Nature

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"*To the solid ground*
Of Nature trusts the mind which builds for aye."—WORDSWORTH

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NATURE

A WEEKLY ILLUSTRATED JOURNAL OF SCIENCE.

"*To the solid ground*
Of Nature trusts the mind which builds for aye."—WORDSWORTH.

THURSDAY, MARCH 7, 1912.

SEA FISHERIES.

Sea Fisheries: their Treasures and Toilers. By Prof. Marcel A. Hérubel. Translated by Bernard Miall. Pp. 366. (London: T. Fisher Unwin, 1912.) Price 10*s.* 6*d.* net.

"THE English have long understood that the men of the seaboard are not foreigners, but of the same nation as the men of the cities, the mines, and the fields." So writes Prof. Hérubel in the very complimentary preface to this English edition of his "Pêches Maritimes d'aujourd'hui et d'autrefois." He flatters us somewhat. The heroism, the picturesqueness, and the more striking hardships of fishing, these are pretty well known; but there is little enough knowledge of the working, as opposed to the spectacular, conditions of fishing, and of the fisheries as a trade and an employment. Fishing, to most people, is the special affair of someone else. Nor has the large amount of scientific research into fishery problems been adequately popularised. It has presented, as it were, no report to and for the general public. There is no good bridge between the highly technical Journal of the Marine Biological Association and learned monographs and trade periodicals on the one side, and unsystematic picture-books about fish and fishing on the other. Sharp controversies affecting the livelihood of more than a hundred thousand sea-going fishermen, who land yearly over ten millions' worth of fish, rouse next to no widespread interest, mainly for the reason that so few people know enough about fishing to hold an opinion.

The description given of a companion volume in the "Bibliothèque des Amis de la Marine" applies well to Prof. Hérubel's "Sea Fisheries": —"C'est une œuvre d'intelligente et agréable vulgarisation." It is a work, too, which was as needed in England as in France, and although the author wrote primarily of the French fisheries for his fellow-countrymen, he has so much to say about the English industry, and fishing in any case is so international, that he has produced what is certainly the best book up to the present for giving English readers some precise understanding of their own great fisheries. (But not their small fisheries; his remarks on the French small fishermen, merely transferred to England, are very misleading.) Without undue technicality —and it is so much easier to be technical on technical subjects—he is exceedingly systematic and comprehensive. Starting with the oceanography of the North Atlantic and with a brief survey of fish biology, he works out in some detail the cycle of oceanic life from non-living matter through plankton upwards to food-fishes, and arrives at the conclusion that "fishing-grounds are *regions in unstable equilibrium, when* [*where* in the French] *there is an encounter of two critical conditions,* one biological and the other oceanic"; or where, in other words, the oceanic conditions, such as meeting currents, with a consequent abundance of plankton, and contiguous breeding-grounds and nurseries, are favourable to fish-life, and where, in addition, the struggle to live amongst fish has a favourable issue for the edible species.

It so happens that these conditions are to be found together only where the sea is not too deep for fishing on the so-called continental plateaux. After considering the effect of fishing on the unstable equilibrium, Prof. Hérubel proceeds to lay down the law on fishery problems and regulations, and it may be said at once that his views on these

subjects are far more questionable than the view which he presents of oceanic life and fishery operations.

In the second section of the book—and it is this which makes the work so unusually complete—he deals with the human side of the industry; with the fishermen as an integral part of it; with social life on the coast, the chief fishing ports, boats and gear, fishermen, profits, and distribution. Here his recommendations rest on a sounder basis. The scandalous toll taken by the middleman and the imperfections of transport cannot but strike any investigator in England no less than in France; nor can the fishing industry become really prosperous for the fishermen producers as well as for its horde of middlemen until its amazing abuses, its fluctuations and consequent gambling on the markets, are taken firmly in hand. All efforts to improve the fisheries must be more than futile so long as neither the fisherman nor the consumer stands to obtain any of the benefit.

It is a point insufficiently recognised by Prof. Hérubel. He has apparently been misled by the magnitude and the huge turnover, the confusing noise and hustle, of the English capitalistic steam fisheries; so much so, indeed, that he insists on his countrymen adopting their methods, though later on in the book he seems to admit that the more co-operative German and Danish methods are even better. "For one step taken by the French the English take fifty and the Germans a hundred." I do not observe (from his bibliography) that he has studied the 1904 report of the evidence given before the House of Lords Committee on the Sea Fisheries Bill. Had he done so, he could hardly have helped moderating his animus against small fishermen and his desire to suppress them altogether; for it was there conclusively shown that immature flat-fish do at certain ages and seasons congregate on the extra-territorial fishing grounds, and that the destruction of them inshore by all the small fishermen put together is an almost negligible factor compared with their wholesale destruction by the great steam fleets. It is impossible to avoid thinking that Prof. Hérubel's inordinate admiration for the steam fishing companies has led him to take sides with them, and to base his recommendations on the incomplete scientific hypotheses which happen to be favourable to their interests.

As soon, in fact, as incomplete scientific investigations are embodied in recommendations and regulations affecting the livelihoods of men, we meet with the question of fictitious accuracy in an acute form. An average, for instance, is not a substantive quantity, and is not used as such in scientific work; it is only valid for purposes of comparison with other averages similarly obtained. But when it is used in the framing of fishery regulations, its non-substantive character should be plainly realised, the more so since minor legislating bodies are always only too anxious to shelve their responsibilities on their scientific advisers.

Prof. Hérubel affirms that the flounder is adult (*i.e.* can reproduce itself) at $3\frac{1}{8}$ in., the sole at $5\frac{1}{10}$ in., the turbot at $5\frac{1}{2}$ in., &c. The average sole may be adult at $5\frac{1}{10}$ in.; but the average sole is a fiction; soles themselves are adult at somewhere about that size. Or to take a more striking example, Prof. Hérubel states that "400 Iceland herring will fill a barrel, while 800 Channel herring are required"; and that "the herring of one region never show themselves in another region—at all events, not in the form of shoals." Channel herrings do average somewhere between 700 and 800 to a barrel; but as a statement of fact, and not of average, Prof. Hérubel's figures are simply untrue; last winter I could scarcely pack $600\frac{1}{2}$ of Channel herrings into barrels which, this winter, were not properly filled with 900. (It may be worth while to state that a hundred of herrings in Channel ports is 120 fish, and on the barrels a hundred and a half is written $100\frac{1}{2}$.) Suppose, then, it were a question of forbidding fishermen to catch Channel herrings on account of their small average size. Obviously a regulation founded on the average figures would be as remote from actual fact as the much-advertised mean temperature of a certain seaside resort, where excessive heat in summer and withering east winds in the winter combine to produce an *average* temperature that would be delightful to live in if it ever existed there. In a like manner, by using averages and by exchanging terms which are not interchangeable, Prof. Hérubel arrives at the astonishing conclusion that the British fisherman "gains more than *twice as much* as the French fisherman." He does not, of course. He may catch more than twice the worth of fish, but very little of the excess is actually pocketed by himself.

Figures of fictitious accuracy, valid in scientific work, where they are compared one with the other, but not valid in their bearing on human life, are now so much in vogue—not only for framing fishery recommendations—that means should be taken more carefully to define what might be called their human validity. Had Prof. Hérubel done so, his "Sea Fisheries" would have been authoritative throughout instead of authoritative in its presentation, but extremely debatable in some of its recommendations, more especially as regards the small fisheries.

STEPHEN REYNOLDS.

DESIGN IN ILLUMINATION.

Principes de la Technique de l'Éclairage. By Dr. L. Bloch. Translated by G. Roy. Pp. 183. (Grenoble: Jules Rey; Paris: Gauthier-Villars, 1911.) Price 5 francs.

THIS book is a translation of Dr. L. Bloch's "Grundzüge der Beleuchtungstechnik," and although an interval of four years separates the original from the translation, the work was worth doing, as the admirable treatment accorded the subject by Dr. Bloch will secure a prominent place for his treatise in the literature of the subject for a long time to come.

The subject-matter is in strict accordance with the title, a condition not too closely observed in some text-books on illuminating engineering. The author has devoted his attention almost entirely to the development of methods of design of lighting installations from given data, whereby the results in illumination and costs can be predicted with a reasonable degree of certainty.

In the first chapter fundamental quantities and their relations are clearly and accurately dealt with, the idea of luminous flux in particular being elucidated by a material analogy, which will carry conviction to a far larger number of readers than will the hardly worked analogy with magnetic flux. The author uses throughout the photometric notation of the Geneva Congress of 1896.

Methods for the determination of mean spherical intensity from polar curves of intensity are briefly described in the second chapter, including the author's modification of Rousseau's construction, which adapts it for rapid calculation, but the equally convenient graphical method due to Kennelly is not mentioned.

Some general considerations with regard to exterior and interior lighting bring the third chapter to a conclusion, great stress being rightly laid on the importance of mean horizontal illumination as a factor in design.

The real business of the book begins in the fourth chapter. A method is here given by which the integral of the Rousseau curve for a given light source over the lower hemisphere is made to supply material for a table of total luminous flux emitted under any angle from the vertical to the horizontal.

A number of such curves are developed, each from the average polar curve of luminous intensity of a specified type of source, and all being reduced to the same value of mean spherical intensity. With the help of these tables, the cosine law, and some experimental data on reflection coefficients obtained by the author, a complete method of design is elaborated, applicable to most conditions in modern lighting. The author's justification for his broad generalisations and approximations appears from the comparatively close agreement existing between his observed and calculated values of illumination in examples taken from his practice in the street lighting of Berlin.

Photometry is dismissed at the beginning of the fifth chapter with little more than a description of the Brodhun illumination photometer as used by the author on the Berlin streets. This is followed by a description of a method for reducing to a minimum the number of street observations necessary for the determination of the value of the mean horizontal illumination.

The sixth and last chapter is devoted to indirect lighting, and, in spite of obvious difficulties, it is shown from actual examples that the formulæ and methods already devised are still able in certain cases to give fairly accurate results. It is not easy, however, to follow the author in his contention that the difference in cost between direct and indirect lighting for a given effect achieved may be in many cases of very small moment.

The book is a successful attempt to place the design of illuminating installations in a position comparable with that held by design in other branches of engineering.

THE FACE OF THE EARTH.

La Face de la Terre. By Prof. Ed. Suess. Vol. iii., pt. 2. Pp. xii + 531–956, 2 maps, 124 figs. (Translated under the direction of E. de Margerie.) (Paris: Armand Colin, 1911.) 12 frs.

THE present instalment of the French edition of Prof. Suess's great work includes only the first half of the final volume. It consists of translations of chapters x.–xvi., which deal with the western representatives of the Altaid mountain system of Prof. Suess, and with the Alps, Atlas, and various related mountains, which are all attributed to foldings within areas surrounded by an Altaid framework. The last chapter deals with the North Atlantic area, including Iceland and Greenland.

As the original has already been reviewed in NATURE, it is unnecessary to reconsider the problems dealt with in the work. The chapters have been translated by MM. H. Baulig, Ch. Jacob, and P. Lemoine; the volume is edited by M. de Margerie, who is to be warmly congratulated on the great service he has made to students of Prof. Suess's work by this accurate and scholarly translation, and by the issue of this well-illustrated edition of the book.

The study of the work requires such frequent reference to geological maps, of which the original edition contains so few, that it is difficult to read except in a geological library. M. de Margerie's

edition is, however, so richly illustrated by excellent maps and sections that the book is complete within itself. The German edition of the part here translated is illustrated by one plate and twenty-three figures. To these, M. de Margerie has added three plates and 101 figures, and, as many of them have been redrawn for this edition, they are often clearer than the originals. Moreover, many new additional references have been added and occasional explanatory notes, which are all enclosed within square brackets. Amongst these additions the bibliography of the Caucasus and the footnotes on Algeria are especially useful. Among the most important of the new illustrations is a valuable coloured geological map of the western Atlas. M. de Margerie's edition forms an atlas of diagrammatic sketch maps of the countries discussed. The maps are artistically excellent, but they sometimes follow the current, but inconvenient, practice of translating place names. It is no doubt difficult to decide when the translated form of a proper noun has become so widely used that it would be pedantic not to accept it. Nevertheless, it would be generally convenient if the number of such place-names were restricted as far as possible. Thus, such cases as the use of Terre de Grant for Grant Land render the index less useful to foreign students, and the adoption of François, instead of Franz, for a locality named after the Austrian Emperor tends to conceal the history of the name.

J. W. G.

DARWINISM IN THE LIGHT OF MODERN RESEARCH.

Die Abstammungslehre: Zwölf gemeinverständliche Vorträge über die Deszendenztheorie im Licht der neueren Forschung. By O. Abel, A. Brauer, and others. Pp. iv+489. (Jena: Gustav Fischer, 1911.) Price 11 marks.

THE handsome volume issued by the Society for Natural Science in Munich (Münchener Verein für Naturkunde) is a striking proof of the breadth of Darwin's knowledge and of the many-sided character of his researches. The volume contains twelve papers relating to subjects dealt with by Darwin in establishing his theory of evolution; but while Darwin dealt with all of them single-handed, each of the contributions to this volume is the work of an expert. The first paper, an introduction to our present knowledge of evolution, is written by Prof. Richard Hertwig, of Munich, who gives a very clear account of the work and beliefs of Darwin's predecessors, especially of Cuvier's position as regard evolution. The second and third papers are written by Prof. Richard Goldschmidt, of Munich, and relate to the origin of species in the light of our present knowledge of heredity. In the fourth, by Prof. Richard Semon, the inheritance of acquired characters is discussed; the author thinks these may be inherited, but he employs the term inheritance in a limited sense. In the fifth, Dr. Paul Kammerer, of Vienna, recapitulates the chief facts in support of Darwin derived from experiments in breeding. The position of natural selection as a factor in evolution is the subject of the sixth paper, by Prof. Franz Doflein, of Munich.

Prof. August Brauer, in the seventh paper, gives the evidence arising from our modern knowledge of the geographical distribution of animals; while the additional evidence afforded by modern palæontology by Dr. Edgard Dacqué, of Munich, constitutes the eighth paper. Prof. Abel, of Vienna, writes the ninth paper, and describes the various fossil forms which have been discovered since Darwin's time, and their bearing on our knowledge of the evolution of the higher vertebrates. The bearing of recent discoveries in comparative anatomy on the theory of descent is related by Prof. Otto Maas, of Munich (tenth paper); while Prof. Karl Giesenhagen writes the eleventh, on the evolution of plant forms.

The last and twelfth paper occupies a third of the volume. It is written by Prof. Hermann Klaatsch, of Breslau, and is entitled by him "The Place of Man in Nature." Prof. Klaatsch, who deals with the descent of man, unlike the other contributors to this volume, is not content by a mere statement of the progress made since 1871; he brings forward a new genealogical tree for man and the anthropoid apes. Like Darwin, he regards man as derivative of the same stem as the anthropoid apes, but differs in supposing that man has retained the characters of the common stock to a greater degree than the anthropoids have.

Those who wish to examine a full statement of Prof. Klaatsch's theory of man's origin will find it here. In Prof. Klaatsch's opinion, the modern population of Europe is formed by the mixture of at least two stocks; one of these was evolved in common with the orang and entered Europe through Asia, while another human stock was evolved in common with the gorilla and entered Europe from Africa. In this way he accounts for the two prevailing types of nose among modern Europeans. The prominent or "Grecian" nose he supposes to be derived from the human "gorilloid" stock, while the australoid nose—of which he cites Darwin's nose as an example—came into Europe by the Eastern or "orangoid" stock. It is difficult to believe that Prof. Klaatsch is really quite serious in his contribution to "Die Abstammungslehre."

A. K.

OUR BOOKSHELF.

Jelinek's Psychrometer-Tafeln. Anhang: Hygrometer-Tafeln von J. M. Pernter. Herausgegeben von W. Trabert. Sechste Auflage. Pp. xii+129. (Leipzig: W. Engelmann, 1911.) Price 7 marks.

JELINEK'S psychrometer tables are among the best known of the many humidity tables in use on the Continent. Originally prepared by Jelinek from the earlier tables of Regnault and Wild, the work has been successively re-edited by Hann and by Pernter, and now we have a further revision undertaken by Hofrat Trabert, the present director of the Austrian meteorological service.

The new edition differs from its predecessor mainly in the method of treatment of the wet-bulb readings at temperatures below the freezing-point. The values of the saturation pressure of water vapour used hitherto were those for vapour in equilibrium with supercooled water, although in practice the wet bulb is normally coated with ice. The present edition has been amplified by the addition of a table of saturation pressures of water vapour in equilibrium with ice, taken from the results of Scheel and Heuse, and on this table has been based a new set of tables for finding the vapour pressure and relative humidity from readings of dry and wet bulb thermometers at temperatures below the freezing-point when the wet bulb is covered with ice. The results for higher temperatures have been entirely recalculated, but their general arrangement remains unchanged.

The tables differ from most humidity tables in general use in that allowance is made in them for variations of wind velocity. The figures as printed are applicable to the readings of screened thermometers under conditions of light or moderate wind, but by the application of simple corrections to the wet bulb readings they can be rendered applicable on the one hand to readings in still air, and on the other to readings taken during gales or strong winds, or with an aspirated psychrometer such as the Assmann instrument.

Peeps at Industries: Sugar. By Edith A. Browne. Pp. vii+88. (London: A. and C. Black, 1911.) Price 1*s.* 6*d.* net.

THIS little book is the first volume of a series intended to deal with industries in the same way as "Peeps in Many Lands" has dealt with countries. The general get-up is attractive, the illustrations are good, and the reader is never fatigued by having too much serious matter presented to him on any one page. The whole ground is covered, both beet and cane sugar coming within the purview of the author, and the descriptions range from an account of a Demerara estate to a Belgian sugar factory and a London refinery. The style of the book may be judged by the following quotation:—"Sugar is hatched from germs which inhabit the sap of certain plants. In the birth stage it takes the form of tiny grains. I am going to tell you quite simply and briefly the way in which the germs become solid little grain bodies, and in the course of the story I shall answer many of the questions with which you are now bubbling over; sweep away, I hope, most of the difficulties that are now puzzling you."

We are not sure that the ordinary reader will quite catch the idea the author wishes to convey, but she becomes much more lucid in writing about the social aspects of the industries as distinguished from the more purely technical side. The descriptions of the sugar plantations, of the school for the negroes, and of Georgetown have an air of reality that cannot fail to appeal to the reader, whilst the accounts of the milling and extraction processes are equally attractive. Nor are economic questions left untouched, and although no actual tables of statistics are given—they would indeed have been out of place in a volume of this nature—the author succeeds in conveying the essential facts relating to the economic position. Altogether the little book is one that will give the intelligent child the sort of information he wants about the subject.

Photographic Lenses: A Simple Treatise by Conrad Beck and Herbert Andrews. Seventh edition, completely revised, with index. Pp. 324. (London: R. and J. Beck, Ltd., n.d.) Price 1*s.* net.

MANY thousands of this volume having been sold in the previous editions, there is but little need to describe its scope. It will be sufficient to say that the authors do not intend in it to give a full explanation of the laws that underlie the construction of photographic lenses, but rather to provide a practical guide for the user of lenses that he may be able to use them to the best advantage. The volume is excellently illustrated with diagrams that make clear the principles of elementary optics, the construction of various objectives, the comparative results of their tests, and also examples of the actual work that they enable the photographer to do. For those who wish to go a little further into the subject there is an appendix on "Equivalent Planes," and a second appendix in which a lens-testing optical bench is described, with the manner of using it. The lenses illustrated and referred to are all of Messrs. Beck's manufacture, but that fact does not, in a practical sense, limit the usefulness of the book. The present edition is brought up to date, especially with regard to recent anastigmats, and it is provided with a very good index.

Practical Botany. By Dr. F. Cavers. Pp. xvi+408. (Cambridge: University Tutorial Press, Ltd., 1911.) Price 4*s.* 6*d.*

TAKING a general view, there are four different sections recognisable in this students' practical botany: histology is placed first, then follow physiology of growth and nutrition, physiology of movement, and finally a sketch of practical work on selected cryptogamic types. There is, of course, no reason why teachers should begin with histology; on the contrary, experience points to a

beginning with the seed and germination. Dr. Cavers lays some stress on the second chapter, which is intended to impress a more thorough knowledge of the organic products in plants. Seeing that the real aim of students' courses is rather to teach general methods and provide training than to implant facts, tests for proteins and other complex substances are much less valuable than the more tangible experiments of a physical nature.

Except in this matter, there is no hesitation in recognising that the author presents a remarkably clear and informative series of experiments. There is always satisfaction in experiments requiring simple and natural material, as in the test of a living turnip with beetroot juice, but Dr. Cavers on the whole favours the view that there is a necessity for specially designed apparatus capable of yielding exact measurements, in which connection he directs attention to several instruments designed by Prof. Ganong. An appreciable amount of generally unknown detail is supplied in the life-history of Pellia and Funaria, and otherwise this section is no mere repetition of available information. Teachers will be well advised to consult the book before drafting their physiological courses, as they are tolerably certain to discover suggestions or new experiments.

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.*]

Heredity.

So long as naturalists persist in using ill-defined terms, the meaning of which they have not clearly thought out, the controversy about the inheritance of so-called "acquired characters" is bound to be sterile and interminable. If it be once granted that organisms are the product of the interaction of two sets of factors—the factors of the inheritance and the factors of the environment—it becomes obvious that not only every organism, but every "character" of an organism, must be the result of both sets of factors. And if by "character" we mean any such resulting structure or property as it appears to our senses, as we see it before us, then it becomes manifest that no character can be due wholly to inheritance or wholly to environment. The very words "acquired character" involve a fatal fallacy—suggesting as they do that one character may be more acquired than another. Since such wholly acquired characters do not exist, it is waste of time to discuss their possible inheritance.

Even Dr. Reid, in his letter in last week's NATURE, does not entirely escape from this logical error when he uses the word inheritance for the transmission of acquirements (characters) in unicellular organisms. It is a return to the vague, popular use of the term which would inevitably lead us back into the old tangle of inconsistencies. The biologist may define inheritance as the transmission of hereditary factors—it is not ready-made characters which are inherited, but the factors which help to produce them. The transmission in a protozoon of the characters of its parent is no more inheritance in the strict biological sense than is the transmission of the eggshell and albumen from the fowl to the chick, or of money from father to son.

Variation may be caused by changes in the environment giving rise to "modification," or by changes in the inheritance (the totality of the hereditary factors) giving rise to "mutation." Changes in the inheritance are due to the rearrangement of, addition to, or subtraction from the factors of inheritance. Ultimately these changes must be referred to the environment, and it is only when something from the environment thus alters or enters into the inheritance that mutation can occur.

It follows that if certain observations seem to show that "acquired characters" are transmitted by true inheritance, either they must be capable of some other interpretation, or our premise that every organism is the resultant of two sets of factors must be wrong. No escape from this alternative seems possible.

The dogmatic tone of this letter will, I hope, be forgiven me, as it has been assumed merely for the sake of brevity. E. S. GOODRICH.

Merton College, Oxford, March 1.

Mars and a Lunar Atmosphere.

IN NATURE, February 22, p. 565, reference is made to an interesting observation by Prof. Luther, of the Düsseldorf Observatory. The note states that he saw the half of the disc of Mars nearest the moon become green just before occultation on December 4, 1911, and he suggests that this may have been due to a lunar atmosphere. The time was 16h. 40m. (Greenwich mean time), and I notice that the moon was full at 14h. 52m. on December 5, so that, at the time of the observation, the unilluminated crescent of the moon towards the planet must have been extremely narrow, so that the illuminated part of the lunar disc must have been quite close to the planet.

Now no refracting telescope is perfectly achromatic, and as one of the residual colours is green, it seems to me possible that this colour may have been due to moonlight imperfectly achromatised. It may also be suggested that the reddish colour of Mars might lead to the focus of the telescope being different for the planet and the moon. Another suggestion is that the colour of the planet might give rise to a complementary tint.

Turning to the date of Prof. Luther's previous observation, October 16, 1902, I find that the moon was full on that very day, and this seemed to link the two observations together, both being associated with a nearly full moon.

But, to my surprise, I found, on consulting the Nautical Almanac table of occultations, that no occultation of Mars, or of any planet, is set down for October 16, 1902, and, on looking up the positions of the moon and of Mars, it is obvious that none could have occurred, as they were distant in R.A. by some nine hours. It is evident then that there is some mistake in the earlier date, unless it is meant to apply to some small stars in Pisces.

I observed with a refractor the disappearance occultation of Mars at the dark limb of a moon rather more than half-full in the early morning of January 29 this year, but saw no trace of any green colour on the disc of the planet.

C. T. WHITMELL.

Hyde Park, Leeds, February 26.

The Teaching of Mathematics.

IN an article entitled "The Teaching of Mathematics" in NATURE of November 30, 1911, considerable space is devoted to a memorandum written by me for

the Department of Public Instruction of New South Wales, to accompany and explain the programmes for the mathematical classes in the high schools recently established in this State. Regret is expressed by the writer of that article that New South Wales "has been frightened by difficulties which were bound to arise in a period of transition, into going back to the old methods instead of boldly remedying the evil by helping all teachers to get the spirit of the new methods."

The point at issue is the treatment of the fundamental theorems of congruence, parallels, and the angle-sum for a triangle, in the course of deductive geometry given to pupils in these high schools. In the programmes, as issued, the teachers are advised to follow Euclid's method (or something of the same nature) in these fundamental theorems. The Board of Education circular, from which we have ventured to differ in this particular alone, recommends that these results be obtained by induction and experiment.

It seems proper that your readers should be aware of the following facts:—

(i.) The course of geometry in question is not meant for children of twelve years of age and under, as the writer of your article seems to assume.

Pupils enter these schools after completing a full course of primary education. Their age at entrance varies from thirteen to thirteen and a half.

(ii.) Before entering the high schools they have had a full year's work at geometry. In this preliminary study the newer methods are fully employed; the results are obtained by induction and experiment, and a great part of what the Board of Education circular recommends is adopted. However, the box of mathematical instruments does not hold sway to the entire exclusion of theoretical work.

(iii.) Although it has been thought advisable to ask for some uniformity of treatment in these early theorems in the deductive course, when this stage is past the fullest amount of freedom is granted.

There is no doubt that experience will show that some modifications in the syllabus are necessary. Some of the points mentioned in your article had already been noted as requiring alteration, and the suggestions which it contains will certainly receive the careful attention of the proper authorities. But the decision with regard to the earlier stages of the geometry course was made only after the fullest consideration. For this reason it is to be regretted that it has been, to some extent at least, misunderstood by the writer of your article.

Sydney, January 10. H. S. CARSLAW.

IN spite of Prof. Carslaw's assurance that pupils on entering secondary schools have reached the age of thirteen or thirteen and a half and have had a full year's work at geometry, the writer of your article feels most strongly that it is extremely unwise to impose on them in their first year at the secondary school a logical treatment of the fundamental theorems of congruence and parallels. Anyone who has had much experience of teaching pupils of that age knows how difficult it is to teach this work and how little impression it makes except on a very small minority; on the other hand, if these theorems are frankly assumed (after the pupils thoroughly understand their meaning) the rest of the geometry usually done in secondary schools can be treated logically, and the vast majority of pupils will get a proper grasp of the ideas of logical geometry. In the latter case the foundations are broad and the structure is firm at every stage; if the fundamental theorems are treated logically, an attempt is made to build on a narrower base, but in the majority of cases the lower stories of the structure are insecure.

The writer of your article must still regret the attitude taken up by the New South Wales authorities on this point. R. Y. S.

The Isothermal Layer.

IN reading Dr. Evans's reply to my letter in NATURE of January 25 with regard to the isothermal layer, I was specially interested in his reference to radiation of heat from orbital interplanetary matter as a probable climatic factor, because in *Symon's Meteorological Magazine* of February, 1911, I suggested that the recurrence year after year of warm and cold periods, first directed attention to by the late Dr. Buchan, may be attributable to modifications in a screen of cosmic matter, such, for instance, as that from which the zodiacal light and the Gegenschein are reflected.

I mentioned in a later number of that magazine that my own observations of the light in tropical latitudes, extending over several years, conveyed to me the impression of a ring of cosmical bodies encircling the earth about the zodiac.

For evidence of the isothermal layer at the equator the report of Prof. Borson on the aërological expedition of the Royal Prussian Aëronautical Observatory to East Africa in 1908[1] may be quoted. In this report at least two instances are recorded of balloon ascents near the equator in which the isothermal was reached: on August 30, at a height of 17·3 km., when a temperature of −82·5° C. was registered, and slightly lower temperatures at higher elevations; and on September 5, at 15·4 km., temperature −70·3° C., slight inversions being registered at greater altitudes.

The greater height of the isothermal in equatorial regions may be due to strong convection currents, as Mr. W. H. Dines supposes,[2] even though the origin of the layer be attributable to reflected heat from interplanetary matter. CAMPBELL HEPWORTH.

2 Amherst Road, Ealing, W., February 18.

St. Elmo's Fire.

ON Thursday evening, February 22, about 9.20 p.m., whilst traversing a country road which crosses the head of Carr Wood, a well-wooded clough in the neighbourhood of Heywood, near Rochdale, I was fortunate enough to witness a most unique phenomenon. The road in question skirts a hill on the left-hand side, and the opposite side, at this particular place, overlooks a small plateau which runs along the edge of the clough.

During the day we had had much rain. The atmosphere was now very close and heavy, and everything was ominously silent, even the usual *breeze having disappeared.* Suddenly, without the slightest warning, there appeared an area of faint electric-blue light, almost circular in shape and about 70 yards in diameter, which covered the plateau. The edge of this area was not more than 10 yards from where the observations were made. The whole electric field seemed to be three or four feet above the ground-level, and was in a state of intense agitation. Within the general blue ground there appeared flashes of a more decided blue, very similar in character to forked lightning, but not nearly so distinct.

1 "Results of Investigations of the Royal Prussian Aeronautical Observatory at Lindenburg." Edited by the Director, Doctor Richard Assman.

2 "The Vertical Temperature Distribution in the Atmosphere over England, and some remarks on the General and Local Circulation." By W. H. Dines, F.R.S., Phil. Trans. Royal Soc., Series A, 211, page 269.

Sounds of two distinct types accompanied the agitation. The first consisted of whistling sounds, like that of numerous long-lashed whips swishing rapidly through the air, or perhaps that of the whistle of bullets. These sounds seemed to be associated with the general field of fainter blue.

The other sounds consisted of the characteristic crackle of electricity, and these became so numerous as they approached the climax that they resembled a magnified rustle. These cracklings seemed to be associated with forked discharges, and were probably due to the more distinct flashes coming into contact with the bushes which surround the plateau.

The phenomenon lasted about fifteen to twenty seconds, and disappeared as spontaneously as it had arisen. J. McV. M.

THE phenomenon described above appears to have been the luminous discharge known as St. Elmo's Fire. This takes place usually from pointed objects, and possibly the tree in your correspondent's sketch (not reproduced) played a part in the production of the phenomenon. The colour associated with St. Elmo's Fire depends upon the character of the discharge. It is blue when the earth is kathode and red when the earth is anode.

The discharge is not infrequent in mountainous countries. E. GOLD.

Hampstead Garden Suburb, N.W.

Earthworms and Sheep-rot.

EVERYONE who is interested in agriculture is aware that liver-fluke or sheep-rot is popularly associated with one or another of our common plants. Halliwell gives "sheep-killing" as a name for "the herb pennywort." In Britten and Holland ("English Plant Names") we find sheep-rot, sheep-bane, and other similar terms, and we are told that such plants as *Pinguicula vulgaris*, L., and *Hydrocotyle vulgaris*, L., are known by these popular names because of a supposition that these plants cause the liver-rot in sheep, which disease is often prevalent on wet land where the plants grow. The authors further inform us that "It is now ascertained that the liver-fluke, which always accompanies rot in sheep, exists in one of its stages as a parasite in the bodies of small water snails, which, in wet weather, creep upon the leaves of marsh plants, and are eaten by the sheep with the herbage. It is therefore with some reason that such names as 'Flowkwort,' 'Sheep-killing Pennygrass,' and 'Sheep-rot' have been given to these marsh plants."

Withering ("British Plants") has a similar note. Speaking of Pinguicula, he says, "The plant is generally supposed injurious to sheep, occasioning a disease which the farmers call 'rot.' But it may be questionable whether the rot in sheep is so much owing to the vegetables in marshy grounds, as to a flat insect called a fluke (*Fasciola hepatica*), which is found in these wet situations adhering to the stones and plants, and likewise in the livers and biliary ducts of sheep that are affected with the rot. From experiments conducted with accuracy, it appears that neither sheep, cows, horses, goats, nor swine feed upon this plant."

During a recent visit to Cumberland, however, the matter was presented to me in a new light. I was conversing with a farmer on the economy of the earthworm, when my friend protested that they were responsible for rot in sheep. His explanation was as follows. The worms make casts in spring, known in the north as worm-sprouts, just as in the eastern counties they are called worm-puts. On these fine young plants grow rapidly, proving very attractive to sheep. When the sheep feed on this tender grass they are liable to suffer from fluke, and it is therefore maintained that the fluke, or rot, is in some way due to the earthworm.

It would be interesting to know more about this popular fancy, and to learn whether anything is being done to help farmers to a more correct knowledge of the facts. HILDERIC FRIEND.

Swadlincote, Burton-on-Trent, February 17.

Meteor-showers.

I AM sure that a great many of your readers who are interested in the subject of meteors have noticed the letters of Mr. John R. Henry which have appeared from time to time in your columns, but I do not recollect having seen any letter from an observer stating either that Mr. Henry's prediction had been fulfilled or that it had failed. If a shower of the thirty-third magnitude is sufficiently marked to enable three secondary maxima to be fixed with accuracy, one of the third magnitude, such as we are promised at the end of this month (February) ought to be very perceptible indeed. But perhaps the word "magnitude" does not refer to the number of the meteors but to their average mass. If so, how is this mass to be ascertained? Mr. Henry gives us no information as to the part of the sky in which these meteors should on each occasion be looked for. F.R.A.S.

Dublin.

"F.R.A.S." is right in surmising that the magnitude of a shower does not depend upon the number of meteors that may be actually observed, but rather upon the general mass or quantity of matter imported into the atmosphere at the time. This may appear to be a distinction without a difference, but as the number of shooting stars counted by an observer will be influenced by the altitude of the radiant, the clearness of the sky, &c., it is evident that the intensity of the phenomenon cannot be fully measured by such results. It is assumed that the radiant is the same as that usually associated with the time of the year at which the shower occurs.

To determine the absolute mass of a meteor-shower is a somewhat intricate problem, but it is possible to obtain an approximate solution of it by assuming that the portion of the meteor-swarm which enters the atmosphere is moving nearly parallel to the earth's surface, and in being brought to rest puts the surrounding air in motion. There must thus result an atmospheric depression, and given the mean depth and extent of the latter, the mass of the shower may be calculated from purely dynamical principles.

The order of magnitude does not express, as may be supposed, the absolute but rather the relative intensity of a shower, with reference to some other shower which may be regarded as the standard-shower. Thus of the two showers referred to by "F.R.A.S.," one of the thirty-third, and the other at the end of February of the third order of magnitude, the former is of the weakest and the latter of the highest intensity in the whole month. The greater meteoric event, apart from its high intensity, happens to belong to an interesting type or group of meteor-showers, one of which of the tenth order of magnitude occurred in 1908 on September 28, and another of the eighteenth order in 1911, on April 8–9, both occasions being marked by a magnetic and the latter also by a moderate seismic disturbance.

JOHN R HENRY.

THE AMERICAN LOBSTER.[1]

THE work referred to below is "in a measure both a revision and an extension" of Prof. Herrick's well-known memoir on "The American Lobster," published in 1896 in the Bulletin of the United States Fish Commission, from which several figures, including three fine coloured plates of larval stages, are reproduced. By far the larger part of the memoir, however, is concerned with the new knowledge of the natural history of the lobster that has been gained during the past fifteen years from the investigations of the author himself and of many other naturalists on both sides of the Atlantic. As Prof. Herrick remarks, "in all probability there is no marine invertebrate in the world which is now better known," and he has rendered a great service to zoology by bringing together a vast amount of information on the habits and mode of life, the reproduction, development, and growth of the lobster, and on the economic and legislative problems relating to its preservation and artificial propagation. Out of the many points of interest discussed only a few can be selected for comment here.

The European and American lobsters are commonly regarded as distinct species of the genus Homarus, but they are very closely related, and, as Prof. Herrick remarks, they "might at first sight be considered as geographical varieties" of a single species. The only structural character which is given as distinguishing the two is the form of the rostrum, which in European lobsters is smooth on the underside, while in American specimens it usually bears a pair of small spines. According to Prof. Herrick, "either one, two, or three spines of inconstant size may be present," and he implies that they may occasionally be absent altogether in American lobsters. Slight differences are said to exist in the larvæ of the two forms, although the author scarcely seems to be justified in stating that the European lobster is hatched "in a stage nearly comparable to the second larva of the American lobster." Even if this were so, however, it would be by no means conclusive as to their specific distinctness, since other cases are known among Crustacea of species (*e.g.* the prawn *Palaemonetes varians*) which differ in their mode of development in different parts of their geographical range. As a mere matter of nomenclature the question is, of course, only of interest to the systematist, but in view of the temptation to fill in gaps in our knowledge of the bionomics of either form by data drawn from the other, it may be of more than merely academic interest to determine as exactly as possible the degree of affinity between them.

Prof. Herrick states of the European lobster that its range in the Mediterranean is limited on the east by the Adriatic Sea, and this agrees with statements in other works of authority. If it be correct, however, it is curious that the species should have been so well known to Aristotle, whose natural history studies were mainly carried on, as Prof. D'Arcy Thompson has recently told us, on the island of Mitylene.

A detailed account is given of the structure and development of the great claws and of the process of autotomy and regeneration as affecting them. An interesting little piece of mechanism is described in the interlocking processes which strengthen the articulations between the basal segments of the limb. In the young lobster, in which the articulation between the second and third segments is movable, processes of this kind are developed on the adjacent margins of these segments. In later stages, however, the second and third segments become soldered together, the junction forming the "breaking plane" at which autotomy takes place, and a new process grows out from the third segment to interlock with one on the first. A full description is given of the torsion of the great claws by which the movable finger comes to lie on the inner side instead of on the upper and outer side as it does in the

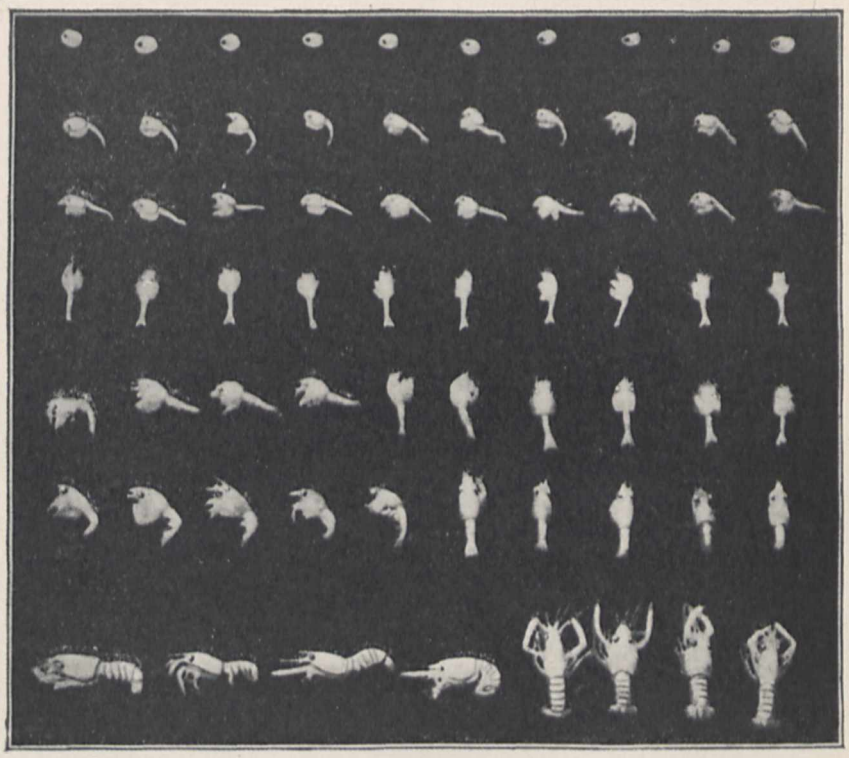


FIG. 1.—Growth stages of young lobsters: *e*, embryo at hatching (July); 1 (first line), first larva, not free from first moult; 1 (second and third lines), first free larval stage; 2, second larva; 3, third larva; 4, fourth stage.

[1] "Natural History of the American Lobster." By F. H. Herrick. Bulletin of the Bureau of Fisheries, vol. xxix., pp. 149–408, pls. xxvii–xlvii. (Washington, 1911.)

two following pairs of legs. The observation of this torsion, however, is not quite novel, for it was briefly but accurately described by Boas in his well-known (but apparently little read) "Studier over Decapodernes Slægtskabsforhold" (Vidensk. Selsk. Skrifter, Kj benhavn, 1880). The periodic arrangement of the teeth on the fingers of the great claws is described, and it is shown to arise in a very simple way by the successive appearance of new sets of teeth between those already existing. Reference is made to Stahr's fantastic opinion "that the æsthetic sense of this self-admiring crustacean is aroused as its eye wanders over the dentate margin of its 'hand.'"

The habits and reactions of the larvæ are dealt with at some length, and many interesting facts are recorded in connection with their swimming movements, food (and occasional cannibalism), colour, and power of colour-change. Even their psychology is not neglected, for it is stated that the "instinct of fear" becomes apparent only at

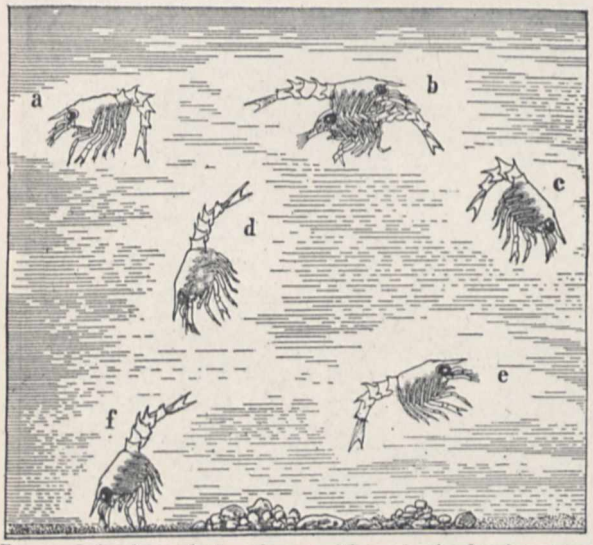


FIG. 2.—Swimming attitudes of young lobsters in the first free stage. *a*, body bent in usual quadrant form; *b*, lobster swimming astride the carcase of another and devouring it; *c*, thoracic legs directed forward; *d*, rising position occasionally assumed; *e*, "floating" position; *f*, too weak to rise.

the fourth stage, when the little lobster prepares to give up its free-swimming life and to seek shelter on the bottom.

Prof. Herrick's remarks on the subjects of protective legislation and artificial hatching of lobsters are worthy of close attention. He strongly advocates the view that a minimum size-limit, such as most lobster-fishing countries have adopted, is ineffective on account of the fact that the smaller lobsters, which alone are protected, are vastly less fertile than the larger individuals. Some striking statistics are given to show the futility of artificial hatching unless the young lobsters are reared through the critical pelagic stages before they are set free.

As is usual with publications of the United States Government departments, the style of printing and illustration forms a pleasing contrast to that of most official publications in this country.

W. T. C.

SCIENTIFIC RESEARCH IN THE SUDAN.[1]

IN reviewing the third report of the Wellcome Research Laboratories (NATURE, June 24, 1909), we suggested that it would be advisable to separate the purely medical subjects from those dealing with agricultural or economic questions and matters of general scientific interest. This has been effected in the fourth report, and we now have two volumes, A, Medical, B, General Science, but the change is accompanied by at least one drawback, viz., that each of the separate volumes is now as large as its parent, and in addition we have a still bulkier review of the literature.

If we may unburden ourself at once of initial criticism, it is that these volumes are too bulky.

Copyright. From Fourth Report Wellcome Tropical Research Laboratories, Khartoum.

FIG. 1.—Sharpened teeth as practised by the Nyam-nyam.

This, we believe, is not entirely due to the number of subjects included, but in part to the diffuse style in which many of the articles are written, and the desire to impart elementary information—a praiseworthy desire, but one we think perhaps out of place in reports dealing with researches. The articles would, in our opinion, be improved by severe pruning. We suspect that there are certain considerations which prevent this, but for

[1] Fourth Report of the Wellcome Tropical Research Laboratories at the Gordon Memorial College, Khartoum, Dr. Andrew Balfour, Director. Vol. A, Medical, pp. 404+xxiii plates+118 figs. Price 21*s.* net. Vol. B, General Science, pp. 333. Price 18*s.* net. Supplement to the Fourth Report, pp 448. Price 15*s.* net. (London: Published for the Department of Education, Sudan Government, Khartoum, by Baillière, Tindall and Cox, 1911.)

the scientific reader, not to mention the reviewer, the gain would be appreciable. The amount of literature put forth is so great that conciseness should be aimed at in the interests of all. Again, although we must express our admiration for the immense amount of labour involved in preparing the reviews of recent advances in tropical medicine, yet we feel certain that this is not the function of the overworked staff of the laboratory, and that they should spare themselves the drudgery and mental effort involved in producing such a work.

In Vol. A, Medical, the first article deals with a question of the first importance, viz., the extent to which sleeping-sickness prevails in the southern portions of the Bahr-el-Ghazal, and the measures

C. G. SELIGMANN. From Fourth Report Wellcome Tropical Research Laboratories, Khartoum

FIG 2.—Dwelling of Shilluk King, Fashoda.

taken to prevent its spread. So far cases have not been detected north of Wandi in the Lado, and in the coloured map this is represented as the distribution of *Glossina palpalis*, but this fly exists also on the bank of the Nile at Kajo-Kaje, south of Rejaf, as was shown later. Inspection posts have been established, clearing operations instituted, and the authorities are keenly on the alert. Whether *Gl. morsitans* in connection with sleeping-sickness is a negligible factor is open to considerable doubt: that it is not so in Rhodesia and Nyasaland, in parts of which we have cases of sleeping-sickness in absence of *Gl. palpalis*, is now established. In these places there appears to be a new species of human trypanosome; whether in the absence of this particular trypanosome, *Gl. morsitans* is free from danger to man remains yet to be definitely proved. In this article we do not see it expressly stated that the thick blood film method was employed for diagnosis, but its great utility and convenience can hardly be denied.

The second article likewise deals with trypanosomiasis, but in regard to animals. Four species occur in the country, viz. *T. brucei*, *T. evansi*, *T. nanum*, and *T. vivax*, but a consideration of the question as to whether these names represent the species present or not involves us in the very difficult problem of trypanosome identification. We cannot enter here into this question, but we would add a word of caution as to the measurement-curve method introduced by Sir David Bruce. The number of trypanosomes counted in one of the curves given is certainly too small, only 150, and as a matter of fact the chart (1910) given of *T. brucei*, though it resembles the earlier chart, bears not the slightest resemblance to the latest chart of this species published by Sir David Bruce.

The director contributes a lengthy paper on spirochætes in fowls, which is exceedingly prevalent, and marshals his evidence in favour of the view that the spirochæte breaks up into granules in the internal organs. His paper on fallacies and puzzles in blood examination will perhaps do some good in preventing the finding of any bits of stained matter in a blood film being recorded as new parasites by those desirous of fame; for in these days the editorial waste-paper basket is not

as large as it used to be, and the publication of rubbishy papers is all too common. Yet, on the other hand, we fear the conscientious tyro will be overwhelmed with all the pitfalls recorded, and perhaps it is not enough emphasised that known parasites when present are easily recognised, and even each new parasite as it is discovered has such definite characters that, as a rule, the question of its parasitic nature is not a very difficult matter.

The existence of kala-azar in the eastern Sudan is a serious condition, for the disease may assume epidemic proportions. Unfortunately, at present little can be effectively done, as the mode of transmission is unknown, nor is treatment of much avail.

We have noted some of the longer and more important articles, but there is a medley of other matter. Worthy of note is the successful treatment by vaccines of two cases of "Veldt Sore." "Tropical Ulcer" seems to be rare, but the condition known as Oriental sore is not uncommon. There are in addition several articles on different aspects of tropical sanitation.

The amount of matter reviewed in the supplement is amazing, and the labour involved must have been very great. We gather from the introduction, however, that this will be its last appearance. While we shall regret its disappearance, yet we feel that the authors are quite right and absolutely justified in their decision.

Volume B, General Science, like Volume A, deals with a medley of subjects: water and soil analysis, research into gum and its relation to bacteria, entomology—it may be noted that a successful larvicidal fish has not yet been found—economic ornithology, poisonous snakes and scorpions, plant pests, municipal engineering, gold-mining in ancient times, and anthropology. The two papers on this last subject are perhaps of the most interest to the general reader, viz. that on tribal customs of the Nyam Nyam and Gour peoples, and that of the Divine Kings of the Shilluk. They are both extremely interesting, but may occasionally shock the hypersensitive. Our illustrations are taken from these two papers.

The volumes are, as usual, profusely illustrated with coloured plates, maps, and text figures, and there are complete indices.

We must express our astonishment at the amount of work done. We feel that the authors give too much of themselves, and that they are overtaxed. Undoubtedly the staff should be increased, and each member be allowed to devote himself to special subjects. It is quite impossible, if the best results are to be got, for a person to be a "factotum."

NOTES.

We are glad to learn that the preparation of a Life of Lord Lister is contemplated. We are asked to say that any letters of scientific interest forwarded to Mr. R. J. Godlee, 19 Wimpole Street, London, W., will be gratefully received for this purpose. If desired, the letters will be returned, after being copied.

It is announced in *The Times* that the Amsterdam General Radium Company has purchased the entire present stock of radium of the Austrian Government.

Lieut.-Colonel D. Prain, F.R.S., director of the Royal Botanic Gardens, Kew, has been elected a foreign member of the Royal Swedish Academy of Sciences, in succession to the late Sir Joseph Hooker.

An interesting collection of photographs by Mr. G. R. Ballance, of St. Moritz, Switzerland, illustrating the scenery on the frontier of Switzerland, France, and Italy, is on view at the Royal Photographic Society's house, 35 Russell Square, W.C. The exhibition is open free to the public, on presentation of visiting card, until April 20.

A series of seven lectures on "Modern Aspects of Helminthology" will be given at the Lister Institute by Dr. W. Nicoll on Tuesdays and Fridays, commencing March 19, at 5 p.m. These lectures will deal with the general outlines of helminthology and with the chief special problems relating to the parasitic worms of man. The course is open, without fee, to all medical men and to others interested in the subject.

On Tuesday next, March 12, Dr. T. Rice Holmes will begin a course of three lectures at the Royal Institution on "Ancient Britain," and on Thursday afternoon, March 21, Dr. F. A. Dixey will deliver the first of two lectures on "Dimorphism in Butterflies." The Friday evening discourse on March 15 will be delivered by Mr. Frederick Soddy, on "The Origin of Radium"; on March 22 by Prof. d'Arcy W. Thompson, on "The North Sea and its Fisheries"; and on March 29 by Sir J. J. Thomson, on "Results of the Application of Positive Rays to the Study of Chemical Problems."

An extra meeting of the Chemical Society was held on Thursday last, February 29, when Sir William Ramsay, K.C.B., F.R.S., delivered a memorial lecture in honour of Henri Moissan, who was born in 1852 and died in February, 1907. In introducing the lecturer, the president, Prof. Percy F. Frankland, F.R.S., stated it was fitting that the lecture held in honour of the discoverer of the most active element should be given by the discoverer of the most inert element. Sir William Ramsay referred to Moissan's early researches on the products of reduction of the oxides of the iron group and to his work on the oxides of manganese, nickel, and cobalt, and on the chromous salts. Moissan's numerous experiments on the compounds of fluorine, a series of researches which culminated in the discovery of elementary fluorine and, finally, of its isolation, and the apparatus used in this work, were described, and reference was made to the researches which led to the discovery of the method of preparing artificial diamonds.

The biology class of the University of Colorado sent Dr. Alfred Russel Wallace, O.M., F.R.S., greetings on his birthday on January 8. The February 2 issue of *Silver and Gold*, a newspaper published three times a week by the associated students of the Uni-

versity, publishes the reply received from Dr. Wallace, in which he says:—"From the day when I first saw a Bee-orchis (*Ophrys apifera*) in ignorant astonishment, to my first view of the great forests of the Amazon; thence to the Malay Archipelago, where every fresh island with its marvellous novelties and beauties was an additional delight, nature has afforded me an ever-increasing rapture, and the attempt to solve some of her myriad problems an ever-growing sense of mystery and awe. And now, in my wild garden and greenhouse, the endless diversities of plant life renew my enjoyments; and the ever-changing pageants of the seasons impress me more than ever in my earlier days. I sincerely wish you all some of the delight in the mere contemplation of nature's mysteries and beauties which I have enjoyed, and still enjoy."

THE Academy of Natural Sciences of Philadelphia will celebrate the centenary of its foundation on March 19, 20, and 21. An important feature of the celebration will be the publication of three commemorative volumes: an index to the scientific contents of the entire series of Proceedings and Journal, now amounting to eighty-five volumes; a detailed history of the academy by the recording secretary, Dr. Edward J. Nolan, of which the Short History contributed by him to the "Philadelphia Founders' Week Memorial Volume" in 1909 may be regarded as a Prodromus; and a quarto volume of liberally illustrated memoirs by members and correspondents. A sufficient number of contributions have been received to guarantee the success of the latter publication, and the general committee has reason to believe that the entire celebration will be an adequate recognition of the honourable record of the society as one of the most efficient agencies in the cultivation of the natural sciences in America during the past hundred years.

A MEETING was held at the Mansion House on February 28 in support of the London School of Tropical Medicine. Mr. Harcourt, Secretary of State for the Colonies, was the principal speaker. He said that in the last seven years the School has received from the Tropical Diseases Research Fund 13,000*l.* for special work in protozoology and entomology, for which separate laboratories in new buildings have recently been provided. The School has managed to save 5000*l.* as the nucleus of an endowment fund, but at least another 20,000*l.* is required to put it on a sound financial basis. It is also desired to raise 10,000*l.* for the provision of additional laboratories and residential quarters. Mr. Harcourt said it may, possibly, be asked why the Government does not itself find the necessary funds. The keepers of the national purse, he pointed out, have not been niggardly in their practical assistance to the work. The Treasury has contributed, and is contributing, for the last five years 1000*l.* per annum to the Sleeping Sickness Bureau; for five years, 1000*l.* per annum to the Entomological Research Fund; for three years, 5000*l.* per annum to Sir D. Bruce's expedition to Nyasaland to inquire into sleeping sickness; and from 1904–7, 500*l.* per annum; and from 1908 onwards, 1000*l.* per annum to the Tropical Diseases Research Fund; this amounts to 8000*l.* a year, in addition to capital donations. In addition, approximately 50,000*l.* has been spent during the last five years in investigation and suppression of sleeping sickness in Uganda.

THE Committee on Science and the Arts of the Franklin Institute, Philadelphia, Pennsylvania, made the following awards of the Elliott Cresson medal on February 7:—Dr. Alexander Graham Bell, Washington, D.C., in recognition of the value of his solution of the problem of the electrical transmission of articulate speech; Dr. S. W. Stratton, Washington, D.C., in recognition of his distinguished and directive work in physical science and metrology, and its application in the arts and industries; Dr. A. A. Michelson, Chicago, Ill., in recognition of his original and fruitful investigations in the field of physical optics; Dr. A. Noble, New York, in recognition of his distinguished achievements in the field of civil engineering; Dr. Elihu Thomson, Swampscott, Mass., in recognition of his leading and distinguished work in the industrial applications of electricity; Dr. E. W. Morley, West Hartford, Conn., in recognition of his important contributions to chemical science, and particularly of his accurate determinations of fundamental magnitudes; Dr. J. F. A. Von Baeyer, Munich, in recognition of the many important results of his extended research in organic chemistry and of his discovery of synthetic processes of great industrial value; Sir William Crookes, O.M., F.R.S., in recognition of his important discoveries in inorganic and analytical chemistry, and of his pioneer work on the discharge of electricity through gases; and Sir Henry E. Roscoe, F.R.S., in recognition of his extended and important researches in the domains of inorganic, physical, and industrial chemistry.

DR. KNIGHT DUNLAP contributes to the current number of *The Psychological Review* an account of some interesting experiments upon the sensibility of the human subject to differences in the rate of succession of stimuli in two regular series of stimuli. One of these regular series is constant, the other is varied, and the two series are presented successively, the subject having to judge which has the faster rate. The rate-threshold thus reached is compared by Dr. Dunlap with the time-threshold, *i.e.* the subject's sensibility to differences in the length of a single interval of time. As might be expected, he finds that the sensibility for rate differences is considerably more acute than that for time differences, at least under the conditions of his experiments. The writer concludes that the rate judgment is not essentially based upon a judgment of individual time intervals. His paper is especially valuable as a record of experimental methods and for careful details of the instruments employed.

FROM Mr. W. Junk, of Berlin, we have received a "Bibliographica Coleopterologica," containing nearly 4000 entries of works and papers devoted solely or partially to beetles. The actual catalogue is preceded by a useful introduction on the faunistic literature of the subject.

CONSIDERABLE interest attaches to the description by Miss D. M. A. Bate in the January number of *The Geological Magazine* of the dentition and other remains of a large mouse (rat, we should have preferred to call it) discovered by herself in a cave on the west coast of Crete. The new species (*Mus catreus*) considerably exceeds the brown rat in size, and may be compared in this respect to the great Gambian rat (*Cricetomys gambianus*); it consequently forms a second instance of a relatively gigantic rodent in the Pleistocene of the Mediterranean islands.

THE fourth number of "Behaviour Monographs," published by Messrs. Holt and Co. at Cambridge, Boston, Mass., is devoted to an account of the ecology of the pond-snails of the genus Physa, by Miss Jean Dawson. From their omnivorous habits, these snails are valuable as purifiers of the ponds in which they dwell. Their own mucus serves to assist in procuring food, since it entraps microscopic organisms of all kinds, which are then devoured by the snails, together with the mucus itself. The rudimentary eyes apparently afford no assistance in procuring food, but the head and fore part of the foot are sensitive to food-stimulus.

A NEW Polypodium from the Panama regions, described by Mr. R. Mason in an extract from the Smithsonian Miscellaneous Collections (vol. lvi., No. 24), is remarkable, because the pinnæ of the sterile fronds are entire, while those of the fertile fronds are toothed or lobed and bear the sori apparently at the tips of the teeth. Another striking feature is the variation in the fronds, due to differences in the pinnæ, which in some cases are entire or once forked, in others much branched; it is suggested that the branching is correlated with injury to the apex of the fronds, which are normally of indeterminate growth.

IN connection with afforestation on the Thirlmere estate in the Lake district, Mr. A. B. Edwards contributes to the Transactions of the Royal Scottish Arboricultural Society (vol. xxvi., part i.) an article containing some useful hints on planting at high altitudes. Three-year-old seedlings were generally selected, and planted in prepared pits. Larch formed the main bulk of the plants, but where shelter was required a belt or intermixture of Scots, Austrian, and Corsican pines has been adopted. For higher elevations fir or spruce is recommended, notably the Menzies spruce. In support of a favourable anticipation of the financial success of operations, the author quotes figures from a plantation in the same district.

THE Upper Rhine, from Basle to Mainz, is one of the chief seismic districts of Central Europe, about 400 earthquakes being recorded there between 1800 and 1895. Of the latest earthquake, that of November 16, 1911, a popular account by W. Salomon is given in *Naturwissenschaftliche Wochenschrift* for February 11. Judging from the area of greatest intensity, there would appear to be two epicentres, one near Lake Constance, the other, from forty to fifty miles farther north, in the neighbourhood of Balingen, Ebingen, and Hechingen. From the frequency of after-shocks in the latter district, and from their absence from the former, however, there appears to be some doubt whether the shock belongs to the class of twin-earthquakes.

IN Heft 5 of the *Mitteilungen aus den Deutschen Schutzgebieten*, the region of the upper basin of the Mungo River, in the Cameroon protectorate, is fully described from the geographical viewpoint by Dr. F. Thorbecke. He deals specially with the higher country round the volcano of Manenguba, which rises to an altitude of more than 2000 metres, and considers it to consist essentially of a crystalline block overlaid by basaltic or trachytic sheets of lava. This seems to have been slowly raised, subsequent faulting and volcanic action having also played an important part in producing the present surface forms. Meteorological observations for 1910 from stations in the Cameroons, Togo, and New Guinea are also contained in this volume.

THE Canadian Naval Service Act having been passed in May, 1910, the Department of Naval Service was forthwith organised with branches dealing with naval matters, fishery protection, tidal and current surveys, hydrographic survey, and wireless telegraphy. Reports on all these for the fiscal year ending March 31, 1911, have been published, and contain many points of interest. The tidal work has been previously mentioned in noticing the tidal tables which have recently been published. Hydrographic surveys were carried out on the Great Lakes, on the Atlantic and Pacific coasts, and in Hudson Bay and elsewhere. Not many details are given of methods and results, but it is stated that the local attraction of compasses reputed to exist in Hudson Bay was not substantiated. Thirty-two radio-telegraphic stations exist, and a scheme has been prepared for the establishment of a system of such stations on the Great Lakes.

IN the November (1911) number of the *Geographische Zeitschrift* Prof. Penck gives a most instructive critical comparison of the three principal German atlases—these three, the hand-atlases of Stieler, Debes, and Andree, are generally considered to stand in the foremost rank of modern topography—and the discussion of the differences between them. He notes the increasing use of the most suitable projections in place of the very limited selection formerly employed, the careful choice of scale, and greatly improved character of the representation of relief. Contour lines or layers of colour might in some cases be utilised, and the great scarcity of physical maps in most atlases, which devote their pages primarily to the distribution of man and his works on the earth's surface, is a matter which calls for consideration. In spite of much recent progress, there is always room for improvement, and there is ample scope for the scientific study of cartography; the same may be said of cartography in this country, where, however, there is much more to be done before an ideal standard is reached.

A HEAVY gale was experienced in all parts of England on March 4 and the following night, when at

Dover the wind attained the velocity of 71 miles an hour. For a long time past cyclonic disturbances have arrived in proximity to our coasts from the Atlantic with considerable frequency, but, due to the persistent high barometer over western Europe, the incoming storm systems have followed a track to the northward, skirting our western and northern coasts. The storm area which arrived on March 4 completely traversed the British Isles, and probably subsequent disturbances arriving will for a time now follow a similar path. In connection with the disturbance, a severe squall, accompanied by thunder and lightning, passed over Kew at 4.30 p.m. on March 4, when the wind attained the velocity of 60 miles an hour, and a similar squall passed over South Kensington at 4.40 p.m., the wind velocity recording 42 miles an hour. At Dover a squall, with the wind blowing 68 miles an hour, was experienced at 4 p.m., and a corresponding disturbance passed over Valencia, in Ireland, at 7.40 a.m., which gives a rate of travel of rather less than 50 miles an hour.

THE past winter, comprised in the three months December, January, and February, proves to be one of the warmest experienced of recent years, notwithstanding the severe frost which occurred at the close of January and at the beginning of February. A summary of the weather for the thirteen weeks ended March 2, issued by the Meteorological Office, shows that the mean temperature for the winter was in excess of the average over the entire kingdom; the greatest excess occurred in the east and south-east of England and in the Midland counties. The aggregate rainfall for the winter was largely in excess of the average over the whole of the British Isles, except in the north of Scotland, where the deficiency amounted to 2·95 in. The greatest excess was 5·3 in., in the south-east and south-west of England. In the Midland counties the excess was 4·3 in., and in the south of Ireland 4·5 in. The rainy days were also in excess of the average everywhere, except in the north of Ireland. The duration of bright sunshine was deficient, except in the north of Scotland, but the difference from the normal was nowhere very large. At Greenwich the mean temperature was above the average in each of the three winter months, the excess being respectively 5°, 2°, and 4°; the mean for the whole period was 42·5°, which is 3° above the normal. There has only been one winter as warm in the last thirty-five years, the mean for the three months being 43·5° in the winter of 1898–9. The rainfall was also in excess of the average in each of the three months, the aggregate excess being 3·3 in. The duration of bright sunshine was in good agreement with the normal.

IN the December (1911) number of the Annals of Tropical Medicine and Parasitology, issued by the Liverpool School of Tropical Medicine, some novel "Tables of Statistical Error" are given by Sir Ronald Ross and Mr. Walter Stott. The tables show, for a given true percentage, how many observations must be made in order that the odds may be $m : 1$ that the observed percentage lies within given limits. The limits taken are ±1, ±2, ±3, ±4, ±5, or ±6 per cent., the odds 99999 : 1, 9999 : 1, 999 : 1, 99 : 1, 9 : 1, and 1 : 1, and the percentages are tabulated by steps of a unit. As the calculation appears to have been made, however, on the usual basis of a normal distribution, it is not clear what meaning can be attributed to the figures given for very low percentages, where the number of observations is not nearly sufficient to justify such an assumption. The tables, which are obtainable as a separate publication, should do much to lessen the publication of results based on quite inadequate statistical data, and thus serve a very useful purpose, but the point to which we have directed attention should have received more attention in the explanatory introduction.

MR. G. R. M. TEMPLE sends us from York a copy of a photograph, here reproduced, which illustrates very clearly the result of the expansion of water by freezing during the recent severe frost. The bottle was filled with clean water and tightly corked; when the water had frozen a stem of ice about 4½ in. in length was found to be projecting from the neck of the bottle, as shown in the illustration. This stem represented, of course, the increase of volume undergone by the water in passing from the liquid to the solid state. The bottle must have been cracked while solidification was going on, otherwise the water would have escaped.

Protruding stem of ice formed by the freezing of water in a bottle.

THE illustrated article by Prof. E. F. Northrup on a photographic study of vortex rings in liquids, published in our issue of February 1 last (vol. lxxxviii., p. 463), has prompted Mr. A. W. Ackermann to send a description of some experiments performed by him twenty years ago in the production of vortex rings in liquids. He took a cubical vaseline tin of 8·5 cm. edge, cut a hole in the lid 1 cm. in diameter, filled the tin with a solution of permanganate of potash, and placed the tin in a bath 6 ft. long. By means of a long stick impulses were given to the top or end of the tin, and the vortex rings were ejected at pleasure and studied. At Mr. Ackermann's suggestion, Prof. C. V. Boys, F.R.S., was asked if he had investigated the matter. He reminds us that the late Prof. Guthrie had a large glass trough made in the early eighties of the last century for experiments on liquid vortex rings. In the centre of one end there was a "gun" with a thick sheet india-rubber back. The gun was filled with a solution of rosaniline. Dr. Guthrie's trough was used later by Sir Arthur Rücker, F.R.S., while professor of physics at the Royal College of Science, London. Prof. Boys goes on to inform us that he would have expected that a trough wider than 12 cm., as described in Prof. Northrup's article, certainly not less than 30 cm. or a

foot, would be greatly preferable, and equally that a gun with a larger muzzle than that employed would have been better.

THE annual general meeting of the Institute of Chemistry was held on March 1, Dr. George Beilby, F.R.S., the president, occupying the chair. During the course of his address the president said the fund for new buildings for the institute has reached 8500*l.*, but 15,000*l.* is considered necessary for erecting a building suitable for the work of the institute. Touching on the difficulties which confront public analysts and private practitioners, he referred to the attempts made on the part of certain local authorities to lower the status of the professional chemist by offering appointments at ridiculous remuneration. Enlightened municipal bodies realise that the proper administration of statutes, such as the Sale of Food and Drugs Act, cannot be expected unless they attract to their appointments men of competence and integrity, who can hold their own as responsible representative officers of their authorities. The Act is as much a statute against fraud as in the interests of public health, and it must be understood that the public analyst is in no way subject to the control of the medical officer of health. Prof. R. Meldola, F.R.S., was elected as president for the ensuing year, and the following as vice-presidents:—Dr. G. T. Beilby, F.R.S., Dr. F. Clowes, Dr. G. McGowan, Sir Alexander Pedler, F.R.S., Dr. J. M. Thomson, F.R.S., and Sir William Tilden, F.R.S.

THE Bulletin of the Bureau of Standards for December 15, 1911, contains an account of an investigation carried out by Mr. F. W. Grover on the effect of temperature and frequency on the capacity and phase difference of a number of commercial paraffined paper condensers. The alternating currents used were supplied by special generators designed for the Bureau. Bridge methods were used, balance being indicated by a vibration galvanometer. The phase differences found range from 6′ to 22° of arc. The change of capacity with frequency is large for low frequencies, and decreases as the frequency increases. The temperature coefficient of capacity is generally positive and of the order 1 per cent., but in some cases may be negative. The absorption appears to be represented with a fair degree of accuracy by Von Schweidler's extension of Pellat's theory that the dielectric displacement on the application of an electric field attains instantly a certain fraction of its final value, and then increases exponentially to its final value. Three exponential terms appear to be necessary to represent the observations. It follows from these results that paper condensers cannot serve as standards of capacity, and should not be used in any work in which a constant capacity is required.

COMMENTING on the fatal accident to Mr. Graham Gilmour, *Engineering* for March 1 considers that if the trussing of his machine was after the usual pattern in this type of machine, the provision for horizontal strength would not be very great, and failure would most likely be in this direction. The essential lesson in this and previous accidents appears to be that it is high time that the question of the strength of monoplane wings was gone into in a public manner, and that it is due to the public that the makers should demonstrate that they have a reasonable factor of safety, both vertically and horizontally, otherwise the monoplane in its present state will be put down as a machine in which safety has been so far sacrificed to the craze for "records" that it is not fit for practical flight.

THERE have been several proposals within the past few years to construct internal-combustion air-compressors on the free-piston system, and one which has been made and tested by Signor Giuseppe Matricardi, of Pallanza, Lago Maggiore, Italy, is described in *Engineering* for March 1. A heavy piston is propelled from one end of a cylinder to the other end by the explosion of a gaseous mixture behind it. During its motion it expels air in front of it through a port, and thence through a non-return valve into a reservoir. Near the end of its travel the piston overruns the port, and compresses into the end of the cylinder a fresh charge, which is exploded in its turn, shooting back the piston to the other end. In its passage the piston compresses and discharges into a reservoir the air in front of it, as before. It is said that a good efficiency and large output have been secured in the small machine already tested, but actual figures are reserved until a larger compressor, now under construction, is ready and tested by independent engineers.

WE are indebted to Messrs. Cassell for a copy of the first part of a new issue of Kearton's "British Birds' Nests." The fact that bitterns nested last year in Norfolk is recorded.

THE first part of "The Nature Book," which is described in a subtitle as a popular description by pen and camera of the delights and beauties of the open air, has been published by Messrs. Cassell and Co., Ltd. The work is to be completed in thirty-six fortnightly parts, at 7*d.* net each. It is profusely illustrated from photographs and a series of coloured plates.

THE report of the ninth meeting of the International Meteorological Committee, held at Berlin in September, 1910, and of the sixth meeting of the Commission for Terrestrial Magnetism and Atmospheric Electricity, which preceded it, has just been published as a Blue-book (Meteorological Office, No. 208, price 3*s.*).

THE "Classified List of Smithsonian Publications available for Distribution, January, 1912," has been received from Washington. Applicants for these publications are requested to state the grounds of their requests, as the Smithsonian Institution is able to supply papers only as an aid to the researches in which applicants are especially interested. The papers included in the list are distributed gratis, except in some cases, where a small charge is made.

OUR ASTRONOMICAL COLUMN.

BRILLIANT WHITE SPOTS ON MARS.—In No. 10, vol. xix., of *Popular Astronomy* Mr. L. J. Wilson, who observes Mars with an 11-inch reflector, cites several occasions during October and November, 1911, when his observations at Nashville, Tenn., revealed the presence of very conspicuous and brilliant white spots on the planet's disc; such spots were seen, on October 14, in the region following Hesperia. Comparing his recent observations with those made during 1909, Mr. Wilson concludes that the frequent formation of such spots is an unusual feature of the present apparition.

COMETARY PHENOMENA.—A discussion of cometary phenomena is published by Prof. Karl Bohlin in an abstract from the *Naturwissenschaftlichen Rundschau*. Prof. Bohlin deals with such matters as the orbits, the brightness and structure of the different parts of comets, the facts revealed by spectroscopic analysis, and the peculiar fluctuations of the form and brightness of the tails of various comets. Of general interest will be found the tables he gives showing the variation of all these features in a large number of well-known comets which have appeared since the seventeenth century.

THE ANTARCTIC CAMPAIGN.

AT the present time it is not unlikely that the south pole has been reached by both Captain Scott and Captain Amundsen, who are leading respectively British and Norwegian Antarctic expeditions. The accomplishment of this athletic feat is one that the public take an intense interest in, and not least of all at the present time because there are two competitors in the polar race, which adds zest from the sportsman's point of view. Any journey in Antarctic regions must also add something to our knowledge of the Antarctic regions, and any additional knowledge is of scientific value. But the two expeditions are of much greater interest to the scientific community from the point of view of the work they will do outside this journey to the pole, for, so far as the polar journey is concerned, Captain Scott intends to follow over his own track and Sir Ernest Shackleton's, except for the last hundred miles, and Captain Amundsen may, after tracking in a south-westerly direction across the surface of the Ross Barrier, also follow Sir Ernest Shackleton's track up the Beardmore Glacier, and thence to the pole, practically in the same line as Captain Scott. The only additional topographical information therefore gained by these journeys is in the possible track of Amundsen from the vicinity of Edward Land to the Beardmore Glacier, and the same track that both Scott and Amundsen are likely to take over the last hundred miles to the pole, which, we fairly well know from Shackleton's observations, must be situated at an altitude of something like 10,000 ft. on the inland ice of Antarctica. We hope that Scott and Amundsen will meet each other, and, mutually helping one another, reach the pole with honours divided.

Mr. Mossman reports that great reticence was shown by the members of the Norwegian expedition while in Buenos Aires with regard to Amundsen's southern journey, but that he was to leave for the south not later than September, and that he hoped to reach the plateau by another way than the Beardmore Glacier, and emerge somewhere in the neighbourhood of Alexander Land, a region already visited by Amundsen on board the *Belgica*. The accomplishment of a journey along this route would be not only a triumph of physical endurance, and good organisation of food supply and equipment, but would also add immensely to our knowledge of Antarctica.

If the pole is attained by either or both of these explorers, the thanks of the scientific world are due to them for having once and for all settled the matter, and thus helping the public to understand that serious south polar exploration is not to reach a certain mathematical point before somebody else, but rather to carry on systematic investigations within the greatest unknown area on the surface of our globe, an area that occupies about five and a half million square miles—*i.e.* almost as great as the area of Europe and Australia combined.

It was Scott's intention to land a party not only at McMurdo Sound, but also on Edward Land. After Scott and his party were landed at McMurdo Sound, Lieutenant Pennell received command of the ship, and took Lieutenant Campbell's party with him, consisting of six, all told. The party was, however, unable to land at Edward Land, "owing to the perpendicular ice cliffs." This being so, an attempt was made to land them "as far west of Robertson Bay as possible," and make discoveries in that direction, but "from Smith Inlet to Robertson Bay there was not a single spot where a party could land—all sheer ice cliffs." Campbell and his party therefore landed at Cape Adare. After landing the party Pennell cruised to the west of Cape North, and discovered new land westward in two places. In the meantime, Scott and his party had finished setting up their camp, and Scott had begun a journey to the south that was probably preliminary to his great effort to reach the pole. Beyond this we have very little information, but since the return of the *Terra Nova* to New Zealand we understand that the ship was chartered by the New Zealand Government in order to carry out some hydrographic operations in the vicinity of New Zealand during the winter months. These hydrographic observations, made under the auspices of the New Zealand Government, are sure to be of the greatest possible scientific value; and now the *Terra Nova* has sailed once more for the south, and no word will be heard of her for another month or so. It is understood, however, that Lieutenant Pennell takes news to Captain Scott that sufficient funds have been acquired to enable him to stay out for another season, so that if reaching the pole is disposed of, the expedition should have a most excellent opportunity of carrying out explorations and various observations which will be of the highest possible scientific value.

Amundsen's party has, according to information received, succeeded in landing on the Ross Barrier in longitude 162° W., about fifty miles west of Edward Land, at a place he has named Bay of Whales. The news of the discovery of the Norwegian expedition at this point by Lieutenant Pennell came as a great surprise to all in Britain, but from the scientific point of view it cannot but add to the value of Scott's observations as well as Amundsen's, and, as I have said, from the sportive point of view it adds zest. Moreover, every mile Amundsen and his party travel over to the east of Beardmore Glacier will be new, and any observations taken at the Norwegian base station will be entirely new and of great value.

The *Fram*, which has carried two successful expeditions to the Arctic regions, made a long voyage out to the Ross Barrier from Madeira without calling at any intermediate port, and again from the Ross Barrier she made a second extensive voyage without calling at any port until she reached Buenos Aires. During the past southern winter she has crossed the Atlantic twice from Buenos Aires to Africa, and has taken observations at sixty stations. In order to

get a clear idea of the past work and future programme, I quote from information that Mr. Roald Amundsen has been good enough to send me which has been furnished to him by Captain Nilsen, the commander of the *Fram* :—

"We left Buenos Aires," says Captain Nilsen, "on June 8, 1911, exactly one year after our departure from Hörten (Norway), on our first oceanographic voyage to the northern part of the South Atlantic. The pilot accompanied us to Montevideo, where we stopped until Sunday morning, June 11, on account of a 'pamperos' (south-westerly wind very violent), when we continued our way in the Atlantic Ocean in good order. The weather hindered us from beginning the sounding before June 17, but from that day everything went on all right. We commenced first with sounding, taking also water samples and temperatures down to 2000 metres; but this took us eight hours, and as during this time we had to stop with fixed sails, one-third of the twenty-four hours passed. Time being short, as we would have to leave Buenos Aires about October 1, we could only get on a short distance in the Atlantic if we had to continue this work, and it was necessary, therefore, to abandon sounding altogether, and we took observations down to 1000 metres only. We sailed from the La Plata River in a line approximately straight towards 9° E. longitude and about 21° S. latitude; we arrived here on July 22, and sailed towards St. Helena, which we passed on the evening of July 29. We continued to South Trinidad, which we passed very close to on August 12. On August 25 we finished the oceanographic observations in about 25° S. latitude and 40° W. longitude. All in all, we have had sixty stations, and have collected 891 water samples, which will probably be sent home by the *Kronprinzessin Viktoria*. We have also about 200 bottles of plankton.

"We returned to Buenos Aires at midnight on September 1. During the whole time the weather has been fair, and our course was fixed according to the winds; we sailed eastward to Africa by almost steady northerly and north-westerly winds that lasted exactly four weeks, and during this time the motor was at a complete standstill. In order to cover as even distances as possible, we sailed at a rate of 4 to 5 knots. As we had to take in the sails at each station, they got so worn that they scarcely kept together at last; and I had no mind to use our second set of sails, that ought to be in tip-top order when we got into the 'roaring forties.'

"The voyage has in every respect been a good one for the *Fram*; her motor has been thoroughly examined and cleaned during the long rest, the rigging looked after, all iron has been cleaned for rust, and the vessel has been painted all over; the *Fram* looks finer now than she did when she was new. The stores have been arranged, registered, and cleaned, and the sailmaker, Rönne, has been sewing sails, &c., from 6 a.m. to 6 p.m., and several alterations and modifications have been made by the chief engineer, Lundbeck, who is a man and an engineer of the first order."

This is the chief information received from Captain Amundsen.

It seems almost a pity that a vessel so well fitted for oceanographical research as the *Fram* is, in higher latitudes, worked north instead of south of 40° S., for with the exception of the *Scotia's* hydrographical observations south of 40° S., little has been done in oceanographical research in high southern latitudes in the Atlantic Ocean, whereas north of that latitude the *Challenger* and subsequent expeditions have done much to add to our knowledge of those seas.

Some important observations have, however, been made south of 40° S. by the *Deutschland*.

The *Fram* is not expected to carry out any oceanographical research in her circumpolar voyage—she will only just have enough time to fetch the landing party, and again regret must be expressed that time has not been allowed to carry out such researches in those high southern latitudes by an ice-protected ship. Nothing is yet decided as to 1912, but Mr. Roald Amundsen does not think it likely that the *Fram* will proceed across the North Polar Basin before 1913, as that depends on the funds available.

Four other expeditions are also carrying on researches in the south polar regions, namely, an Australian one under Dr. Douglas Mawson, a German one under Lieutenant Dr. Filchner, a Japanese one under Lieutenant Shirasé, and last, but not least, the Argentine expedition, which sailed for the South Orkneys to continue the meteorological and magnetical work initiated by the Scottish expedition at Scotia Bay in 1903, and continued by the Oficina Meteorologica Argentina since 1904 at an annual cost of about 6000*l*. With regard to the Japanese expedition, practically no news has reached Europe, and, indeed, notice that the expedition left Sydney on November 19, 1911, came as rather a surprise, as it was thought that after being so hopelessly late in the previous season they would not for the present attempt further work. Whatever are the aims of the present Japanese expedition, the writer has reason to believe that we may expect Japan to take a very prominent part in Antarctic exploration of a purely scientific kind before many years are past. The work of the German expedition lies in the Weddell Sea in longitudes west of Coat's Land, Dr. Filchner having generally agreed with the writer that the region to the east of this should be left for the proposed Scottish expedition. If, however, the Germans fail on account of conditions of ice or other difficulties to carry on their work to the west of this longitude, it is quite understood that they are to be free to work to the eastward. So far as the writer is concerned, he is of opinion that it is not in the interests of science that an expedition actually in the field should be hampered in any way by reserving an area for another expedition which has not so far succeeded in raising all the necessary funds. The area of the unknown Antarctic regions is so vast that there is plenty of room for all-comers, and more especially so if there is a division of labour in the work.

There are two prominent theories of the structure of Antarctic lands. Filchner bases the plan of his expedition upon the theory held by himself, Dr. Penck, Dr. Otto Nordenskjöld, Sir George Darwin, and others, that there are two Antarctic land masses which are divided from each other by a channel possibly covered by a continuation of the Ross Barrier running across from the Ross Sea to the Weddell Sea, thus dividing Graham Land from the rest of the land. The other prominent theory, which has for long been held by Sir John Murray, and is supported by Sir Ernest Shackleton, Dr. Mawson, and myself, is that there is one great Antarctic continental land mass with no such division across it. A third theory, held by Dr. Nansen, is that the Antarctic land is composed of an archipelago of islands. In a paper [1] delivered to Der Schweizerischen Naturforschenden Gesellschaft at Basel in 1910, I summarised my reasons for holding the view that there was one great Antarctic continent.

Having a definite theory of the structure of the Antarctic continent, Filchner sets out to test the accuracy of it. His confidence augurs well for the success of the German expedition. "Morgen früh 10 Uhr (also am 10 December) gehen wir," says he, "in See nach dem Eis mit rein südlichem Kurs bis zum Auftreffen auf die Eisbarre und folgen ihrem nördlichen Rande, dann so lange östlich, bis wir sie durchqueren können." This confident assurance reaches us from South Georgia, from which place

[1] "Über die Fortsetzung des antarctischen Festlands zwischen Enderbyland, Coatsland und Grahamland, sowie das Vorhandensein im Morrellsland." Von Herrn Dr. William S. Bruce, Direktor der Scottish Oceanographical Laboratory.

I have had word from Lieutenant Dr. Filchner and Dr. Heim, geologist to the expedition. They inform me that they have so far had a successful voyage, having landed at St. Paul's Rocks, and having already taken as many as eighty soundings. Several of them appear to have been taken in the neighbourhood of South Georgia and the South Sandwich Group, and these will form a most important contribution to the study of former Antarctic continental connections with South America. "Storm and stress of weather hindered every attempt at landing on the South Sandwich Group," and in this connection it is interesting to note that this heavy weather was previously predicted by Mr. R. C. Mossman at Buenos Aires.

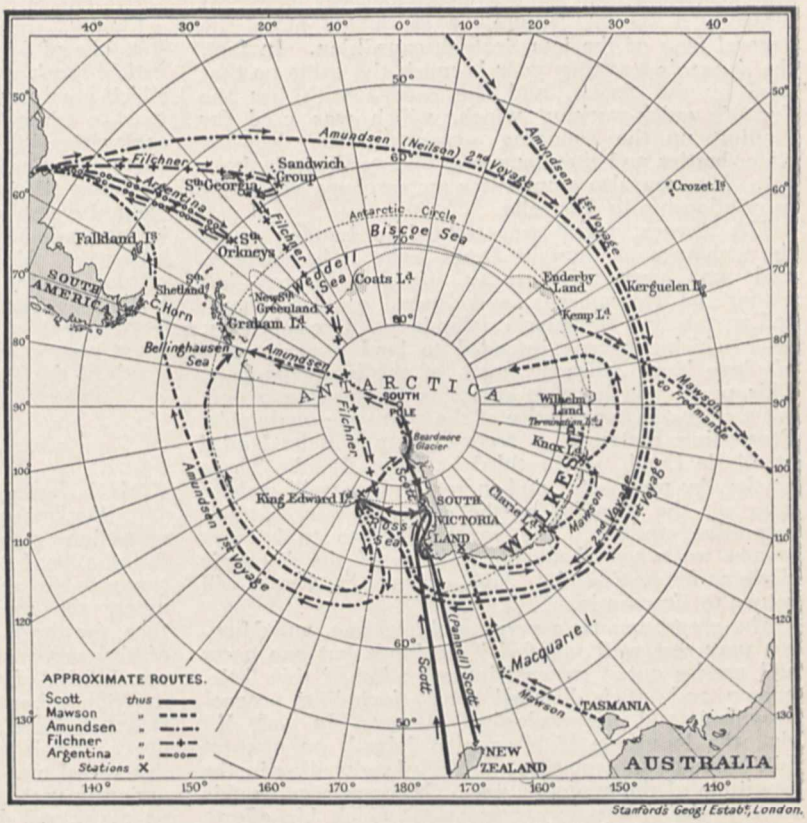
Prof. Penck, who has been good enough to furnish me with much useful information, says:—"Reaching the pole does not form a special feature of the programme." He also writes saying that Filchner will establish a station to the west of Coat's Land, and will not leave the Antarctic regions until the summer of 1913–14.

A most important line of sixteen soundings[3] has been taken from Monte Video to South Georgia and the South Sandwich Group which confirms the existence of deep water of 2500 fathoms which the writer supposed existed there[4] between 35° S., 52° S., and 21° and 55° W. Filchner extends this 3000-fathoms water to a point west of South Georgia, where he obtained a sounding of 3064 fathoms. This sounding, along with one of 2358 fathoms and a second of 2413 fathoms Filchner considers to the west of South Georgia, precludes the possibility of a "rise" (unterseeische Verbindung) between South Georgia and the South Sandwich Group, but another sounding of 1787 fathoms between Lieskow Island and South Georgia seems to confirm, to my mind, the existence of such a rise. Close to Candlemas Island 478 fathoms was obtained, and depths of 1144 and 1757 fathoms were obtained close to the group, just as the *Scotia* sounded in 1745 fathoms 15 miles off the South Orkneys.

Although the deeper water from the north dips rather further south than it was previously supposed to do, the suggestion that there is no "rise" is worth consideration as leading to the possibility of the Sandwich Group being cut off from the South American-Graham Land connection, and indicates the great importance of more soundings to the south of South Georgia. Quite extensive and interesting geological excursions were made in South Georgia, which were facilitated by Captain Larsen lending the German expedition his 500-ton yacht *Undine*. The Germans have found that South Georgia is a folded mountain range, probably part of the Faltengebirge of the South American Andes and Graham Land. The tuffs found by Gunnar Andersen in 1902 are found to be old Mesozoic and young Palæozoic tuffs. Dr. König found an ammonite in the slate of Possessions Bay. Bad weather prevented pendulum observations, but earth magnetic elements were determined.

It took from November 1 to 14 to go from South Georgia to the South Sandwich Group. A course was first steered to Lieskow Island; the *Deutschland* then passed Candlemas Island, and left the group at Zavadowskij Island. Some of these islands are extinct, and others active, volcanoes. The rocks appeared to be basaltic. Volcanic sand containing basaltic fragments was secured by sounding.

Meteorological and other observations were made, and it is especially interesting to note that for the first time in Antarctic regions *ballons-sondes*, as used by the Prince of Monaco in Spitsbergen, were employed, since in South Georgia sixty-five of these balloons were released. These were traced to a height of 9 kilometres, or 29,528 ft., and should give valuable information regarding the higher atmosphere in the south polar regions.



Stanford's Geog.l Estab.t London.

Whether Filchner succeeds in pushing far to the south to the west of Coat's Land, where he believes he will be able to land on a barrier similar to and continuous with the Ross Barrier, depends on the state of the ice in the Weddell Sea, and Mossman unfortunately predicts a series of bad ice years. If Filchner meets the pack as Ross met it in 1842–43, and as the Scottish expeditions met it in 1892–93 and in 1902–03, in which latter season also Nordenskjöld's ship, the *Antarctic*, was crushed and lost, he will not attain a high latitude to the west of Coat's Land, but if he has an open summer, as Morrell and Weddell had in 1822–23, he will get far south, and will fall in with land somewhere about 75° S., if the supposed rift valley from the Ross Sea does not exist. Filchner will also in all probability then be able to prove the

[3] *Zeitschrift der Gesell. f. Erdkunde zu Berlin*, 1912, No. 2.

[4] "Bathymetrical Survey of South Atlantic Ocean and Weddell Sea." By Wm. S. Bruce. With Map and Illustrations. *Scot. Geog. Mag.*, August, 1905.

existence or non-existence of New South Greenland, discovered by Captain Johnson in 1821–22, and revisited and described by Morrell in 1822–23—the summer Weddell attained the high latitude of 74° 15′ S. in those longitudes. If Filchner falls in with New South Greenland it will almost preclude the possibility of the existence of the suggested ice-covered strait cutting across Antarctica from the Ross to the Weddell Sea.

Altogether, the German expedition has most interesting and fascinating problems to solve, and with such a good ship—the *Deutschland*—with such excellent equipment and staff, and so competent a leader, should not fail to bring us back much valuable information.

The Australian expedition, under the able leadership of Dr. Douglas Mawson, is on quite a different plan from any of the others in the field, and in that it will do not only a considerable amount of hydrographical work, but will also make deep-sea biological research a special feature, it resembles more the general plan of the late Scottish expedition. In fact, the *Aurora's* trawling gear is much the same as that used by the *Scotia*, and she carries with her the *Scotia's* quick-working winch, which was used for hauling up the sounding apparatus, the deep-sea water-bottles and thermometers, and vertical plankton net. Mawson also emphasises meteorology, especially in relationship to Australia.

The *Aurora*, which was refitted in London under the guidance of Captain Davis—who is her master, and was previously master of the *Nimrod*—left Hobart on December 2, and pushed south-eastward, calling at the Macquarie Islands on December 21, after which Mawson intended to land a party west of Cape North, directly north of the magnetic pole. This party will hope to complete the magnetic data yet wanting in the vicinity of the south magnetic pole. Proceeding eastward, a second party will be landed at Clarie Land, and a third at Knox Land. These parties, by man, dog, and motor sledges, will seek to map out the coastline to the east and west of their respective stations. The voyage is then to be prolonged westward about the latitude of the Antarctic circle as far as Enderby Land, whence the *Aurora* will return to Fremantle.

The programme is a very ambitious one, and Mawson may rest well satisfied if he lands but one party and carries out a general investigation of this little-known and much disputed coast, including oceanographical and meteorological survey. In 70° E., viz., the longitude of Kerguelen Island, an attempt will be made to penetrate southward as well as in the longitude of the magnetic pole. Mawson regards this part of the Antarctic continent to which his efforts are to be directed as by far the most important portion of Antarctica yet to be explored. He points out that "along the whole 2000 miles of coast between Cape Adare and Gaussberg a landing has been made once only, and then but for a few hours, by d'Urville's expedition in 1840. Only a few vessels have ever come within sight of this coast, and practically none since the days of d'Urville and Wilkes."

Mr. Alfred Reid tells me that lack of coal may render it necessary for the *Aurora* to put into Kerguelen for ballast on her return to Fremantle under canvas. In April the *Aurora* will again go south with a number of Australian men of science in order to carry out dredging and sounding in seas between Australia and Antarctica, and in December the *Aurora* will proceed south once more to pick up Dr. Mawson and his colleagues at the three stations.

Mawson carries with him an aëroplane and certificated air pilot, and has, like Filchner, an installation of wireless telegraphy. The expedition, which carries a crew and staff of fifty persons, is well supported by the Australian and British Governments and by private enterprise.

Mawson is a geologist of the first order and a trained magnetic observer, and with Shackleton's expedition gained an intimate insight into the geology of Antarctica and its relationship to Australasian geology. He is an enthusiast, and his plans are original and well thought out. Mawson is well supported by Captain Davis and an excellent scientific staff, and thus the Australian expedition is sure of a scientific success, and more especially so since the expedition is not hampered by taking part in the race to the pole.

As I have already stated, little is known of the plans and prospects of the Japanese expedition, but it is to be hoped that they will be rewarded with a rich harvest of scientific results that will encourage future efforts on the part of Japan.

Finally, success is assured for the enterprising Republic of Argentina, with meteorological and magnetical work at the first-class station at Scotia Bay, which now commences work for the tenth consecutive year—a triumph without equal in the annals of polar exploration. Every year the Argentines send out a party of trained meteorologists and magneticians, who winter at Scotia Bay, frozen in and cut off completely from the rest of the world for twelve months, and it is interesting to note that the leaders of this work, under the able directorship of Mr. Walter J. Davis, of the Oficina Meteorologica Argentina, have been trained at Ben Nevis Observatory, which the British Government persistently refuses to support for no other reason apparently than that it happens to lie north of the Tweed.

WILLIAM S. BRUCE.

FISHERIES OF BENGAL.

THE Journal of the Royal Society of Arts of December 22, 1911, contains a full report of a paper on the fisheries of Bengal, by Dr. J. T. Jenkins, read before the society on November 14. In response to an invitation from the Indian Government, the author proceeded to India in October, 1908, for the purpose of undertaking, during a period of eighteen months, a practical investigation into the possibilities of the fisheries of the Bay of Bengal and the Sandarbans. He was provided with a trawling steamer, the *Golden Crown*, which was unfortunately not so efficient as she might have been; and with this vessel trawling was carried on for a considerable period in various parts of the bay, work being carried on night and day. As a rule, four hauls were made *per diem*, and it was found, despite the monsoon, that trawling can be carried on at all seasons of the year. The results fully confirmed the anticipations which had previously been made by Lieut.-Col. Alcock and others as to the richness of the fishery, large supplies of the food-fishes most esteemed in the Calcutta market, as well as others, being obtained.

Even the coarser kinds would find a ready sale among the poorer classes of Bengalis, while in the case of uneatable species like sharks and swordfishes the liver and fins could be utilised.

As to the practicability of bringing the catches in good condition to market, it was found that, if stored in ice, the fish would keep perfectly well for a certain time. In the event of the fishery being worked commercially, it is recommended that Diamond Harbour, which is much lower down the Hughli than Calcutta, with which it is connected by railway, should be selected as a base for trawling.

The collections included a large series of fishes and invertebrates, which have been handed over to the Indian Museum to be worked out.

Only a short time could be devoted to the fisheries of the Sandarbans, that vast area in the Ganges delta which includes large rivers and pestiferous creeks where fish-life is impossible, but such observations as could be made indicate that here too profitable fisheries could be established, for it is to the Sandarbans that the hilsa (Indian shad), one of the most esteemed of Calcutta food-fishes, resorts for the purpose of spawning.

As a preliminary to the development of the rich fisheries of Bengal, it is recommended that a Fisheries Department should be established by the Indian Government without delay. R. L.

DISINTEGRATING BACTERIA AND OTHER ORGANIC CELLS.

BACTERIAL toxins may be broadly divided into two varieties. In one of these the toxin is excreted into the medium on which the organisms are cultivated, and in the other type the toxin is retained within and forms an integral part of the living bacterial cell.

It is now generally recognised that the disease-producing effects of pathogenic micro-organisms are almost entirely due to the toxins, whether intracellular or extracellular, which they secrete. For immunising purposes or for the preparation of anti-sera, the toxin which is excreted may be obtained from the culture medium by filtration through a porous porcelain filter, such as the Pasteur-Chamberland, the organisms being retained by the filter and the toxin passing through. The diphtheria and tetanus bacillus are examples of this type.

The majority of micro-organisms, however, do not excrete their toxin, at least to any extent, and among those that retain it within the cell are typhoid, cholera, plague, glanders, *B. coli, B. streptococci, B. staphylococci,* &c. In these cases some method of rupturing the cell-wall, so that the contents may escape, has been found to be desirable. This allows of not only the use of the toxin as such, but also renders it possible to investigate the chemical composition and properties of the bacterial proteins and other cell constituents.

The apparatus to be described fulfils the required conditions, and causes the cell-wall to be ruptured so that the contents are obtained unaltered. It is necessary that there should be no appreciable rise of temperature during the operation, apart even from any extraneous cooling arrangement, or else chemical change would occur; the apparatus therefore must be so far as possible frictionless. Every organism must come under the grinding action, so that either no whole cells remain or their number is reduced to a minimum. The containing vessel in which the grinding action takes place must be so effectually sealed that, during the process of disintegration, no cells have any opportunity of escaping. This applies particularly when pathogenic organisms are being dealt with. The apparatus as designed is made in two forms; in one (Fig. 1) it is mounted between horizontal centres, and in the other (Fig. 2) between vertical centres. In the former the grinding action is controlled by gravity, and in the latter by electro-magnetic means.

The appliance consists essentially of a phosphor bronze or steel pot or vessel, A, in which a number of steel balls, B, are allowed to revolve. The steel balls accurately fit the inside of the containing vessel, so that as the machine rotates they are in contact over nearly one-half of their circumference with the inside of the vessel. A metal cage, C, is made of such a shape that its prongs lie between the balls, so that the latter cannot collide one with another when the machine is rotating. Mounted at the centre of the metal vessel is a steel cone, D, which is of such a size that it keeps the balls in their proper position in close contact with the periphery of the containing vessel. This cone is an important part of the apparatus as upon it depends the pressure that may be exerted on the balls; and, further, as the result of its use the balls themselves have freedom to slip

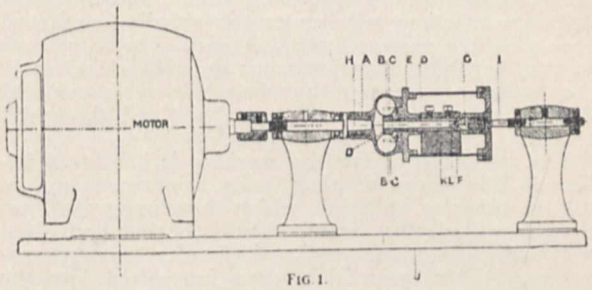


FIG. 1.

if any additional strain is thrown on them, or if any undue amount of material comes under their action. The containing vessel is closed by a metal cap, E, which screws down, hermetically sealing the vessel. A groove is made in the top of the containing vessel into which a lip on this screw cap loosely fits. Sufficient space remains between the two, as shown in the figure, to allow of some bacterial agent being placed therein, thus effectually preventing the escape of whole bacteria or ground material from the containing vessel. Over the whole of this a cylindrical cap, F, is placed, and in the top of this cap a metal cone, G,

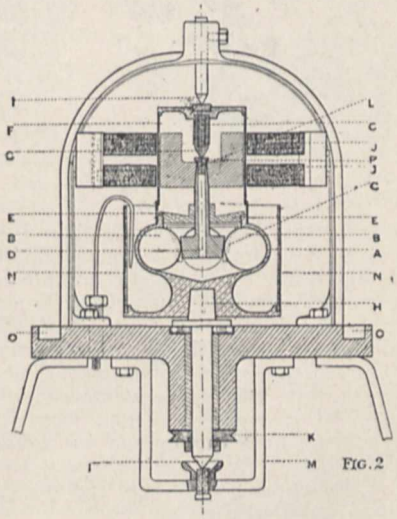


FIG. 2.

is fitted, which presses by means of a spring on to the top of the steel cone, D. The steel cone is itself hollow, and is closed by a small metal cap, L. A lead or steel weight, K, is fitted on to the steel spindle, D, and is clamped on any desired position along it.

The apparatus is mounted on a cone, H, and runs between this cone and the centre, I. It may be conveniently connected directly up to a motor, as shown in the illustration, or may be driven by a belt from any suitable source of power by putting a grooved pulley on to the left-hand end of the spindle.

The grinding action takes place between the steel

balls contained in the metal vessel and the interior surface of the same. It is evident that if the weight, K, were not on the central cone, as shown, or unless some similar method were adopted to control the cone to prevent it from rotating, no grinding action would result; the central cone, in fact, must either remain still or be allowed to rotate at a slower speed than the containing vessel. The metal weight, K, is of such size that on the whole machine being driven at a suitable speed the action of gravity results in the steel cone remaining still, and so a grinding action takes place between the steel balls and the inside surface of the containing vessel. To bring the bacterial or other cells under the grinding action of the balls, the speed of rotation should be from 1000 to 1500 revolutions per minute; centrifugal action is then sufficient to ensure that the whole of the material does actually come between the balls and the metal vessel.

The method of using the machine is briefly as follows:—The bacteria, after being removed from the culture tubes or plates on which they are grown, are centrifugalised; the semi-fluid mass is then emulsified with saline solution, so that it is of a creamy consistence. This material is then introduced into the container by means of a pipette through the hollow centre of the steel cone. This ensures that no parts of the machine are disturbed more than is absolutely necessary either before or after grinding. The machine is then run for a longer or shorter period, depending on the amount of material to be dealt with, and the ground material is then pipetted off through the central steel cone. As the balls are themselves free to rotate, the amount of friction is negligible, but any rise of temperature may be prevented by allowing a small stream of carbonic acid gas from a cylinder of liquid carbonic acid to impinge on to the side of the vessel; alternatively an ether spray, such as is used for section-cutting purposes, may be used, and will be found quite efficient.

The vertical type of machine (Fig. 2) is exactly similar in all essential details, except that the central steel cone is controlled by means of electromagnets. On the top of the cone a mass of soft iron is fixed, and this is kept from rotating by means of the electro-magnets, J. The only constructional difference is that the containing cylinder, F, is made of vulcanite, so that it is perfectly diamagnetic. The chief advantage of this design over the one previously described is that it can be completely covered by a glass bell-jar while in action. A bactericidal agent may be placed in the groove O, and the bottom edge of a bell-jar allowed to dip into it.

The effect of disintegrating yeast cells for ten and fifteen minutes is seen in Figs. 4 and 5 respectively, Fig. 3 showing the cells before the commencement of the process. It is interesting to note that in Fig. 5 the cell contents have taken up the stain which was used in making the microscopical preparation, whereas the cell envelopes remain unstained and show as clear areas, thus demonstrating that the cell contents have been completely expressed. J. E. BARNARD.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Mr. E. A. Newell Arber, of Trinity College, has been approved by the general board of studies for the degree of doctor of science.

The general board of studies has issued an important report on advanced students, of which there are at present two classes: (1) those who qualify for a degree by submitting a dissertation approved by a degree committee of a special board, and (2) those who qualify for a degree by reaching a certain specified standard in a tripos examination. The board points out that there is considerable variation in the standard required of advanced students in the various tripos examinations.

FIG 3

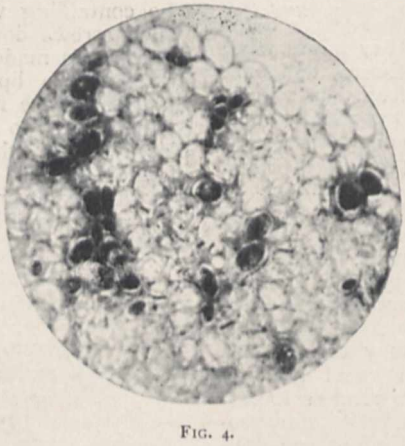


FIG. 4.

FIG. 5.

The number of advanced students of the latter class admitted to courses of study in the fourteen years from 1896 to 1909 inclusive was 101. In the same period eight applications were refused. Of the 101 admitted, 35 reached the standard required in their respective tripos examinations; 18 were rejected; 48 did not present themselves for examination. These statistics point to the conclusion that a good many students are admitted to the status of advanced students who have no real claim to the distinction which such admission may be held to confer.

After full consideration of the working of the present regulations, the general board has come to the conclusion that it is desirable that advanced students should no longer be admitted to courses of advanced study, but that they should be admitted to courses of research only.

With this end in view, the board proposes that the class of affiliated students should be enlarged, and that affiliated students should not only be permitted to proceed to a degree after residing in the University for six terms, but in the case of certain tripos examinations should be also admitted to the second part without necessarily having fulfilled the ordinary condition of having previously passed in the first part of the tripos or in some other tripos.

OXFORD.—On Wednesday, February 28, Mr. W. Bateson, F.R.S., honorary fellow of St. John's College, Cambridge, and director of the John Innes Horticultural Institution, delivered the annual Herbert Spencer lecture at Oxford, the subject being "Biological Fact and the Structure of Society." Man, he said, is an animal guided by natural laws. It is only lately that accurate inquiry has been started into the actual meaning of heredity, but it is now becoming recognised that parents cannot pass on factors that they do not themselves possess, and that the conditions of life are less important than genetic qualities. Still, even now our knowledge is not sufficient to warrant public interference with the ordinary practices of society. "We should probably be no better off if marriages were made at Westminster instead of in heaven." In one respect, however, the course is clear—segregation of the feeble-minded and hopelessly unfit is absolutely necessary. On the other hand, the existence of a physical defect such as cataract is not incompatible with a useful life and profitable work. There are many kinds of men, but the conditions are so complex that complete classification is impracticable. Two classes, however, may be distinguished—those who can take an interest in science and those who cannot; public men belong, as a rule, to the latter class. In law all men are equal, but science is juster than the law. A high birth-rate is not an unmixed blessing; it produced, for example, the misery of the "forties." It is incumbent on the State to see that no one goes without food, but a motive must be kept for individual effort. Classes are essential, and a necessary condition of progress is that every individual should be got into his right class. Present social conditions are too unstable to last, and Mr. Bateson doubts whether many wish that they should. It is to be hoped that the new order, whatever shape it may take, will grow up not in subservience to nostrums, but under the guidance of scientific fact.

WE learn from *Science* that the plans of Mr. George M. Pullman for the establishment of a manual training school at Pullman, Ill., are assuming definite form. Prof. L. G. Weld, formerly professor of mathematics and Dean of the University of Iowa, has been despatched on a tour of America and Europe to collect data to guide the board of trustees in the construction of the buildings and the arrangement of the curriculum. Building operations, it is expected, will be commenced next year. A site of forty acres has been purchased at a cost of 20,000*l*. A fund of 200,000*l*. was bequeathed by Mr. Pullman at his death in 1897 for founding the institution. This fund was invested in securities, which have increased in value until now there is about 500,000*l*. at the disposal of the governors for the school.

THE general and departmental reports for the session 1910–11 of the Bradford Technical College show a steady increase in the number of students in attendance. In view of the advanced nature of much of the work in the day courses, the committee has decided to follow the practice usual in connection with university colleges, and appoint external examiners, who will be associated with the college staff in the final diploma examination and the examinations for the technological scholarships. An extensive research has been carried out in the chemistry department, with the help of students, on the production of some new sulphur bases and their utilisation as sources of colouring matters. The work in the evening classes, it is satisfactory to note, is organised mainly in systematic courses of instruction, in which the technical subject is associated with the underlying sciences. Laboratory work, wherever possible, supplements class work. The courses occupy three evenings per week, and extend over three, four, or five years. The various laboratories of the engineering department continue to carry out tests and investigations for local firms and for trade purposes. The value of the experience gained in this way and the opportunity afforded of bringing the department into constant touch with the trade are greatly appreciated.

THE first issue of the Johns Hopkins University Circular for the present year is devoted to the report of the president of the University for the year 1910–11. President Ira Remsen says that the principal event of the year was the work that culminated in the raising of the sum required to secure the contribution of 50,000*l*. by the General Education Board towards the endowment of the University. In the offer of the General Education Board it was stipulated that "a supplementary sum of not less than 150,000*l*. shall be contributed to the University on or before December 31, 1910." The work of collecting this money was actively undertaken in October, 1910, and was so successful that on December 31 the desired amount had been contributed in cash or promised. Indeed, the amount contributed was greater than that stipulated by the General Education Board. Up to the present, including the amount contributed by the General Education Board, the University has available, in consequence of this effort, about 240,000*l*. Of this sum, 100,000*l*., according to the conditions of the gift, must be reserved as endowment. It is hoped that additional contributions will be made so that the sum of 400,000*l*. may be available for several pressing needs. The greater part of the volume, which runs to 109 pages, is made up of reports on the instruction in the chief branches of study and reports by various administrative officers of the University.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, February 15.—Sir Archibald Geikie, K.C.B., president, in the chair.—Dr. T. Graham **Brown**: An alleged specific instance of the transmission of acquired characters—investigation and criticism. An examination of the "Brown-Séquard phenomenon" in guinea-pigs—usually considered to be a classical instance of the alleged transmission of an acquired character—throws much doubt upon its value in this controversy. The phenomenon is not an acquired peculiarity produced *de novo* on division of a great sciatic nerve. It is due to the raised excitability of a mechanism—that of the scratch-reflex—already present; and this raised excitability is probably due to the removal of an inhibiting influence by section of the nerve. The phenomenon, therefore, cannot be considered as transmissible as an acquirement *per se*. If anything is transmitted as an acquired character, it must be the state of raised excitability of the scratch-reflex. The presence of the phenomenon in the offspring observed by Brown-Séquard may be admitted, but this may be explained otherwise than by assuming a transmission of acquired characteristics. That the alternative explanation—the presence in the offspring is due to a production of the state by injury to the toes and feet inflicted by the parent—is true is rendered possible, and indeed highly probable, by certain parallel evidence submitted in this paper.—W. B. **Alexander**: Further experiments on the cross-breeding of two races of the moth, *Acidalia virgularia*. This paper

deals with the descendants of some of the moths of this species reared by Messrs. Prout and Bacot, who read a paper on their results to the Royal Society on February 25, 1909. They did not arrive at any definite conclusions in regard to the process of heredity followed. The author agrees with them in finding that *Acidalia virgularia* and its variety *canteneraria* are not two Mendelian forms of the species, though he finds that one of the differences between the two forms, namely, the presence of black speckling on the wings of *A. virgularia*, is inherited according to Mendel's law.—F. H. A. **Marshall**: The effects of castration and ovariotomy upon sheep. (1) The development of horns in the males of a breed of sheep in which well-marked secondary sexual differentiation occurs (as manifested especially by presence or absence of horns) depends upon a stimulus arising in the testes, and this stimulus is essential not merely for the initiation of the horn-growth, but for its continuance, the horns ceasing to grow whenever the testes are removed. (2) The removal of the ovaries from young ewes belonging to such a breed does not lead to the development of horns or definitely male characters, except possibly in a very minor degree.—Dr. T. L. **Lewellyn**: The causes and prevention of miners' nystagmus. Miners' nystagmus is an occupational neurosis confined to coal miners. It is characterised by a rotatory oscillation of the eyes, and produces a disability which is marked and prolonged in severe cases. One thousand six hundred and eighteen cases received compensation in the United Kingdom in 1911. Pathologically the complaint appears to be a condition of imperfect centripetal impulses (imperfect fixation, disturbance of equilibrium, &c.), the intimate connection between the centres governing the associated movements of the eyes being lost, and incoordinate movements ensuing. The principal preventive measures indicated are improvement of illumination, elimination of unfit workers by medical examination, and employment of coal-cutters in thin seams.—W. Lawrence **Balls**: The stomatograph. The stomatograph is a self-recording instrument adapted from Mr. Francis Darwin's porometer (see NATURE, August 10, 1911). A five days' record of the opening and closing of the stomata of the cotton plant in Egypt is given, showing the stomata wide open during bright sunshine. The author has elsewhere shown that during this part of the day *no* growth occurs, and there is evidence that the apparent waste of water then occurring is of importance as keeping the leaves cool, since when transpiration is artificially checked the leaves are rapidly injured or even killed by the high temperature.—G. A. **Buckmaster** and J. A. **Gardner**: The composition of the blood gases during the respiration of oxygen. A number of analyses were made of the blood of cats respiring (1) air, (2) oxygen for periods of one to two hours. The average composition in c.c. per 100 c.c. of arterial blood for cats breathing air was as follows (mean of thirteen experiments):—Total gas, 53·76; CO_2, 38·43; O_2, 14·22; N, 1·12. The percentage saturation of hæmoglobin with oxygen was 83. For cats breathing oxygen the mean values by thirteen experiments were as follows:—Total gas, 53·79; CO_2, 38·65; O_2, 14·93; N, 0·16. The average percentage saturation of hæmoglobin with oxygen was 89·6. From their experiments the authors conclude that the inhalation of oxygen does not materially augment either the quantity of this gas or the quantity of carbon-dioxide in the blood.

February 22.—Sir Archibald Geikie, K.C.B., president, in the chair.—Prof. H. L. **Callendar**: Bakerian lecture on the variation of the specific heat of water, investigated by the continuous mixture method. A single formula has been found to represent the variation of the specific heat s according to the continuous electric and mixture methods over the range 0° to 100° C. The formula is as follows:—

$$s = 0{\cdot}98536 + 0{\cdot}504/(t+20) + 0{\cdot}0084(t/100) + 0{\cdot}0090(t/100)^2,$$

in terms of the specific heat at 20° C. taken as unity, and in terms of the scale of the temperature t deduced from the platinum scale pt by means of the standard difference-formula,

$$t - pt = 1{\cdot}50t(t-100) \times 10^{-4}.$$

The same formula for the specific heat also represents the most probable reduction of Regnault's experiments over the range 110° to 190° C.—Dr. C. **Chree**: Short index to reports of physical observations—electric, magnetic, meteorological, seismological—made at Kew Observatory.—R. T. **Lattey** and H. T. **Tizard**: The velocities of ions in dried gases. The authors have determined the velocities of positive and negative ions in dried hydrogen and carbon dioxide.—Prof. T. H. **Laby** and P. W. **Burbidge**: The observation by means of a string electrometer of fluctuations in the ionisation produced by γ-rays.—F. B. **Pidduck**: The wave-problem of Cauchy and Poisson for finite depth and slightly compressible fluid. The paper is in some respects a completion of a former one on the propagation of a disturbance in a fluid under gravity. The solution of the two-dimensional Cauchy-Poisson problem for finite depth is worked out numerically, the effect of limiting the depth being very considerable.

Royal Meteorological Society, February 21.—Dr. H. N. Dickson, president, in the chair.—J. **Fairgrieve**: The thunderstorms of May 31, 1911. The author dealt with the thunderstorm which visited the London district on Derby Day, and especially with the movement of the rain which accompanied the storm. Having obtained information from nearly 700 observers as to the time of rainfall or absence of rain, he has been able to prepare an interesting series of maps for each quarter of an hour from 12.30 to 8.45 p.m., showing the areas over which rain was actually falling.—R. G. K. **Lempfert**: The thunderstorm of July 29, 1911. This storm was of the line-squall type. The author has been able to trace the spread of the phenomenon across the British Isles, and he showed by a map of isochronous lines that it first struck the extreme end of Cornwall about 2 p.m. on July 29, and passed across Shetland at 3 p.m. next day. He pointed out that the disturbance may be regarded as the displacement of an easterly by a southerly current, but the process of displacement was an unusually complicated one. The general sequence of events seems to have been somewhat as follows: a moderate east wind is interrupted suddenly by a squall from the south. After the squall has passed the wind returns temporarily to an easterly direction, to be again interrupted by another squall from the south. This process may repeat itself several times. A period of several hours of light and variable wind, during which easterly directions predominate, supervenes, and finally the wind settles down to a steady southerly or south-westerly wind of moderate force. In many cases the squalls were not accompanied by rainfall. What appears to have struck observers most forcibly was the way in which huge quantities of dust were whirled up by the wind. Accounts from Cardiff state that dust was brought from the south side of the Bristol Channel by the squall winds, which did much structural damage.—S. **Skinner**: The "Drosometer," an instrument for measuring the amount of dew.

PARIS.

Academy of Sciences, February 19.—M. Lippmann in the chair.—L. **Guignard**: Notice on the life and work of Edouard Bornet.—A. **Lacroix**: The volcanoes of Central Madagascar. The Ankaratra *massif*. The products of the Ankaratra volcanoes cover an area of not less than 4000 square kilometres. The petrographical constitution has been investigated, and is found to be much more complex than that sketched by Baron.—A. **Müntz** and E. **Lainé**: The quantity of water and frequence of watering as depending on the physical properties of soils. It is very essential that any irrigation scheme should be preceded by a careful study of the soils on which the water is to be placed. Cases are cited in which, owing to the lack of permeability of the soil, irrigation has been actually harmful to the land.—M. du **Ligondès**: The condensation of the solar nebula in the Laplace hypothesis. The enormous condensation necessary, according to the Laplace hypothesis, to the formation of Neptune has been pointed out by Fouché; the author shows that there is also a discontinuity in the condensation between Jupiter and Mars.—**Billon-Daguerre**: The fusion of pure quartz. A description of the electric furnace used for fusing quartz, and obtaining a clear, transparent product.—P. Th. **Muller** and Mlle. V. **Guerdjikoff**: Refraction and magnetic rotation of mixtures. H. Becquerel has shown that for pure substances there is a connection between the refractive index and the magnetic rotation; for solutions, however, there would appear to be no general relation between these two magnitudes.—Paul **Joye** and Charles **Garnier**: Contribution to the study of neodymium compounds. The different spectra given by neodymium hydroxide heated to temperatures between 300° and 700° C. are shown to correspond to the formation of definite hydrates.—A. **Portevin** and G. **Arnou**: The effects of reheating aluminium bronzes. Measurements are given of the alteration of hardness produced, and photographs reproduced showing the change in the structure of the alloys.—Daniel **Berthelot** and Henry **Gaudechon**: The photolytic decomposition of smokeless powder, of picric acid, and of ammonium picrate by the ultra-violet rays. The gas in which the smokeless powder is exposed to the rays is shown to have an influence on the nature and amount of the gaseous decomposition products.—H. **Masson**: The principal constituents of essence of labdanum. Two ketones were isolated from this oil, 1 : 5 : 5-trimethyl-6-hexanone and acetophenone; the latter substance has not been previously noticed as a constituent of an essential oil.—A. **Prunet**: The Japanese chestnut at the experimental station at Lindois (Clarente). Experiments have been carried out on the disease-resisting properties of various chestnuts, and the Japanese chestnut (*Castinea japonica*) has been found to be the most suitable tree to replace the chestnuts destroyed by the *maladie de l'encre*.—A. **Demolon**: The fertilising action of sulphur. Sulphur has been shown by direct experiment to be beneficial to plant growth, especially Cruciferæ. It appears to exert a favourable action upon the development of chlorophyll, since during drought the plants on the plots treated with sulphur did not turn as yellow as the untreated control plots.—Em. **Bourquelot** and Mlle. A. **Fichtenholz**: The identification of the glucoside from the leaves of *Kalmia latifolia* with asebotine. Eykman in 1883 gave the name asebotine to a glucoside extracted from the leaves of *Andromeda japonica*; the glucoside extracted from the leaves of *Kalmia latifolia* is shown to be identical with asebotine.—**Michel-Cohendy**: Experiments on life without micro-organisms. Although normally provided with a rich microbial flora, the chicken can live absolutely without micro-organisms, and this aseptic life does not prejudice growth or development in any way. According to these experiments, the theory of the necessary connection between the animal and its bacteria, a principle which has been given as a well-established biological law, is not in accord with facts.—P. **Armand-Delille**, A. **Mayer**, G. **Schaeffer**, and E. **Terroine**: The culture of the Koch bacillus in a definite chemical medium. A formula is given for a culture medium containing definite chemical compounds only. On such a medium it is found that the tubercle bacillus develops perfectly, rapidly, and abundantly, retaining all its morphological and biological characters.—A. **Moutier**: The measurement of the arterial elasticity in clinical practice. The measurement of arterial elasticity cannot be carried out with an apparatus using circular compression, only those using localised compression giving correct results. Bloch's sphygmometer is the best instrument at present available.

BOOKS RECEIVED.

Expédition Antarctique Française (1903–1905), Commandée par le Dr. Jean Charcot. Hydrographie Physique du Globe. By Lieuts. A. Matha and J. J. Rey. Pp. vi+619. (Paris: Gauthier-Villars.)

Botany, or the Modern Study of Plants. By Dr. M. Stopes. Pp. 94. Heredity. By J. A. S. Watson. Pp. 94. The Science of the Stars. By E. W. Maunder. Pp. 95. The Principles of Electricity. By N. R. Campbell. Pp. 91. Organic Chemistry. By Prof. J. B. Cohen, F.R.S. Pp. 96. Each in "The People's Books." (London and Edinburgh: T. C. and E. C. Jack.) 6*d*. net each.

Colour-music: the Art of Mobile Colour. By Prof. A. W. Rimington. Pp. xx+185. (London: Hutchinson and Co.) 6*s*.

Butterfly-hunting in Many Lands: Notes of a Field Naturalist. By Dr. G. B. Longstaff. Pp. xviii+728. (London: Longmans and Co.) 21*s*. net.

Types of Ore Deposits. Edited by H. F. Bain. Pp. 378. (San Francisco: Mining and Scientific Press; London: The Mining Magazine.) 8*s*. 6*d*. net.

Graphical Solution of Fault Problems. By C. F. Tolman, jun. Pp. 43. (San Francisco: Mining and Scientific Press; London: The Mining Magazine.) 4*s*. 6*d*. net.

The Seven Follies of Science. By J. Phin. Third edition. Pp. ix+231. (London: Constable and Co., Ltd.) 5*s*. net.

Direct and Alternating Current Manual. By Drs. F. Bedell and C. A. Pierce. Second edition. Pp. xiii+360. (London: Constable and Co., Ltd.) 8*s*. net.

Railway Signal Engineering (Mechanical). By L. P. Lewis. Pp. xviii+358. (London: Constable and Co., Ltd.) 8*s*. net.

An Introduction to the Study of Fuel. By Dr. F. J. Brislee. Pp. xxii+269. (London: Constable and Co., Ltd.) 8*s*. 6*d*. net.

A Treatise on the Analytic Geometry of Three Dimensions. By Dr. G. Salmon, F.R.S. Revised by R. A. P. Rogers. Fifth edition, in two volumes. Vol. i. Pp. xxii+470. (London: Longmans and Co.; Dublin: Hodges, Figgis and Co., Ltd.) 9*s*.

Common Land and Inclosure. By Prof. E. C. K. Gonner. Pp. xxx+461. (London: Macmillan and Co., Ltd.) 12*s*. net.

Principles of Human Nutrition. By W. H. Jordan. Pp. xxi+450. (London: Macmillan and Co., Ltd.) 7*s*. 6*d*. net.

Laboratory Problems in Physics. By F. T. Jones and R. R. Tatnall. Pp. ix+81. (London: Macmillan and Co., Ltd.) 2*s*. 6*d*.

Monographien einheimischer Tiere. Band iii. Hydra und die Hydroiden, zugleich eine Einführung in die experimentelle Behandlung biologischer Probleme an niederen Tieren. By Dr. O. Steche. Pp. vi+162. Band iv. Die Weinbergschnecke. *Helix pomatia*, L. By Prof. J. Meisenheimer. Pp. iv+140. (Leipzig: Dr. W. Klinkhardt.) Each, 4 marks.

A History of British Mammals. By G. E. H. Barrett-Hamilton. Part x. Pp. 169–216. (London: Gurney and Jackson.) 2*s*. 6*d*. net.

Indian Chronography. By R. Sewell. Pp. xii+187. (London: G. Allen and Co., Ltd.) 31*s*. 6*d*. net.

A History of the Birds of Colorado. By W. L. Sclater. Pp. xxiv+576. (London: Witherby and Co.) 21*s*. net.

Are there Equinoctial Storms? Development of the Marine Barometer in American Waters. By J. H. Morrison. Pp. 21+30. (New York: W. F. Sametz and Co.)

Synthese der Zellbausteine in Pflanze und Tier. By Prof. E. Abderhalden. Pp. xi+128. (Berlin: J. Springer.) 3.60 marks.

Filariasis and Elephantiasis in Fiji: being a Report to the London School of Tropical Medicine. By P. H. Bahr. Pp. viii+192. (London: Witherby and Co.) 6*s*. net.

Fergusson's Percentage Unit of Angular Measurement, with Logarithms; also a Description of his Percentage Theodolite and Percentage Compass. By J. C. Fergusson. Pp. lxvii+467. (London: Longmans and Co.) 3*l*. 3*s*. net.

Milk and the Public Health. By Dr. W. C. Savage. Pp. xviii+459. (London: Macmillan and Co., Ltd.) 10*s*. net.

Leisure Hours with Nature. By E. P. Larken. Pp. xv+263. (London: T. Fisher Unwin.) 2*s*.

Pflanzengeographische Monographie des Berninagebietes. By Dr. E. Rübel. Pp. x+615+plates. (Leipzig: W. Engelmann.) 36 marks.

DIARY OF SOCIETIES.

THURSDAY, MARCH 7.

ROYAL SOCIETY, at 4.30.—(1) On the Devitrification of Silica Glass; (2) The Volatility of Metals of the Platinum Group: Sir William Crookes, O.M., For. Sec. R.S.—A Critical Study of Spectral Series. II.—The Principal and Sharp Sequences and the Atomic Volume Term: Prof. W. M. Hicks, F.R.S.—An Optical Load-extension Indicator, together with some Diagrams obtained therewith: Prof. W. E. Dalby.—(1) The Transmission of Cathode Rays through Matter; (2) The Velocity of the Secondary Cathode Particles ejected by the Characteristic Röntgen Rays: R. Whiddington.—On the Voltage Effect in Selenium: E. E. Fournier d'Albe.

LINNEAN SOCIETY, at 8.—Internodes of Calamites: Prof. Percy Groom.—Coloured Drawings of Barbados Plants: Miss Ethel M. Phillips.—On *Psygmophyllum majus*, sp. n., from the Lower Carboniferous Rocks of Newfoundland, together with a Revision of the Genus and Remarks on its Affinities: E. A. Newell Arber.—Historic Doubts about *Vaunthompsonia*: Rev. T. R. R. Stebbing.—Living Specimens of Cactoid Euphorbias from South Africa: Dr. Otto Stapf.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Tariffs for Electrical Energy, with Particular Reference to Domestic Tariffs: W. W. Lackie.

FRIDAY, MARCH 8.

ROYAL ASTRONOMICAL SOCIETY, at 5.—The Long-period Variable RT Cygni: A. N. Brown.—The Constitution of the Solar Corona. II.—Coronium: I. W. Nicholson.—On a Device for Facilitating Harmonic Analysis and Synthesis: E. W. Brown.—The Nebula HI 159 Cassiopeiæ: Dorothea Roberts.—The Real Paths of 420 Fireballs and Shooting Stars Observed in the British Isles 1897–1911: W. F. Denning.—Erreurs systématiques et probables dans les mesures d'Étoiles Doubles: R. Jonckheere.—Occultation of B.A.C. 1189 and of Mars: Cambridge Observatory.—Position of Comet Beljawsky (1911*g*): Cambridge Observatory.—On Librations in Planetary and Satellite Systems: E. W. Brown.—The Effect of Atmospheric Dispersion on the Greenwich Photographs of Eros: Royal Observatory, Greenwich.—*Probable Papers*: A Determination of the Frequency Law of Stellar Motions: A. S. Eddington.—A Tentative Explanation of the "Two Star Streams" in Terms of Gravitation: H. H. Turner.

MALACOLOGICAL SOCIETY, at 8.—The Distribution and Habits of Alopia, a Subgenus of Clausilia: Rev. A. H. Cooke.—A Synopsis of the Recent and Tertiary Freshwater Mollusca of the Californian Province. Part I., Pelecypoda and Pulmonata: H. Hannibal.—Note on the Existence of Two Editions of Férussac's Tableaux Systématiques: Major M. Conolly. Note on *Pleurotoma bipartita*, Smith: E. A. Smith.

PHYSICAL SOCIETY, at 8.—Exhibition of a "Method of Making Capillary Filaments": H. S. Souttar.—The Intensity at Points near the Principal Focus of an Object Glass with Symmetrical Aberration: J. Walker.—The Equipment of the Spectroscopic Laboratory of the Imperial College of Science: Prof. A. Fowler, F.R.S.

SATURDAY, MARCH 9.

ROYAL INSTITUTION, at 3.—Molecular Physics: Sir J. J. Thomson, F.R.S.

MONDAY, MARCH 11.

ROYAL SOCIETY OF ARTS, at 8.—The Loom and Spindle: Past, Present and Future: Luther Hooper.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Some New Zealand Volcanoes: Dr. J. Mackintosh Bell.

TUESDAY, MARCH 12.

ROYAL INSTITUTION, at 3.—Ancient Britain: Dr. T. R. Holmes.

MINERALOGICAL SOCIETY, at 5.30.—On the Zeolites from Killyflugh and White Head, County Antrim: Dr. G. F. Herbert Smith and F. N. A. Fleischmann.—On Quartz-twins: J. Drugman.—Note on the Optical Properties of Mercuric Iodide: T. V. Barker.—Notes on the Minerals and Mineral Localities of Shropshire: Arthur Russell.

SOCIETY OF DYERS AND COLOURISTS, at 8.—A Note on the Analysis of Weighted Silk: F. J. Farrell and Dr. J. N. Goldsmith.—Paper Yarn; Its Production and Uses: W. P. Dreaper.

INSTITUTION OF CIVIL ENGINEERS, at 8.—*Further Discussion*: (1) Roller and Ball Bearings; (2) The Testing of Anti-friction Bearing Metals: Prof. J. Goodman.—*Probable Papers*: The Main Drainage of Glasgow: A. B. McDonald and G. M. Taylor.—The Construction of the Glasgow Main Drainage Works: W. C. Easton.—Glasgow Main Drainage: The Mechanical Equipment of the Western Works and of the Kinning Park Pumping Station: D. H. Morton.

WEDNESDAY, MARCH 13.

GEOLOGICAL SOCIETY, at 8.—On the Glacial Origin of the Clay with Flints of Buckinghamshire and on a Former Course of the Thames: Dr. R. L. Sherlock and A. H. Noble.—Some New Lower Carboniferous Gasteropoda: Mrs. Jane Longstaff.

ROYAL SOCIETY OF ARTS, at 8.—Greek Sculpture: Prof. E. A. Gardner.

THURSDAY, MARCH 14.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: The Effects of Ultra-Violet Rays upon the Eye: Dr. E. K. Martin.—On the Presence of Radium in some Carcinomatous Tumours: Dr. W. S. Lazarus-Barlow.—An Improved Method for Opsonic Index Estimations involving the Separation of Red and White Human Blood Corpuscles: C. Russ.—The Electrical Conductivity of Bacteria, and the Rate of Inhibition of Bacteria by Electric Currents: Prof. W. M. Thornton.—A Critical Study of Experimental Fever: E. C. Hort and W. J. Penfold.—Certain Results of Drying Non-Sporing Bacteria in a Charcoal Liquid Air Vacuum: S. G. Shattock and L. S. Dudgeon.

ROYAL SOCIETY OF ARTS, at 4.30.—The Indian Census for 1911: E. A. Gait.

MATHEMATICAL SOCIETY, at 5.30.—The Cubic Surface as a Degenerate Quartic: G. T. Bennett.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.

FRIDAY, MARCH 15.

ROYAL INSTITUTION, at 9.—The Origin of Radium: F. Soddy, F.R.S.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—The Diesel Oil Engine, and its Industrial Importance particularly for Great Britain: Dr. Rudolf Diesel.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Heat Value of Fuels: A. E. Gladwyn.

SATURDAY, MARCH 16.

ROYAL INSTITUTION, at 3.—Molecular Physics: Sir J. J. Thomson, F.R.S.

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