevost and F. Battelli. Under the influence of a current of suitable strength, the tremulous vibrations are replaced by true rhythmic contractions of the heart, with restoration of the blood pressure, if the current is applied within fifteen seconds of the appearance of the trembling.—General considerations on the male reproductive organs of the Coleoptera, by M. L. Bordas.—The evolution without heterogony of an Angiostome of the ringed adder, by M. Railliet.—On the pigment of the Arenicolæ, by M. Pierre Fauvel.—Chlorophyllian assimi-

lation in solar light which has traversed leaves, by M. Ed. Griffon. The passage of light through a single leaf causes a notable weakening in the activity of those rays which are required for the chlorophyllian assimilation. The results vary much with the conditions of temperature and lighting.—On a bacterial zooglea of definite form, by M. Radais.—On the elements of limited symmetry, by M. Walleront.—Observations on the structure of the diluvium of the Seine, by M. Stanislas Meunier.—On a new hypothesis on the nature of the physical conditions of smell, by MM. Vaschide and Van Melle. The authors combat the view that the sense of smell is due to the emission of particles from the substance, and suggest that the effect is produced by rays of short wave-length, analogous, but not similar to, light rays, Röntgen rays, &c. They adduce ten arguments in favour of their hypothesis.—On a cranial campylogram, by MM. Blin and Simon. A description of an instrument for measuring the curves of the cranium in the living.—Barometric movements caused on the meridian of the sun by its movement in declination, by M. A. Poincaré.

CAPE TOWN.

South African Philosophical Society, November 29, 1899.—Mr. L. Péringney, President, in the chair.—The President recorded the deciphering, by Mr. Donald Ferguson, of an old stone which has been in the South African Museum since 1855. The stone was known to the late Dr. Atherstone and Mr. C. A. Fairbridge as the Mossel Bay stone. It is a rudely cubical block of sandstone with a cut inscription on one surface, which, however, has been broken across. On the fractured surface, at right angles to the inscribed face, there is a peculiarly shaped cross. Mr. Sclater sent an impression of the inscription to Mr. Ferguson, who translated it as follows: "Here was lost the ship *Sao Gonzalo* in the year 1630. They made [built] two boats . . . ?" An account of the fleet of which the *Sao Gonzalo* formed a part is given in an old MS in the British Museum, a transcript and translation of this being sent by Mr. Ferguson. The wreck occurred at Bahia Fermoza, now Plettenberg Bay, and the stone had originally marked the spot. Some of the present inhabitants of Plettenberg Bay remember a stone having been sent to Cape Town, and it is most probably this so-called Mossel Bay stone.—Dr. Gilchrist read a paper on, and showed a specimen of, a new Aplysia. The new species (*Paraplysia Lowii*), found at East London, is the third known one of the group of the Tectibranchiata, characterised chiefly by the peculiar position of the rhinophora. It differs from the other two species, *P. piperata* (Smith) and *P. monhoti* (Gilchrist) in several features which have been supposed to be characteristic of the genus Paraplysia proposed by Pilsbury.—Messrs. Rogers and Schwarz gave an account of the "Orange River Ground Moraine" in the neighbourhood of Prieska. Sections near Prieska show an ancient morainic conglomerate passing underneath the so-called Kimberley shales, and lying unconformably on the older Jasper rocks, quartzites and granite. The conglomerate contains numerous striated boulders, and the underlying rock often presents a rounded, scratched surface, which frequently forms distinct *roches moutonnées*. The ice passed from north to south. The authors could not say certainly what the exact relation of this conglomerate to the Dwyka conglomerate is, but are of opinion that it partially at least represents the land-formed ground moraine of the ancient glacier whose water-borne detritus has elsewhere formed the Dwyka conglomerate. The paper was illustrated by photographs and specimens of the striated boulders and floor.—An account of the earthquake of September 15, 1899, presented by the secretary, was taken as read.

DIARY OF SOCIETIES.

THURSDAY, JANUARY 4.

ROYAL INSTITUTION, at 3.—Fluids in Motion and at Rest: C. V. Boys, F.R.S.

RÖNTGEN SOCIETY, at 8.—The Interpretation of Skiagrams: Chisholm Williams.

FRIDAY, JANUARY 5.

GEOLOGISTS' ASSOCIATION, at 8.—Our Older Raised Beaches: Address by Sir Archibald Geikie, F.R.S.—A New Rhætic Section at Bristol: W. H. Wickes.

SATURDAY, JANUARY 6.

ROYAL INSTITUTION, at 3.—Fluids in Motion and at Rest: C. V. Boys, F.R.S.

MONDAY, JANUARY 8.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—Colour Photography: J. W. Hinchley.—Cinchona: J. M. Vargas Vergara.—Microscopic Character of Vicunna, Camel-hair, and Alpaca: R. M. Prideaux.

TUESDAY, JANUARY 9.

ROYAL INSTITUTION, at 3.—Fluids in Motion and at Rest: C. V. Boys, F.R.S.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Purification of Water after its Use in Manufactories: Reginald A. Tatton.—Experiments on the Purification of Waste Water from Factories: W. O. E. Meade-King.

ANTHROPOLOGICAL INSTITUTE, at 8.30.—The Oak and the Thunder God: H. M. Chadwick.—Notes on some Caves in the Zitzikamma, or Outeniqua District, near Knysna, South Africa, and the Objects found therein: Dr. H. D. R. Kingston.—Notes on Skeletons found in the Zitzikamma and Knysna Caves: F. C. Shrubsall.

WEDNESDAY, JANUARY 10.

GEOLOGICAL SOCIETY, at 8.—On a Particular Form of Surface, the Results of Glacial and Subaerial Erosion, seen on Loch Lochy and elsewhere: Dr. W. T. Blanford, F.R.S.—On the Geology of Northern Anglesey, Part II.: C. A. Matley.—The Formation of Dendrites: A. O. Watkins.

THURSDAY, JANUARY 11.

MATHEMATICAL SOCIETY, at 8.—A Problem in Persistence, illustrative of the Mechanical Theory of Selective Absorption: Prof. Lamb, F.R.S.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Report of the Institution's Visit to Switzerland. The Report will be taken as read, and the discussion will be opened by Mr. Crompton by a Comparison between British and Continental Practice in Electrical Engineering.

FRIDAY, JANUARY 12.

ROYAL ASTRONOMICAL SOCIETY, at 8.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Theory of Structures and Strength of Materials: Prof. T. Claxton Fidler.

CONTENTS.