THURSDAY, SEPTEMBER 4, 1902.

DANGEROUS TRADES.

Dangerous Trades: the Historical, Social, and Legal Aspects of Industrial Occupations as affecting Health. By a number of Experts. Edited by Thomas Oliver, M.D. (London: John Murray, 1902.)

IT is claimed for this volume of some 900 closely printed pages that it constitutes the first serious attempt in this or indeed any other country to deal comprehensively with the conduct of trades in relation to the life and health of the workers. And there is a certain fitness in the fact that such a book should first be produced here and that its authors should be British, inasmuch as Great Britain has led the van in factory legislation as she has hitherto led it in industrial enterprise. Industrial enterprise and the economic and social amelioration of the worker inevitably go together, for in proportion as each country advances in commercial prosperity and in economic development, higher ideals of comfort and higher standards of industrial hygiene are demanded by its people. Our own legislative attempts to secure these began with the opening years of the last century, and have been made the basis of, and the occasion for, similar attempts abroad. The general result has been that during the last forty or fifty years the lot of the artisan has been everywhere brightened by the improvement of the conditions under which much of his labour has to be performed.

It is hardly necessary to say that such a measure of progress has only been obtained by strenuous and persistent effort, by outside interference, or in other words, by the working of the public conscience and the force of public opinion.

Apathy, callousness, self-interest and an obstinate adherence to the doctrines of a perverted political economy have too frequently stood in the way of well-recognised reforms. It must be admitted that much of the improvement has been contemporaneous with the shifting of political power, but whether as the direct result of it is by no means equally certain. The spread of information, a more enlightened self-interest on the part of the worker, the organisation of labour, a deeper and more active sense of public responsibility in regard to unhealthy trades, together with an intelligent appreciation on the part of employers that what is good for the bee is also good for the bee-hive, have combined to secure the good which has been achieved.

The book before us is made up of sixty chapters—so many separate essays, in fact—contributed by thirty-eight authors, all of whom must be considered specialists on the subjects with which they deal.

It is impossible within the space at our disposal to do more than indicate in the briefest possible way the main features of the mass of material which Dr. Oliver and his coadjutors have brought together. We hope, however, to succeed in showing that the work deserves the careful attention of everyone interested in the hygiene of industrial life—employers of labour, factory inspectors, certifying surgeons, and also of the many members of our Legislature who concern themselves with the well-being of our artisan population. It is not to be expected that all will give unqualified assent to every expression of opinion to be found within the work. The various questions of public policy which are incidentally raised are necessarily subjects of controversy, and will be viewed very differently by persons of different political proclivities or of different schools of economics. But we think that every dispassionate and impartial reader will admit that, taking it as a whole, it is a conscientious and praiseworthy attempt to deal with matters which lie at the very foundations of our industrial prosperity and happiness.

In an introductory chapter Dr. Oliver traces in a few short paragraphs the main features of the industrial revolution—the change from the domestic system of industry to the modern methods of production by machinery—which constitutes one of the most momentous epochs in the history of our civilisation, and he indicates the changes in the social and intellectual condition of the people to which it has directly and indirectly given rise. He explains how a demand for the State control of our industries so far as relates to the safety, health and moral condition of the workers has arisen, how it has been met, and within what limitations the control has been operative and effective. As regards the economic effect of factory legislation, Dr. Oliver utters no uncertain sound.

"Those who blame State interference as the cause of the doubtful decline of our industrial supremacy, and who believe that it is checking enterprise, are not making a sufficiently serious attempt to grapple with the question by sifting all the facts carefully. It can be demonstrated that legislation has not paralysed but has improved trade as well as the conditions of labour."

He is no less reassuring as regards the results which have flowed from the Workmen's Compensation Act:—

"The Workmen's Compensation Act," he says, "which was so strongly opposed by many employers on the supposed ground that it would ruin the industries of this country, has had apparently no effect in that direction. Although it has theoretically increased their financial liability, as a matter of fact many employers have been less out of pocket than formerly. The Act has cleared the industrial atmosphere, made employers more careful in their selection of workmen, more willing to safeguard machinery, and do all they reasonably can to prevent accidents. It pays them to do so."

Should the Act be extended so as to include a larger number of industries and more particularly those regarded as dangerous trades? On this point opinions may differ, as was shown by the fate of the proposal in Parliament to place industrial diseases on the same footing as accidents.

The main objection would seem to depend upon the difficulty of defining industrial diseases.

"For a disease to be regarded as industrial, and capable, therefore, of being brought within the scope of the Workmen's Compensation Act, it would have to be placed upon the same narrow limit as an accident. It would require to be shown that it was the sole result of the occupation, and that there had been produced a definite pathological lesion of the body. Adopting this view, the maladies that could be included in the category would be, among others, anthrax, poisoning by lead, mercury, phosphorus, and bisulphide of carbon; but with the exception of anthrax, in which the disease is often

suddenly induced, and as rapidly runs to a fatal termination, there is not as a rule the same exactitude in the incidence of disease as is the case in accident. There might be little difficulty in including anthrax under the Act of 1897. The inclusion of some of the other dangerous trades would give rise to frequent litigation, but it would make employers more careful in the selection of their work-people, and in the means adopted to prevent industrial poisoning."

Among the most thoughtful and suggestive of the essays contained in the work are those contributed by the lady inspectors of factories. Miss Anderson's "Historical Sketch of the Development of Legislation for Injurious and Dangerous Industries in England," and her chapter on the "Regulation of Injurious or Dangerous Occupations in Factories and Workshops in Some of the Chief European Countries," are especially noteworthy for their breadth of view, thoroughness and impartiality. The one chapter, in fact, may be regarded as complementary to the other. Comparing what has been done abroad with the position at home, H.M. Principal Lady Inspector comes to the conclusion that England is lagging behind.

"England stands in a special position, with its own qualities and defects. Having entered long before most other European countries on the path of control of employment in factories owing to the earlier need of such regulation, and having admittedly also led the way in the task of building up a complete and precise sanitary code for regulation of public health, England has shown in the later stages of the part of the work which touches industry too little interest in the later efforts, on different lines, of other countries. This slowness is traceable in part to the same causes as those which have retarded in England the general study of comparative legislation and administration, of which foremost, no doubt, stands the necessity of developing on national lines our own safeguards, yet it seems probable that the country which in a singular degree stimulated European progress in public health by the justly famous "Report on the Sanitary Condition of the Labouring Population," 1838, has latterly retarded its own progress in industrial hygiene by too close an adherence to its own methods."

Again :—

"In several of these [foreign] countries, all of which had originally to some extent looked to the far earlier example and experience of England in enforcement of the law, the important step was taken, considerably in advance of England, of bringing into the factory service medical, engineering, and chemical expert knowledge. No doubt in England, the delay in this matter is directly traceable to the character stamped on the institution by the educational, moral and social origin of our Factory Acts, and to the very recent beginnings of development (1883–1891) of a special basis of factory hygiene."

In one respect, however, England compares favourably with continental nations in the completeness of its statistics in regard to industrial poisoning. As Miss Anderson points out,

"In no other country has the step been taken of laying both on the occupier of a factory or workshop and every medical practitioner the duty of reporting to a chief inspector of factories, or the central authority, individual cases of industrial poisoning.

On the other hand, in no other country is there "a power reserved to employers," similar to that which was in force in England until last year, "of compelling such objections as they can sustain to proposed rules to be settled by arbitration." What Parliament and the country thought of the manner in which arbitration had worked in the past was seen in the practical unanimity with which this form of procedure was swept away in 1901.

In a short chapter on the "Principles of Prospective Legislation for Dangerous Trades," Mr. Tennant, the chairman of the Dangerous Trades Committee, which presented its final report in 1899, deals more especially with the question of the amendment and consolidation of the law relating to factories and workshops, the history of which has this in common with that of the British constitution, that "the structure of each is compounded of small accretions, contributed by what seemed the necessity of the moment." In the present condition of the law there are unquestionably many incongruities and anomalies—exemptions difficult to justify and exceptions incapable of rational explanation. But whilst much of the practical force of Mr. Tennant's contention has been minimised by the transference, above alluded to, of the responsibility for the special rules from an arbitrator or umpire to the Secretary of State, the doubt still remains whether the main defects of the present system are altogether remedied.

Chapter v. deals with the influence of factory labour upon infant mortality, and is made up of two essays, one contributed by Mrs. Tennant, formerly H.M. Principal Lady Inspector of Factories, and the other by Dr. Reid, the Medical Officer of Health of the Staffordshire County Council. Each of these essays tells the same tale, and a sad enough story it is. We heard a good deal some little time since about "the holocaust of babes" in the concentration camps in South Africa, but the waste of infant life there was out of all comparison with that which goes on unchecked as the result of our own factory system. A former Lord Londonderry once railed against the "hypocritical humanity" of Parliament when it sought to protect the lives and limbs of coal-miners. We may hope that Parliament will not continue to turn a blind eye to the large amount of infant suffering and the terrible waste of child-life in our manufacturing towns, but will learn to recognise before it is too late that, as Sir John Simon once said, "a high local mortality of children must almost necessarily denote a high local prevalence of those causes which determine the degeneration of the race."

The exigencies of space only allow of a passing reference to Miss McMillan's essay on "Child Labour" and to that by Mr. Ballantyne on "Home Work." Happily the half-time system is dying out and the age of the full-timer is being steadily raised. The question of home or out-work is one of great difficulty, and there is much in it which calls for State regulation. But it would require a strong Minister with a strong public opinion behind him to deal with it at all adequately.

The editor contributes a short paper on the "Physiology and Pathology of Work and Fatigue," in which he treats of the means of measuring muscular work, the changes which occur in tired muscle and in the blood of fatigued persons, the effect of work on nerve structure, the use of alcohol as a muscle food, &c. Although appealing more particularly to the physiologist, the

article is not too technical, and its style is appropriate to the work in which it appears. It is, perhaps, not undesirable that those who regard men and women as "hands"—that is, as machines for turning out work—should have some knowledge of the pathological consequences of fatigue.

Dr. Tatham's paper on "Mortality of Occupations" deals briefly with matters which have already been more fully treated by him and others in official publications, notably in the successive decennial supplements to the reports of the Registrar-General. In the chapter on "Dust-producing Occupations" he considers more particularly those industries which give rise to the constant inhalation of dust, leading to grave and characteristic lesions resulting in premature breakdown and death among the workers, and in a subsequent section he discusses the effects of the accumulation of respiratory and other impurities in the air breathed, partly from the neglect of suitable methods of ventilation and partly as the result of the cramped position adopted in certain cases of sedentary indoor labour.

Dr. Oliver also contributes a chapter on "Dust as a Cause of Occupation Disease," with special reference to the skin diseases of flax-workers and the diseases of the nails among furriers, lung diseases, and gastro-intestinal lesions attributable to dust.

The chapter on "Dustwomen" is curious and interesting, and serves to show how the dangers due to what is a disagreeable and at times even a disgusting employment may be mitigated by the conditions under which the work is performed if only a little common sense and prudence are exercised.

By far the greater portion of the work is concerned with the effect of particular industries upon the health or longevity of the worker, and it is this section which will appeal most strongly to individual employers, to statisticians and to the practical legislator. Mr. Cunynghame contributes an interesting article on the history of the attempts which have been made by the Board of Trade and by Parliament to bring the dangerous operations on railways under regulations analogous to those which can be made by the Home Office in regard to the dangerous processes in factories and mines. Although time can alone show how far Mr. Ritchie's attempt to bring railway labour within the circle of protected industries will actually realise the anticipations held out at the time of the passing of his Act, there can be no question that the position of railway servants as regards immunity from accidents has been thereby greatly ameliorated.

The extraordinary development of the technical applications of electricity has brought a special crop of dangers to the workers in its train, which are dealt with by Commander Hamilton Smith, who also contributes a chapter on acetylene and its dangers.

Lead and its compounds are naturally dealt with by the editor, who also treats of china and earthenware manufacture and of phosphorus and lucifer matches—subjects with which he has specially concerned himself at the instance of the Home Office. Mr. Malcolm Morris furnishes a short chapter on the industrial employment of arsenic; Dr. Legge contributes one on the dangers in the use of mercury and its salts, and one on the lesions resulting from the manufacture and uses of the alkaline bichromates. The effects of the dust of basic slag, and that resulting from ganister crushing and from buhrstone chiselling, are also treated in special chapters. Steel grinding is dealt with by Mr. Sinclair White, who, as a lecturer connected with the medical department of University College, Sheffield, has special opportunities of acquiring information; and the subject of "brass ague," which is particularly prevalent in Birmingham, the home of the brass trade, is treated by Dr. Simon, of the General Hospital in that city.

The dangers incidental to the use of bisulphide of carbon and naphtha in the manufacture of indiarubber and of benzene in dry cleaning are considered by the editor, who in this connection might also have had regard to the use of carbon bisulphide as a wool cleansing or degreasing agent. Dr. Prosser White, who is officially connected with the Roburite Explosives Company, contributes a chapter on the effects of dinitrobenzene and other nitro-substitution products on the workmen employed in the manufacture of high explosives. The effects of such explosives on the air of mines, together with the general pathological results of breathing the atmosphere of mines, are considered by Dr. Haldane, who is specially well qualified by experience and observation to deal with the subject. Principal Laurie treats of the health of workers in chemical trades; Drs. Hamer and Bell furnish two essays on anthrax and its relation to the wool industry; and Mr. Stuart, who is the medical officer of health at Batley, contributes chapters on blanket stoving and on rags and their products (shoddy mungo, &c.) in relation to health. The woes of the washerwomen—and they are more grievous than many of us are aware—are sympathetically dealt with by Miss Lucy Deane; whilst Miss Paterson tears aside something of the romance which seems to environ the life of the braw fishwife "bearing with apparent ease the enormous creel of fish and her almost equally surprising burden of petticoats." We do not usually associate much that is unhealthy either with the occupation or the appearance of the stalwart lassies that make such a picturesque congregation on the quays of Stornoway, Peterhead or Lerwick. But that the "kipperer" and the "gutter" have their peculiar troubles, and that these may be avoided by definite enactment and administration, with regulated hours and sanitary work places, are equally certain.

There is much else in the book that we should have liked to indicate and many excellent features upon which we could have wished to dwell at greater length. If we have a fault to find it is that it includes too much. The diseases of soldiers at home and abroad and questions of marine sanitation hardly come within the province of a work entitled "Dangerous Trades." Admirable as the articles relating to these subjects are, we think the editor would have been well advised to keep to subjects which are strictly within the purview of the Home Office. No doubt it is an all-embracing Department, but if the profession of arms is to be regarded as a dangerous trade in the sense that the occupation of the potter or the wool-sorter is considered dangerous, it is not easy to see why that of the medical man, the journalist, or even the legislator should not equally have been included.

We venture to think, too, that the work suffers to some extent by the mode in which its parts have been put together. It is necessarily somewhat mosaic in character, and there is a certain want of harmony and continuity of arrangement. No doubt this is due to the difficulty of dealing with so large a body of contributors, all of whom are working independently. But these, after all, are minor blemishes, and do not seriously detract from the very great value of the compilation. We heartily congratulate Dr. Oliver and his colleagues on the production of a work which will unquestionably take high rank in the literature of sanitary reform.

T. E. THORPE.

THE NEW INTERNATIONAL CATALOGUE.

International Catalogue of Scientific Literature. First Annual Issue. D. Chemistry, Part i. Pp. xiv + 468. (1902.) Price 21*s*.

THIS is the second instalment of the work of the International Catalogue Bureau, the first (part i. of Botany) having been reviewed in our issue of July 3 (p. 217). In a notice on p. xiv. it is explained that in consequence of the difficulties attending the complete organisation of the work of the regional bureaus some delay has arisen, and it is hoped that the second part of the volume will be published in a few months. In starting a colossal work such as this "International Catalogue," delay was inevitable, and it is to be hoped that when the different bureaus are in working order the volumes will be published more closely to the period to which they refer. On the title-page it is stated that the MS. for this volume was completed in January, 1902, so we presume that both parts i. and ii. will deal with the year 1901 only.

It is reported that although the seventeen annual volumes which constitute the "Catalogue" will, as a rule, contain the work of twelve months, yet they will not all refer to one calendar year; probably it is impossible to avoid this arrangement so as to maintain the work of the Central Bureau at a uniform rate, but it would certainly be convenient to scientific workers if, for each science, all the papers of one calendar year could be collected into one volume. No doubt the title-page of each volume will indicate the period over which the papers indexed extend, but the annual arrangement, if practicable, would appear to be much more convenient.

The authors' catalogue is contained in 111 pages with 2455 entries; in this the authors' surnames are printed in Clarendon type with the Christian names in Roman; when initials only are given in the original paper, the remainder of the name is placed in square brackets; when a paper is by more than one author, only the name of the first is in thick type. The complete title is given, usually in the language in which the paper is written. In the case of languages other than English, French, German and Italian, a translation of the title in one of these four languages follows the original; in some instances, however, translations only are given, the names of the original languages being placed in brackets. Then follow the abbreviated titles of the periodicals, with the complete reference to volume, year and pages of beginning and ending of the paper, the number of the pages being in parentheses. The registration numbers are placed in square brackets, and when the papers deal with other sciences in addition to chemistry, the letters and registration numbers of these sciences are included. The papers are numbered consecutively, these numbers concluding the entries. At the commencement of the volume, the schedule of chemistry, with registration numbers, is printed in English, French, German and Italian; and at the end there is a list of the periodicals with their full titles and the abbreviations used in the "Catalogue."

The subject catalogue occupies 283 pages, and is arranged in the order of the registration numbers. At the top of each page the registration number is given in thick type and is easily seen. Each division is marked with the registration number and the corresponding subject as a heading. The numbers are here also printed in thick type and the subject in Roman capitals, but they do not catch the eye so well as could be wished; the subsidiary titles are in Clarendon with capital initials, and are more easily seen than the heading of the division; thus on p. 195 the heading "Zinc Oxide" is very visible, whereas the heading "Zinc" at the commencement of the division is not so clearly shown.

In the subject catalogue the entries are, as a rule, reprints of the corresponding entries of the authors' catalogue, commencing with the authors' names in Clarendon and, if the papers belong to more than one division, concluding with the registration numbers other than those of the division under which the entries are made. The entries are repeated under each registration number. As in a subject catalogue the authors' names are not of the first importance, it would be better, if it were possible, to give prominence to the subject. The title of a paper does not always indicate its contents, and we are glad to see that in many of the papers from English serials a title is given in square brackets which shows much more effectually the contents of the papers than the original heading; thus in the authors' catalogue occurs the following entry:—"Frankland, Percy Faraday and Farmer, Robert Crosbie. Liquid Nitrogen Peroxide as a Solvent. London, *J.* Chem. Soc., 79, 1901 (1356–1373) . . . . [0490 7100 7250]" In the subject catalogue under "0490 Nitrogen," subdivision "Nitrogen Oxides," the same entry occurs, with the registration numbers [7100 7250]. Under "7100 Mass Properties," subdivision "Molecular Weights," after the names of the authors there follows "[Molecular weight determinations in liquid nitrogen peroxide by the ebullioscopic method]," with the registration numbers [0490 7250]. Under "7250 Electrical and Magnetic Properties," subdivision "Conductivity, e find the names followed by "[Conductivity of solutions in liquid nitrogen peroxide]," with the numbers [0490 7100]. It will be seen that the last two subjects cannot be inferred from the title of the paper, and there must be many other cases of the same kind. The subject catalogue is much increased in value by this indication of the contents of the papers, for which we are indebted to the activity of the English Bureau, or perhaps more definitely to that of Mr. Ernest Goulding, the referee for this volume. It would be a great boon if the other regional bureaus could be induced to give this partial analysis of the papers. It may be replied that the fact of the reference being placed unde-

certain subdivisions would sufficiently indicate the contents of the paper, and in the case above cited this is partially true; but take the paper numbered 738 and compare its title with those under the various sections (they are too long to quote), and the value of the additional titles will be at once appreciated.

Of recent years our knowledge of organic chemistry has increased so rapidly that it might be difficult to know under which registration number to look for some of the organic compounds, and chemists will be thankful to the Central Bureau for giving a list of organic bodies and their registration numbers extending over nearly sixteen pages in double columns and containing some 1800 references.

It may be thought that the mode of using the registration numbers would be very difficult to acquire, but it is surprising how rapidly one becomes accustomed to their employment after a little practice. It cannot be said that the schedules as they now stand are perfect, but when they are revised in 1905 many emendations will doubtless be made.

We must be thankful to the Central Bureau for the care and accuracy with which this volume has been compiled, and we must congratulate chemists on having another instrument of research at their disposal.

HERBERT MCLEOD.

ANOTHER THEORY OF SEX.

Qu'est-ce qui détermine le Sexe? Par le Docteur A. Van Lint, Médecin Assistant à l'Hôpital Saint-Pierre, à Bruxelles. Pp. 77. (Paris: Baillière et Fils, 1902.)

DR. A. VAN LINT has convinced himself of the validity of a somewhat extraordinary new theory as to the determination of sex, which is in some measure a rejuvenescence of Starkweather's. If it is true, it should give pause to virile fathers who wish to have sons, for unless they can secure still more vigorous mates they are sure to have daughters only. The theory is, that the offspring follow the sex of the weaker parent, though, as we read on, this turns out to mean the parent whose available germ-cells are relatively less vigorous at the time of fertilisation. But an attempt to estimate the relative vigour of germ-cells leads us into the region of the unverifiable.

To understand the author aright we must note that he does not believe in the concept of the germ-plasm ("pour nous, les cellules génitales se développent tout entières aux depens des cellules somatiques," p. 34), and that he postulates the origin of the unisexual organism from primitive hermaphroditism, a tendency to which always persists in more or less subtle guise. We cannot within our limits argue about these postulates, but we cannot agree with either. It is very interesting to compare van Lint's views with those stated by Dr. John Beard in his paper on the determination of sex, also published this year.

Van Lint's new theory is a coordination of five hypotheses, which he expounds in a lucid and suggestive manner:—(1) The ovum and the spermatozoon are antithetic, expressing opposite extremes of cellular differentiation, and perhaps analogous to right-handed and left-handed crystals of the same stuff. (2) There is also a somatic antithesis between the masculine body and the feminine body, often conspicuous in the so-called secondary sex-characters, often inconspicuously expressed in minute contrasts which saturate the whole soma. (3) Again, there is an antithesis between the character of the germ-cells borne by an individual and the character of the body of that individual; they are complementary expressions of the primitive hermaphroditic unity of the organism; indeed, the characters of the sex suppressed in the development of the unisexual gonads are expressed, as it were, in pervasive influence on the soma. (4) So strong is this third antithesis that the male's somatic cells—which the author in a question-begging term calls "parovules"—may be regarded as sexually equivalent to ova; while the female's somatic cells—which the author in another question-begging term calls "paraspermatozoides"—may be regarded as sexually equivalent to spermatozoa. This seems an extravagant and unwarranted hypothesis, and we are quite unconvinced by the facts as to effects of castration, &c., adduced in support of it. But to continue. (5) The properties of the "sexualised" body react on the properties of the germ-cells, in embryonic as well as in adult life, and this in such a definite way that they determine the sexual bias, or the sex of the offspring into which the germ-cells will develop. In short, the sex of the offspring depends on the relative bodily vigour of the parents.

Thus, if a relatively feeble ovum be fertilised by a relatively vigorous spermatozoon, the spermatozoon's qualities will be dominant; the embryo will therefore have (by hypothesis) a masculine or "paraspermatozoid" body, and to balance this the gonads will be female. One naturally wishes to know what the relative vigour of a cell means, and this is discussed in chapter v.; one also wishes to know how the vital force of a parent is measured, and chapter vi. gives the six heads of a complete medical examination. We are relieved to find, however, that the certain sign that a man is more vigorous than his wife is his having a daughter. "Le sexe de l'enfant tranchera la question." Could there be a more conclusive criterion?

In the seventh chapter it is shown that the author's theory fits in well with the phenomena of "crossed inheritance." The son is the result of a more vigorous ovum fertilised by a less vigorous spermatozoon; the somatic cells must balance the gonads, therefore they must be feminine, and, of course, the boy is the image of his mother. Could anything be simpler?

In the eighth chapter the author seeks to show with great ingenuity that the available statistical and experimental results on this difficult subject may be harmonised with his views, and concludes by showing that the so-called auto-regulation of the proportions of the sexes is also explicable on his theory, according to which it is always the more feeble that Nature insists on replacing. If we had space at our disposal we should be delighted to disagree with the ingenuous author in regard to the detailed facts, but it would be of little avail since we cannot admit his postulates. The moral of the book seems good—that the strong man who wishes to have sons must find a still stronger mate; but it also follows, unfortunately, that the weak woman who does not wish

to have daughters has no resource but to find a still weaker husband. The thesis, if accepted, should beget humility in those male parents who have large families of lusty sons. J. A. T.

RÖNTGEN RAYS IN MEDICINE AND SURGERY.

The Röntgen Rays in Medicine and Surgery as an aid in Diagnosis and as a Therapeutic Agent. By Francis H. Williams, M.D. (Harvard). Pp. xxxii + 704; 401 illustrations. Second edition, with appendix. (New York: The Macmillan Company; London: Macmillan and Co., Ltd.) Price 25*s.* net.

THE second edition of this excellent work was called for because the first was unexpectedly exhausted within three months, and we congratulate the author upon his deserved success. Only those acquainted with the subject can appreciate how difficult it is for any author to give a correct view of the progress of such a branch of science as the X-rays, because of the great advances made within a comparatively short period, the number of authors engaged in research and the nature of the subject itself. As might have been expected, Dr. Williams fully understands this, because in his preface he states that the work is rather a report of progress than a final presentation of a growing subject. Further, owing to the short time at his disposal for the preparation of a second edition, he has only been able to add some forty pages, chiefly on apparatus and the therapeutic uses of the X-rays. This will be found in the appendix.

Dr. Williams very properly introduces his subject by reference to the principles of physical science, and, without overburdening the student, he tells what is necessary for their appreciation. Next he deals in the most practical way with the equipment necessary for photographic and therapeutic work. Having thus prepared the way, he enters into a full description of the normal conditions of the cavities of the body so that the observer may be able to appreciate deviations from the normal, a principle which will be thoroughly appreciated by all those who are seeking for information from the clinical aspect. The pathological changes are well described by photographic illustrations, diagrams and histories of selected cases.

A noticeable feature of the work is the amount of attention devoted to what might be called the medical aspect of the subject as opposed to the surgical. This is interesting, because for a long time many who believed in the value of X-rays in the detection of fractures, dislocations of the hard structures and foreign bodies were inclined to think that the use of X-rays would be limited to these. If any are still of this opinion we commend them to a perusal of this work.

The third great step in the development of X-rays in medicine was their application in diseased structures, and the present position of their therapeutic action is frankly and fairly stated in these pages.

While it is true that the work gives a very strong representation of the methods employed in America—indeed, the illustrations themselves show that the work has not been produced in any European laboratory—still the labours of others have not been neglected. In future editions the work might be enhanced in value by a reference to what has been done in this country and the European schools of medicine, a fact which is admitted by the author in his preface, because he states that he had intended to include as complete a list as possible of the publications on the subject. This was not found possible on account of its extent, so he adds that had he foreseen this he would have referred in the text to many other important papers.

The work is well written by one thoroughly familiar with the subject, is profusely illustrated, and to those who desire a guide to the study of the subject the work may be thoroughly recommended; and this remark applies to students and practitioners.

OUR BOOK SHELF.

Elementary Geometry. By W. C. Fletcher, M.A., Head Master of the Liverpool Institute; late Fellow of St. John's College, Cambridge. Pp. 80. (London: Edward Arnold, n.d.) Price 1*s.* 6*d.*

THIS is a very small book and a very good one. Its object is to teach geometry to boys without hindering and wearying them with metaphysical subtleties, or requiring them to express the proofs of propositions with that pedantic recitation of details—that parody of logical accuracy—which has long been identified with the study of Euclid.

The author is perfectly correct when he says that his little book "contains the whole substance of Euclid i.–iv. and vi. except the elegant but unimportant proposition, iv. 10."

The branches of the subject are taken in the following order:—Angles, triangulation (*i.e.* the discussion of the properties of triangles), quadrilaterals, loci, proportionals, circles, tangents, areas, maxima and minima, this last section being very short and merely illustrating what is meant by a maximum or a minimum. There is no formality whatever in the proofs, the most simple propositions being often left to the student with a hint sufficient for the solution. Each section, besides terminating with a number of simple exercises (well within the power of the beginner), contains a number of numerical illustrations to be worked by actual drawing with instruments. This is precisely the kind of teaching which is now being advocated by those who have taken up the question of the reform of mathematical teaching.

In propositions relating to proportion—as, for example, that a line drawn parallel to the base of a triangle divides the sides in the same ratio—the author explicitly states that he assumes two magnitudes to have a common measure, and that the difficulty which arises in the case in which they have not "had better be disregarded for the present." The reason for thus making an *essential* difference between "commensurable" and "incommensurable" quantities of the same kind is not obvious, since any proposition which holds for the former will be admitted, even by the beginner, to hold for the latter when it is pointed out that the unit magnitude may be taken so small that the distinction between commensurable and incommensurable quantities practically disappears. The proposition that the sum of two sides of a triangle is greater than the third is proved by the definition of a right line as the shortest distance between two points. The nature of a tangent as the limiting position of a chord is that which the author adopts. This also is in accordance with modern notions, and it offers no difficulty whatever even to the merest beginner. In p. 42, line 4, for "place them so that two pairs of sides are parallel,"

read "place them so that any two corresponding sides are parallel." In p. 63, ex. 19, for "prove also that OT, ON equal OP^2," read "prove also that OT.ON equals OP^2."

Diagrams of Mean Velocity of Uniform Motion of Water in open Channels, based on the Formula of Ganguillet and Kutter. By Prof. Irving P. Church. 11 Diagrams +1 page Text. (New York: Wiley and Sons; London: Chapman and Hall, Ltd., 1902.)

THIS little work, in spite of its ponderous and somewhat ambiguous title, is a useful and workmanlike collection of curves from which may be obtained the value of the mean velocity v in the empirical formula $v = c\sqrt{rs}$, so much used in computing the flow of water in channels.

To the ordinary reader the term "mean velocity of uniform motion" is puzzling; but anyone versed in hydraulics will understand that the author wishes, very properly, to restrict the application of his curves to cases where the rate of flow is constant, *i.e.* where the same number of cubic feet or gallons pass a given section of a channel of uniform cross-section every second.

In the formula the trouble is with the coefficient c, which is not independent of r and s—the hydraulic mean depth or "hydraulic radius" and the slope. The coefficient may be computed, for channels of different materials, from well-planed timber to earth and stones, by the formidable law of Ganguillet and Kutter,

$$c = \frac{\frac{1{\cdot}811}{n} + 41{\cdot}65 + \frac{{\cdot}00281}{s}}{1 + \frac{n}{\sqrt{r}}\left(41\,65 + \frac{{\cdot}00281}{s}\right)},$$

where n is the arbitrary constant which ranges in value from 0·009 to 0·035 in the two extreme cases cited.

Very few people, we imagine, actually calculate c in this way, as tables by Trautwine and others give its value for all likely values of n, r and s. Prof. Church has, however, gone a step further, and his diagrams give values, *not* of c, but of v, thus avoiding the further calculation usual after c is found from tables.

There are eleven diagrams, each corresponding to a particular value of n, the vertical lines in each diagram showing "slopes," inclined lines "hydraulic radii," and horizontal lines "mean velocity" v. The intersection of any three of these lines satisfies the relations referred to, and shows for the selected values of n, r and s the required mean velocity in feet per second, which, multiplied by the cross-sectional area of the channel in square feet, gives the flow in cubic feet per second.

A test or two, worked out from the formulæ, shows the curves to be accurate enough for practical purposes.

Thus, selecting $n = {\cdot}01$, $r = 10$, $s = 2{\cdot}0 \div 1000$, the calculation gives

$$c = \frac{\frac{1{\cdot}811}{{\cdot}01} + 41{\cdot}65 + \frac{{\cdot}00281}{{\cdot}002}}{1 + \frac{{\cdot}01}{3{\cdot}162}\left(41{\cdot}65 + \frac{{\cdot}00281}{{\cdot}002}\right)} = \frac{224{\cdot}155}{1{\cdot}136} = 197{\cdot}3$$

and

$$v = 197{\cdot}3\sqrt{10 \times {\cdot}002}$$
$$= 27{\cdot}89 \text{ feet per second.}$$

The diagram gives v about 28.

In another test where $n = {\cdot}03$, $r = 10$, $s = 2{\cdot}0 \div 1000$, the diagram gives v about 10·5; calculation makes it 10·38.

There is no doubt, therefore, that Prof. Church has compiled a real "labour-saver" for those who have to make numerous calculations of the kind referred to.

Near the end of the author's explanation he mentions the application of the diagrams to cylindrical pipes and sewers "running full or half-full." We would point out that the rule $v = c\sqrt{rs}$ is not applicable with success to pipes running full, though various American writers attempt to use the law in this sort of universal sense. Much more authentic formulæ are available for calculating the flow in pipes, and the curves given in this little work should not be applied to that purpose. R. G. B.

A First Course of Chemistry (Heuristic). By J. H. Leonard, B.Sc. Pp. vi + 134. (London: John Murray, 1902). Price 1*s.* 6*d.*

THIS little work provides a course of elementary chemistry resembling the well-known course which was drawn up some years ago by Prof. Armstrong and endorsed by a British Association committee. Great pains are taken to make the teaching undogmatic and to imbue the pupil with the zeal of a scientific inquirer. The topics include a study of chalk, lime and carbonic acid, air, water, combustion, acids and salts. Though the work cannot be pronounced superior to some that have already been written with the same object, it gives a good representation of what many people now think the right way of approaching elementary chemistry. On any system the teaching of elementary chemistry will for long remain full of difficulties and inconveniences. We notice that on p. 43 there is an instruction to collect oxygen by displacing air in an inverted cylinder, and on the next page an experiment, correctly enough described, perhaps, leading to the conclusion that oxygen is lighter than air. A. S.

An Elementary Book on Electricity and Magnetism and their Applications. By Profs. D. C. Jackson, C.E., and J. P. Jackson, M.E. Pp. xi+482. (New York: the Macmillan Company; London: Macmillan and Co., Ltd., 1902.) Price 7*s.* 6*d.*

THE object of the authors has been to write a book which will serve both as an elementary text-book and as an interesting account of the subject for the general reader who has a taste for the science. With this in view they have naturally taken industrial development as a guide, and wherever possible have shown the connection between the simple principles of the science and their technical applications. As the general reader is usually ill-equipped with mathematics, we find that little more than the simplest equation is used in the book.

Each chapter is followed by questions. Here are some of the questions which come at the end of the first chapter:—

"How much is known about the real constitution of electricity?"

"What is electricity supposed to be by some scientists?"

"What kind of electricity will a positively charged ball induce?"

The book contains twenty-three chapters, and from chapter xv. to the end the subject-matter is principally technical applications. Thus polyphase motors, electric welding, cooking and Röntgen rays, and other new uses are each described in their appropriate chapters. S. S.

The Face of Nature. By the Rev. C. T. Ovenden, D.D. Pp. ix + 188. (London: John Murray.) Price 2*s.*

IN this little volume we have the material for several "popular readings in elementary science," the subjects of the four chapters being weather forecasting, vegetable life, the record of the rocks, and stones from boulder clay. The village clergyman or teacher who desires to show that there are "sermons in stones" and other natural objects and phenomena will find Canon Ovenden's short addresses of service.

A few points will, we think, lead to misconception if accepted as they now stand. For instance, a barometer is said to weigh the air, whereas it really measures pressure. Again, it is only true in the northern hemisphere that a "cyclone spins always against the hands of a clock, and the anticyclone rotates with the hands of the clock."

In the chapter on plants, roots are said "to suck up water through tiny mouths," "to search for lime salts," and "to pick up compounds of potash." Of some plants we read, "They determined to do by cunning what they could not accomplish by force," "One very clever tree seems to have foreseen this danger and provided a remedy." "The hazel never intended to grow nuts either for boys or squirrels." "The pitcher plant and Venus's fly trap which set most ingenious snares for insects, and devour them when caught."

The point of view of the whole of this chapter is unscientific, for plants do not do any of these things intentionally, and to attribute intelligence to them is misleading.

The illustrations are line drawings enclosed in circles for reproduction as lantern slides. In many cases a scale should have been provided. The diagram of a bean seed (p. 49) is very poor.

Gold Seeking in South Africa: a Handbook of Hints for intending Explorers, Prospectors and Settlers. With a chapter on the Agricultural Prospects of South Africa. By Theo Kassner. Pp. x + 134; with maps and illustrations. (London: Charles Griffin and Co., Ltd., 1902.) Price 4*s.* 6*d.*

NOW that a new era is opening in South Africa, the appearance of any book giving information likely to be useful to intending immigrants is opportune. It will not be taken for granted by everyone that the last discoveries of gold in the Transvaal have already been made, and the venturesome prospectors who go there should include this little book in their outfit, as it is written by one who knows the country well. It contains some useful notes on the geology and history of the Transvaal goldfields, and a number of sketch maps. The De Kaap goldfield is treated somewhat more at length than the others, although even this account can hardly be called exhaustive. The illustrations are numerous, but a protest must be made against the inclusion of some of them, particularly of Fig. 6, which is said to represent a pestle and mortar.

A Text-Book of Inorganic Chemistry. By Dr. A. F. Holleman. Rendered into English by Hermon C. Cooper. Pp. viii + 458. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1902.) Price 10*s.* 6*d.*

THE German edition of this Dutch work was noticed in NATURE, vol. lxii. p. 598, October 18, 1900. A reperusal shows that considerable improvements have been made in the English version. The translation is entirely satisfactory, and the book may be recommended as a lucid and scientific account of inorganic chemistry. It includes a great deal of well-expounded physical chemistry and also many incidental matters of interest that are not usually found in works on inorganic chemistry. It is likely to prove very acceptable to those who wish to have a moderately advanced book of inorganic chemistry embodying an unaggressive presentation of the most modern discoveries and theories.

The Bernese Oberland. By G. Hasler. Vol. i. From the Gemmi to the Mönchjoch. Pp. xxv + 164. (London: T. Fisher Unwin, 1902.) Price 10*s.*

THIS is the first volume of a series of four intended to guide climbers to the peaks and passes of the High Alps of the Bernese Oberland. The routes are arranged in chronological order of the conquest of the peaks to which they lead, and are dealt with in six sections referring to the Balmhorn, Breithorn, Blümlisalp, Bietschhorn, Aletschhorn and Jungfrau groups. With this guide in his pocket, a climber will be able to explore districts which, happily, have not been entirely permeated by the show and tourist spirit characteristic of more frequented spots, and are full of interest.

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.*]

Archæological Remains on the Summit of the Nevado de Chañi.

DURING the excursions that were made under my direction in 1901–1902 in the north of Argentina and the south of Bolivia from the Puna de Atacama to Crevaux at Pilcomayo, some of my comrades climbed to the top of Nevado de Chañi about 6100 metres in Puna de Jujuy.

Two ascents were made, the first by Count Eric von Rosen, the second by Dr. R. Fries, Mr. G. von Hofsten and Mr. Wensceslao Mercado. Von Rosen ascended quite near to the top, the others reached it. The summit is of granite; on the north-west side the rock is sandstone.

Dr. Fries made botanical collections. On the top he found lichens. The microscopical life of the snow was poor. The snow line was about 5600 metres. On the side of the mountain there are remains of old houses. On the top there are small walls, and there Hofsten and Fries found pieces of pottery, a little green stone worked by man, a depot of wood of cactus, tola, &c. The walls were built in two small squares with one side open. One of the pieces of pottery was painted with a wedge-shaped (kilformigt) ornament, quite similar to ornaments found by Count von Rosen on pottery from Ojo de Agua, a pre-Columbian "pueblo" in the Quebrada del Toro, some miles to the south. The wood was found both inside and outside of the walls and very well preserved; probably this may be explained from the fact that at this height there are no, or few, microbes. Also in the Puna about 3500 metres above the sea in the pre-Columbian grave-fields, there are still preserved pieces of clothes, skin, instruments of wood, &c.

It seems to me probable that these small walls on the top of the Chañi are the remains of an old sacrifice or signal place from pre-Columbian time. ERLAND NORDENSKIÖLD.

Dalbyo, August 14.

Radiant Point of the Perseids.

YESTERDAY morning, August 11, I watched the northern sky for shooting stars from a place near Baddeck, Nova Scotia, from 0h. 30m. to 2h. 15m. (Atlantic time). During this period I observed forty-nine meteors—mostly faint—forty-one of which appeared to radiate from the constellation Perseus.

While trying to locate the radiant point, I noticed a speck of light flash out in Perseus, which died away without apparent change of position, as though a third-magnitude star had suddenly appeared and disappeared. This was probably due to a meteor advancing directly in the line of sight, in which case the location of the luminous point perceived may be of importance to astronomers, as an indication of the radiant point of the Perseids.

The right ascension was about 2h. 35m., declination +56°, as nearly as I can make out from a star chart. I may say frankly, however, that I am not accustomed to make observations of astronomical positions. I can point out the exact position in the sky, and would be very glad if some of my astronomical friends would care to verify the R.A. and Decl.

I may add that the paths of most of the Perseids observed seemed to intersect at or near the point where the stationary meteor appeared. ALEXANDER GRAHAM BELL.

Baddeck, N.S., August 12.

Earth Surface Vibrations.

IN NATURE for August 14, Mr. Charles Stewart writes from the Cape stating that exceptionally rapid barometric variations took place there on the morning of May 28. Mr. Hill states in the same number of NATURE that on the morning of May 8, Mr. Ferdinand Clerc, at St. Pierre, "observed the needle of a large aneroid barometer pulsating violently."

The two similar barometric movements at different places suggest that the air disturbances at St. Pierre did not cause the barometric movement there.

Mr. Stewart assumes there was an earthquake at the Cape for the reasons he gives. But the Royal Observatory showed no record of any seismic disturbance.

If the earth movement took place at the Cape as an absolutely *perpendicular* vibration, would the seismograph have recorded it?

Can sudden and abnormal change in atmospheric pressure cause volcanic or other disturbance on the earth?

August 19. F. C. CONSTABLE.

IN NATURE, August 14, p. 371, it is stated that "at 7 o'clock on the morning of May 8, Mr. Ferdinand Clerc observed the needle of a large aneroid barometer pulsating violently." Above this there is, however, another note which says that "nothing unusual was observed in the barometer." But even supposing barometric perturbations to have taken place on May 8 in St. Pierre, what connection could these have had with phenomena which happened twenty days later at the Cape of Good Hope?

The Milne horizontal pendulum installed at this latter place will record disturbances originating at its antipodes, but will not respond to the rapid elastic vibrations of local shocks. You may hear seismic sounds, windows and doors may rattle, but the instrument in question will remain at rest.

The movement of an earth particle at the time of an earthquake is in all azimuths and at varying angles with the horizon. A strictly perpendicular movement seems an impossibility.

Abnormal changes in atmospheric pressure may act on a region in a state of excessive seismic or volcanic strain much in the same way as the last straw is said to act upon the camel's back; the relationship, however, is far from being pronounced. This and other questions referred to by Mr. Constable are discussed in the volumes on "Seismology" and "Earthquakes" published in the International Scientific Series. J. M.

August 26.

Larva Stage of Heliocopris Isidis.

IN the month of March last, I discovered at a depth of a few cm., among the roots of the tree *Albizzia lebbek*, several large balls of earth, varying in diameter from 5·0 to 8·5 cm. These on being broken open were found to be hollow spheres, the thickness of the wall being about 1·5 cm. This wall was composed of concentric layers of mud and bits of vegetable matter mixed, having the composition and appearance of native unburnt bricks.

Inside the sphere was a coleopterous larva about 2·0 cm. in diameter at its thickest part, about 9·0 cm. in length measured along the dorsal line, and about half that length measured along the ventral line; the larva lay on its side and assumed a curved position. A few days ago, an imago of *Heliocopris Isidis* emerged from one of the balls by boring a hole in the roof of its cell just large enough for it to pass through.

If any of these facts are new in the life-history of this beetle, they might interest your readers. FRED. FLETCHER.

School of Agriculture, Ghizeh, Egypt, August 14.

THE LAVA-LAKE OF KILAUEA.

THE recent destructive eruption in Martinique has revived interest in the question of the causes of volcanic action. Only lately have I become sensible of the peculiar value of some observations of my own as evidence of the *primary* force which impels the ascent of lava from its interior habitat, as distinguished from the explosive violence caused by steam generated by the encounter of the ascending lava with ocean and other surface waters.

I have long believed the primary force to reside in the expansion of the gases originally occluded in the magma, ever since its first condensation from the nebula. Whenever released from solidifying pressure by disturbances of the superincumbent crust, the intensely hot magma bursts into a viscid foam and pushes upwards. In a quiet volcano like our Kilauea, meeting no water to generate explosive steam, the lava wells up continuously and steadily in a comparatively gentle fountain, which displays effervescence only on the surface.

In support of this opinion I beg to offer positive evidence contained in certain facts observed by myself in Kilauea during April 8–14, 1892, and on August 28, 1894. The volcano had been in very steady and uniform action for nearly two years before the earlier date, and so continued until a short time after the latter date, or nearly five years in all of a quiet, continuous and rather copious welling up of lava, wholly unattended by any explosive action.

On the earlier date I carefully observed the then existing lava-lake during six successive days. This lake occupied the centre of the inner crater, called Hale-a-mau-mau, or Fern-hut. The main crater called Kilauea is nine miles in circumference, averaging 400 feet in depth, and rather unevenly floored with recent lava. South-west of the centre is the inner pit of Hale-a-mau-mau. This pit was at that time nearly circular

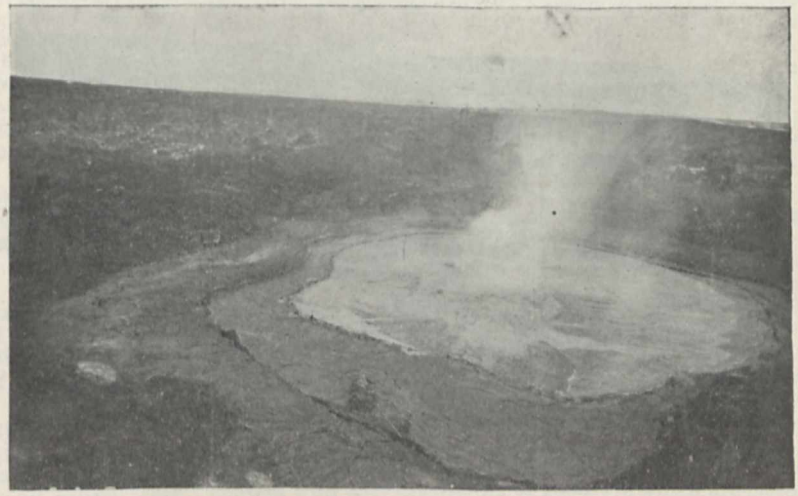

FIG. 1.—Fire-lake as seen in 1891–2.

and 2400 feet in diameter, with vertical sides averaging 150 feet down to the talus. Before the welling up of lava began in 1890, the pit had been about 700 feet deep. In two years the lava had risen 400 feet, and stood within 300 feet of the rim and main floor.

A lake of liquid lava, covered by a thin, spongy film, occupied the centre of the pit. This lake was nearly circular, averaging 850 feet in diameter. It was bordered by a low dyke, which partially restrained its frequent overflows. Outside of the dyke, freshly congealed lava sloped away to the talus. By day the crust-film was grey to the eye, but by night a deep red. It was traversed by numerous fissures of white fire. During the whole time three fountains of lava were welling up with somewhat regular intermittence, and three smaller ones at irregular intervals. There was no explosive action whatever.

The largest fountain was about 120 feet south-east of the centre of the lake. It played with great regularity about three times in a minute, rising in a round billow 25 feet high and 50 feet in diameter, bursting at the top and falling back to level, its discharge moving in a broad stream towards the centre of the lake. The fling of spray from its summit rose to 40 or 50 feet above the level.

West of this central fountain were two others of very different character, being more spasmodic in activity, but never long quiet. Occasionally they would unite their forces for half an hour at a time, forming a stationary line of 130 feet of spraying billow much like a surf-comber with flying spray. This stationary surf-wave was 15 feet high, incessantly flinging its spray 10 feet higher along its whole length. In the night, the effect of these fountains was extremely brilliant and was attended by loud metallic crashing.

The other three fountains were smaller, near the borders of the lake, and often quiet for hours together.

During the thirty months' interval between my two visits, the gradual elevation of the fire-lake continued quite uniformly, as attested by occasional photographs. By its frequent overflows it had built itself up to a height of fully 50 feet above the previous main floor of Kilauea, so that it formed an extremely low truncated cone, surmounted by the level lake, to the edge of which visitors daily approached.

About March, 1894, a recession began, which ended in a final collapse of activity. The lake soon sank some hundreds of feet, carrying with it the sides of a circular pit, about 1400 feet in diameter, and central to the original 2400-foot pit. When I saw it in the following September, the fire-lake was not less than 500 feet below the rim. During the evening, masses of rock frequently crashed in, driving heavy surges of fire far up the talus. There was a good deal of steam-cloud slowly rising, charged with sulphur. During my previous visit, all vapour had seemed to be absent, and I made the circuit of the pit without encountering sulphur. Subsequent photographs had also indicated the absence of vapour from the lake.

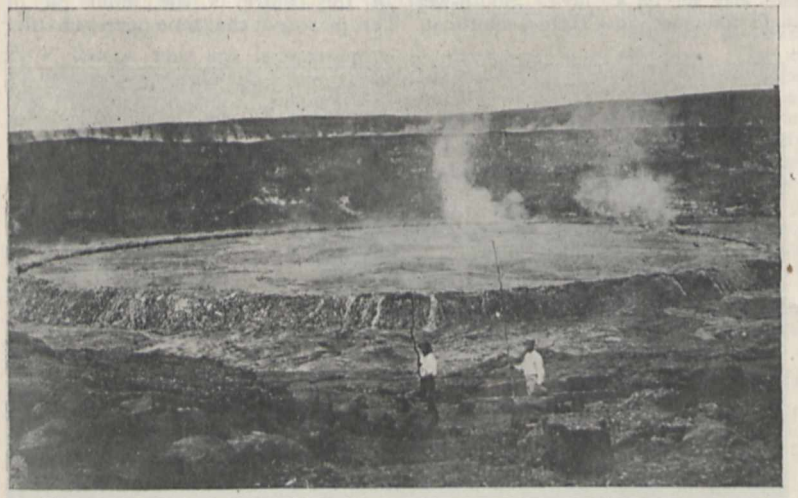

FIG. 2.—Fire-lake as seen in 1892–3. Lake gradually rose so as to overtop the rim of the pit, more than 50 feet in 1894, but all the time keeping its position and limits.

I now have to add an important observation. To my great surprise, at this last visit, I perceived that the three fountains above described were in full activity and in the same relative position as before, although during the thirty months the level of the lake had risen 350 feet and had then fallen 500 feet. By what system of supply-ducts such fountains had been so long maintained was a mystery concealed in the fire-depths. But the fact of a marvellous steadiness and uniformity of action was obvious. For a long period a uniform and gentle outpour of effervescence had been maintained. It had persisted for two years and a half, throughout all the immense changes.

I submit as the unavoidable conclusion that the source of supply for this five years' outpour of gently effervescing lava was in an interior magma which itself contained the impelling force in its own originally occluded gases. For its activity this source was wholly independent of any encounter with water to generate steam. Expanding steam evidently had no part in that steady, quiet, persistent activity in the fire-lake of Kilauea.

I would add that the exceptionally quiet and uniform activity of Kilauea seems to render it one of the most important of all volcanoes for study. I regret to say that since the collapse nearly eight years ago no lava has appeared in the crater, except a small quantity last June, which has again gone out of sight.

Having seen no European notice of the fact, I would report that twelve days after the Martinique eruption very vivid afterglows appeared here, about as bright as those seen here after the first two weeks of the Krakatoa glows in September, 1883. They have not yet wholly disappeared. The solar corona, or "Bishop's Ring," is still conspicuous. It is worth stating that the Krakatoa glows reached Honolulu in ten days, coming twice the distance of the Martinique glows in twelve days.

S. E. BISHOP.

Honolulu, July 31.

THE INFLUENCE OF EDUCATION UPON TRADE AND INDUSTRY.

A SHORT time ago the Technical Education Board of the London County Council appointed a sub-committee to report upon the "application of science to industry." The witnesses called before the committee were leaders of science and employers in various branches of industry. Dealing first with the loss of industries to the country, during the last twenty or thirty years, the committee points out that all the witnesses were practically agreed in considering the loss sustained to be due to deficiencies of our educational system. It is not so much the training of the workmen which is at fault; they even consider that the opportunities open to the London workman for obtaining technical education are superior to those enjoyed by workmen abroad. It is the want of highly trained men of science who are able to undertake research work. Prof. Dewar says he knows of no firm in England where chemists are employed in research work, while in Germany a large firm will employ a number of men for research only, who will have no connection with the business or managerial part of the works.

The causes which have operated to keep manufacturers from taking highly trained men into their works are twofold. In the first place, generally speaking, the men who have been employed as scientific experts have had a wholly inadequate training, but have often the idea, as Mr. Beilby says, that they have "nothing to learn and everything to teach." In the second place, the manufacturer is often afraid that they may learn something. He may be willing to take all they can give him, but he will not let them learn the details of the process which he desires to have improved—details which are not to be found in text-books. There is also the lack of scientific training of the manufacturers themselves, and their consequent inability to recognise the importance of scientific assistance.

With reference to our secondary education, Prof. G.

Lunge observes that in our grammar schools the faculty of observation is too little developed, and that mathematics, drawing and modern languages should be more thoroughly taught. "At present there is no time for this, because far too much time and interest are devoted to athletics. The idea that secondary education should mainly aim at breeding manly characters is very fine, but the hardly veiled contempt of positive knowledge which this implies causes much mischief, and this is, of course, much worse if you substitute 'gentlemanly' for 'manly.'" The committee is convinced that scientific industries have suffered, not only through defects in higher scientific education, but to an even greater extent through defects in general secondary education. Mr. Levinstein, in his presidential address to the Society of Chemical Industry at Liverpool, also refers to our want of a sound system of secondary education; he considers that our primary education is fairly good, but what we require is "*general non-specialised secondary education.*" Those engaged in the educational profession must surely have had it forced upon them that the crying need of the country is specialisation; but it is useless. and worse than useless, to attempt to specialise without first having the sound foundation of a thorough general education.

Dr. Merz thinks that science teachers in secondary and public schools are not of a sufficiently high standard as compared with the teachers abroad. They have too little time for improving their knowledge by further study, the result being that they soon become disciplinarians only instead of men of science. Our teachers often seem unable to instil the love of science into their students, who lack the enthusiasm which exists abroad, and may almost be compared to the tradition which is found in our public school life here. How often one hears a graduate say, "Ah! that's finished; I ground up science for my degree, but I shall drop it now." To such men the degree is a qualification and that is all.

In referring to the London polytechnics, the committee recognises the difficulties under which the heads of departments labour if they desire to carry on research. They are understaffed and underpaid, and almost the whole of their time is taken up in teaching or in superintending the teaching of all branches of their subject. It might here be pointed out that in many cases the governors of the institutes, with the exception of those appointed by the Technical Education Board, have absolutely no idea what research means, and strongly object to chemists and others taking up expert work whereby they would obtain an insight into the technical side of their subject, which otherwise it is almost impossible for them to do.

A generation ago the bulk of the manufacture of fine glass for scientific and optical purposes was in English hands. Now it is almost entirely in the hands of Germans. "German chemists have succeeded in introducing such modifications in the manufacture of optical glass that opticians have been enabled to place on the market lenses approaching more closely to mathematical perfection than any previously manufactured in this country." Mr. Conrad Beck says, "there is no place in the whole of England where a man can learn optics in a way that is of any use to him for practical application to optical instrument making. . . . It is a positive fact that if I desire to employ a mathematician to work out my lenses, I cannot find any ready-made man in England." The German Government has not only endowed institutes where optics, among other subjects, is taught in a practical way, but has granted large sums of money "by which costly experiments on a manufacturing scale have been rendered possible."

Mr. Levinstein's presidential address to the Society of Chemical Industry has already been mentioned, and perhaps a short notice of some of the points in it may be of nterest.

In directing attention to the unsatisfactory condition of our trade, he points out that in 1890 our total exports amounted to 328 million pounds. The average amount during the decade 1891–1900 was only 300 millions. That is to say, during these ten years we exported 280 million pounds' worth of goods less than we should have done if the figures for 1890 had been maintained. With Germany it is otherwise; in 1890 the total exports amounted to 3409 million marks, while the average for 1891–1900 was 3688 million marks. Germany has gone forward, we have gone back; this can hardly be called satisfactory. Mr. Levinstein suggests the following as some of the reasons why Germany has advanced so markedly:—

(1) Superior economy, thoroughness, *attention to detail.*
(2) The possession of a far larger number of thoroughly and systematically trained men than any other country (not men only trained technically, but with a thorough *general* training).
(3) A close alliance of legislation and of science with the interests of trade and industry—a result no doubt indirectly due to the high average of general education and training.
(4) A national system of railways and canals, with a scale of internal and external freights averaging less than one-third of our own.
(5) Cheaper skilled labour, *with longer hours than our own.*[1]
(6) A large supply of unskilled labourers, trained to habits of punctuality and discipline through a system of universal military service.
(7) Protective tariffs.
(8) A system of patent laws which takes the interests of the public as well as those of the inventor into consideration.

Some of these conditions obviously could not be introduced into this country, but Mr. Levinstein suggests the following four measures which he considers require immediate attention:—

(*a*) The appointment of a competent and expert Minister of Commerce.
(*b*) The nationalisation and extension of our canals and waterways.
(*c*) A measure for greatly extending and improving our secondary education.
(*d*) A sensible reform of our patent laws.

It does seem an anomaly that a commercial empire such as ours should be without a Minister of Commerce. The Board of Trade is so tied up with red tape and so steeped in routine that deputations upon trade and commerce often receive but scant attention, and have to be content with hazy assurances of good will which are often forgotten almost as soon as uttered.

Mr. Levinstein pays considerable attention to the question of freights. In France and Germany, the combined network of railways and canals enables merchandise to be carried at extremely low rates. Undoubtedly our railway companies might learn a good deal from America as to the handling and haulage of goods, by which means very considerable savings in the cost of transport could be made. But owing to the enormous cost of construction and over-capitalisation of our railways, even if all possible improvements were introduced and the boards of directors were business men and not appointed because of their social position, we could not compete on level terms with other nations. But how about our 4000 miles of canals? For years they have hardly been used at all, and many of them have become antiquated and are almost, if not quite, ruined. In contradistinction to our want of forethought, France, Belgium and Germany have been continually increasing and improving their canal system, and America, that land of restless energy, is building canals. Before the opening of the Erie Canal the cost of moving one ton of freight from Buffalo to Albany was 100 dollars; on the opening of the canal this immediately

[1] The tendency here seems to be a general shortening of hours and extra holidays to watch *others* playing games.

fell to 10 dollars. At present the cost of moving merchandise by canal from Buffalo to New York, a distance of 500 miles, does not, on the average, exceed one dollar, or four shillings per ton.

European States are devoting millions of money annually to the construction of canals and canalised rivers, with the result that it costs less to-day to bring sugar from Hungary, thousands of miles across Europe, to London than to carry the same sugar on our own railways from London to Manchester. Goods which can be carried from Hamburg to Berlin, a distance of 174 miles, at four shillings per ton cost eight shillings and fourpence per ton from Manchester to Liverpool, a distance of 30 miles. Cattle can be sent at less cost from Chicago to Liverpool (about 4000 miles) than from Northumberland to Liverpool. It costs more to send one ton of goods from London to the west of Ireland than from London to Japan. Denmark can send her dairy and farm produce to London at less cost for transport than can the English farmer living only 30 miles away in the home counties.

Mr. Levinstein calls for a reform of the patent laws. He attributes, as do many of the witnesses examined by the committee of the Technical Education Board, much of the success of the German manufacturer to the excellent and protective patent laws, which have been in operation since 1876. Yet though our patent laws leave very much to be desired, they do not directly, as Prof. Meldola points out, prevent discovery or originality. Indirectly they may do so, because if a man feels that his invention is not properly protected, he may give up working in disgust. In order that a patent may be valid in Germany, it is necessary that the article patented should be manufactured in Germany. We have no similar provision. It pays an inventor to manufacture in Germany and export to England better than to build extra works here, where British labour would be employed.

Admitting, however, that our patent laws are bad, our manufacturers narrow-minded and unscientific and our business methods lacking in enterprise, and that therefore we are, if not absolutely falling behind, barely holding our own in the markets of the world, we always come back to the fact, if we will but admit it, that all these causes may directly or indirectly be traced to our educational system or want of system.

The report of the Technical Education Board is so valuable that I should like to suggest that the County Council publish a digest of it in pamphlet form and circulate it among manufacturers in London. This may seem a rather large order, but how otherwise are these men, upon whom so much depends, to be reached?

F. MOLLWO PERKIN.

BIRD-PHOTOGRAPHY IN THE GARDEN.[1]

ALTHOUGH he disclaims the title of naturalist and states that he knows nothing of photography, the author has contrived to produce a very entertaining little work, illustrated by reproductions from photographs which we have seldom seen equalled and rarely surpassed. They are, in fact—especially the full-page plates—ideal representations of the birds they portray, and ought to tempt the amateur photographer to try to do likewise—if he can. The object of the volume, like so many others at the present day, is to show the outdoor naturalist and bird-lover how full an insight he can obtain of the life-history and habits of his feathered favourites by portraying them in their natural haunts and surroundings. And with this end in view, he describes in some detail the type of camera and plates best suited for the purpose, and the mode of using them. His main difficulty appears to be to find a "shutter" which shall be sufficiently rapid in action, and at the same time not frighten the bird as it falls.

As the title implies, the author, in place of wandering far afield, has been content with the birds commonly met with in any English country garden, and he shows how much may be learnt that is more or less new even with regard to familiar species. Perhaps he would have been better advised had he refrained from saying that our knowledge of bird-anatomy is such that work is no longer needed in that branch of ornithology. Indeed, it is a great pity that field-naturalists and museum-workers are constantly in the habit of belittling one another's efforts; each has his appointed place, and the work of the one cannot be completed without that of the other.

The author restricts himself to ten species, five of which are tits, and he has something interesting to say about each. If we were asked to select the two best illustrations in a work in which all the pictures are charming, we should choose the page-plates of the pied flycatcher and redbreast. We reproduce one of the text-figures.

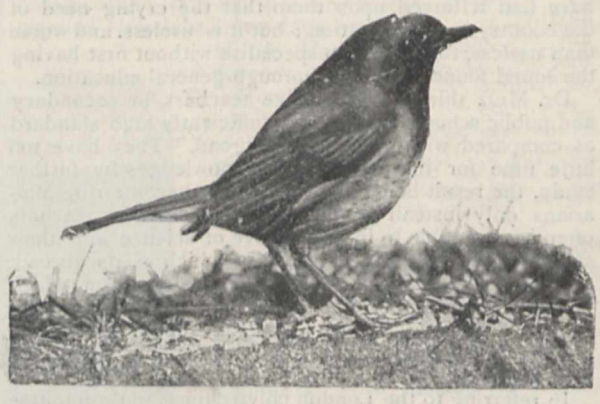

FIG. 1.—Robin Pausing at Food. (From "Birds in the Garden.")

R. L.

[1] "Birds in the Garden." By G. Sharp. Pp. xi + 190; illustrated. (London: J. M. Dent and Co., 1902.)

A NEW THEORY OF THE TIDES OF TERRESTRIAL OCEANS.

MR. ROLLIN HARRIS has done so much good work in preparing his "Manual of Tides" for the United States Coast Survey that it is an ungrateful task to find oneself constrained to criticise adversely his recently published part iv. A. of that treatise.[1]

I shall pass over many points of interest which occur in the earlier portions of the book, because the discussion of them is apparently designed to lead up to a new theory of oceanic tides. That theory, to which I shall confine my attention, depends on a proposition that it is possible to dissect our oceans into a number of basins in which the oscillations are virtually independent of one another and are almost unaffected by the diurnal rotation of the earth.

We may, then, pass at once to chapter vi., where Mr. Harris considers forced oscillations in tanks, as impeded by friction. The waves are treated as long waves in which the water in any vertical slice always remains vertical, and the friction is assumed to be proportional to the velocity of the slice. These assumptions are open to criticism, but I will follow Mr. Harris in supposing that

[1] Reports of the U.S. Coast Survey. Parts i., ii., Appendices 8, 9, Report for 1897. Part iii., Appendix 7, Report for 1894. Part iv. A., Appendix 7, Report for 1900.

the physical conditions are adequately represented in this way.

He desires to find a solution when the period of the external disturbing force is the same as that of a free standing oscillation of the type of a seiche in a lake. For a seiche with a single central node the length of the tank must be equal to half the distance traversed by a long wave in the period of the external force. Thus the size of the tank is determined by the period of the external force and by the depth of the water. In the detailed treatment of the problem the depth is supposed to be uniform. Mr. Harris writes his equation of motion in the form of an equation of virtual work; he reverses the forces of inertia, adds them to the impressed forces and equates the virtual work to zero. Lagrange made the displacements arbitrary, and thus his equation of virtual work was exactly equivalent to as many differential equations of motion as there were variables; but Mr. Harris takes the displacements as proportional to the actual displacements per unit time and obtains a single equation. This is permissible, but the result cannot be anything but an equation of energy. I am unable to see any advantage in this procedure. He then assumes that the type of oscillation will be the same as in free oscillations, but this is surely a quite unwarrantable assumption. If the periodic forces have the same period as the free oscillation the oscillations will be large, but the type will in general be different. Does not this error vitiate his whole treatment of the problem? However, let us proceed. The type and period being the same as those of a free oscillation in the absence of friction, the periodic sustaining forces must exactly balance the frictions, and the frictional forces are proportional to the velocities. Now the motion being of the same type as in a free oscillation, the displacements are all simple harmonic functions of the time, and at any instant are all in the same phase. Hence the frictional forces, and therefore also the sustaining forces, are all in a phase differing from that of the displacements by a quarter period. Thus all the sustaining forces vanish at the instant when the displacement is a maximum, and we get nothing out of the equation of virtual work but what was put into it by dubious assumptions.[1]

As a result of this discussion the following rule (p. 621) is given:—

"Project the force arrow" (of a number of tidal-force diagrams giving the direction and magnitude of the forces at various parts of the basin at successive hours) "belonging to the assumed time in each diagram upon the line of motion passing through it; the aggregate of the elementary masses, each multiplied by the intensity of the tidal force in the direction of the displacement, and again by a quantity proportional to the value of the maximum displacement (since the oscillation is harmonic), must be zero at the time of high and low water. The algebraic sum of these products for any given hour should be plotted as an ordinate at that hour. Where the curve thus constructed crosses the time axis denotes the time of high and low water."

Besides the objection to the proposition raised above in the case of the canal of uniform depth with synchronous disturbing force, I fail to see any adequate consideration of the variability of depth, of the absence of synchronism in the component disturbing force in the direction of the canal, or of the effects of the component transverse to the canal.

But even if it were possible to assent to this rule, it appears to me that there are other still more doubtful assumptions. On p. 624 we read:—

"Considering the actual distribution of land and water, a few computations upon hypothetical cases will suffice to convince one that as a rule the ocean tides, as we know them, are so great that they can be produced only by successive actions of the tidal forces upon oscillatory systems, each having, as free period, approximately the period of the forces, and each perfect enough to preserve the general character of its motion during several such periods were the forces to cease their action. This greatly simplifies matters. . . ." Undoubtedly the simplification is great, but is it true?

Then later:—"The paths of the particles being practically fixed and determined by the boundary conditions, it becomes possible to disregard the forces arising from the earth's rotation."

Now Lord Kelvin has concluded that "the oscillations of water in a rotating rectangular trough are not of the simple harmonic type in respect to form, and the problem of finding them remains unsolved" (*Phil. Mag.*, vol. x., 1880, p. 113). He has, however, solved the case of a rotating endless canal with straight sides, and adduces his results as probably dominating some remarkable characteristics of the tides of the English Channel. It seems to follow that either Lord Kelvin or Mr. Harris is wrong.

I gather that the free period of oscillation in the several basins into which the ocean is partitioned is the same as that of the tidal force. Now it is surely profoundly improbable that any large portion of our curiously shaped oceans should possess even approximately the critical free period, yet unless this is so the theory seems to be inapplicable. Finally, I think that the process of partition should receive an elaborate and critical discussion as to each basin; but I do not find that this is given in the book.

I can, in conclusion, only express a hope that I am not doing an injustice to Mr. Harris in dissenting so absolutely from his views. No one would have welcomed more warmly than I a new clue to our treatment of this difficult problem. I venture to express my admiration at the courage of the attempt, and although, as I think, it is a failure, yet it may inspire others to more successful attacks.

G. H. DARWIN.

[1] A considerable portion of this criticism is due to Prof. Love, with whom I have had the advantage of discussing the matter. He points out, further, that Mr. Harris's equation (308), p. 619, which forms the key-note of the whole, is really identically satisfied by the assumptions.

NOTES.

THE hundredth anniversary of the birth of Abel, the great Norwegian geometrician, is on the point of being celebrated at Christiania. Representative men of science from many countries are expected to be present. The interest which His Majesty King Oscar II. has manifested in this centenary celebration is another proof of his continued sympathy with mathematical work and scientific research generally. It is announced that the Paris Academy of Sciences will be represented by M. Darboux and the Paris University by M. Émile Picard.

IT is announced in *Science* that at a recent meeting of the corporation of the Marine Biological Laboratory at Woods Holl it was voted to transfer the Laboratory and its equipment to the Carnegie Institution. This action was taken after it had been stated to the members of the corporation that the executive committee of the Carnegie Institution would recommend to the trustees that the Laboratory should be accepted, that its debts should be paid, that new buildings should be erected, that 20,000 dollars a year should be allowed for maintenance and that the scientific management should rest as heretofore with the naturalists of the United States.

THE Cape Town correspondent of the *Times* states that great interest is being manifested there in the suggested visit of the British Association in 1905. As a preliminary measure, free passes on all the South African railways are promised for the

delegates, while the Colonial Governments will contribute 7000*l.* towards the expenses of the voyage and of the stay in South Africa.

A REUTER message from Barcelona, dated August 27, states that a severe storm has passed over Felanitz, Majorca, causing great damage in the town and district. The storm was accompanied by a downpour of rain. Several places were flooded and many houses were destroyed by lightning, by which several persons were killed. A south-easterly gale of exceptional violence was experienced on the southern coast of Cape Colony during Sunday evening, August 31, and Monday, September 1, causing much damage and loss of life.

THE following reports of eruptions and earthquakes have appeared during the past week:—*August* 27. A telegram from General Chaffee, the Commander-in-Chief in the Philippines, to the U.S. War Department, states that a series of earthquakes has occurred in Lake Linao country, in the Moro section of the island of Mindanao. The rivers and mountains have been considerably disturbed. Four hundred shocks have been felt since August 21. *August* 26, *St. Thomas*. A despatch received from Dominica at 6 p.m. reports that since two o'clock rumbling noises in quick succession have been heard from the southward, and that there is every indication that Mont Pelée is in violent eruption. *August* 30. A violent eruption of Mont Pelée destroyed Morne Rouge and Ajoupa Bouillon. About 1000 persons were killed and several hundred injured. A wave caused much damage at Carbet. A violent earthquake shock was felt at Carupano, on the coast of Venezuela, at 9 p.m. The disturbance was accompanied by a noise which was heard along the whole shore of the Caribbean Sea. *September* 1. The vessel which was sent to Tori Shima to report on the results of the volcanic disaster in that island in the middle of August has returned to Yokohama, and reports that Tori Shima is in a state of utter ruin. More than 150 lives were lost in the eruption, no one being left alive on the island.—A telegram from Castries states that Mont Pelée has been in constant eruption since August 15. There was an enormous fall of ashes on the night of August 25, and a very severe eruption on the night of August 28. Three eruptions occurred on the night of August 30, and it was impossible to reach St. Pierre from the sea.

AT the annual congress of the Royal Institute of Public Health, which concluded its sittings at Exeter last week under the presidency of the Earl of Iddesleigh, the necessity for teaching the principles of public health in rural districts was strongly urged, and the creation of a "Ministry of Public Health" advocated. Prof. Sims Woodhead directed attention to the need for further funds for the investigation of diseases such as cancer and tuberculosis, and pointed out what a good investment such expenditure would be as regards the national welfare. In the veterinary section, the deplorable condition of town and country stables and country cow-sheds and piggeries was alluded to by Mr. Eaton Jones in a paper on the "Veterinary Supervision of Domesticated Animals," and the meeting passed a resolution advocating the abolition of private slaughter houses, the appointment of veterinary inspectors of all animals intended for food, the inspection of dairies and cow-sheds, and the providing of suitable provision for the disposal of the carcases of animals unfit for food. At a final meeting, Mr. Windley attempted to defend the course pursued by Leicester in its neglect of vaccination, and Dr. Millard suggested that the danger of the spread of small-pox supposed to arise from the presence of a large unvaccinated element in a community had been somewhat overrated. Prof. Smith pointed out that even in Leicester the hospital staff had been vaccinated, and that in the London small-pox hospitals the staffs were subjected to compulsory vaccination and not a single case of small-pox had occurred among them; he believed that no one would attempt to establish a small-pox hospital and to officer it with an unvaccinated staff. The formation of a national water board, the new pharmacy bill and the construction of sanatoria for consumptives were the subjects of discussion in various sections.

PROF. VIRCHOW, who has been lying extremely ill at Harzburg, has been moved to Berlin, where he arrived on Saturday last. His strength is said to be unmistakably failing.

LORD CURZON, the Viceroy of India, has ordered the heads of the Veterinary, Survey, Forest, Meteorological, Geological, Agricultural and Botanical Departments of India to form a board of economic inquiry, which shall meet twice annually to formulate a programme and to review past work. The board is also to act as an advisory committee to the Government. The Royal Society has promised its assistance.

FROM the *Daily Mail* we learn that as a result of the last anti-tuberculosis conference held at Berlin a special organisation called the International Central Committee for the Prevention of Tuberculosis has now been established. The first meeting will be held under the patronage of the German Empress on her birthday, October 22, under the presidency of Prof. Von Leyden. Many prominent physicians from various countries will also be present. The organisation has already 120 members.

THE sixth annual week's fungus foray of the British Mycological Society will be held at Hereford, from Monday to Saturday, September 22–27.

THE following papers will be read in the Section of Physiology at the British Association in Belfast, in addition to those already mentioned (p. 377):—Prof. Symington and Dr. Cecil Shaw will show Edinger's drawing apparatus for higher magnifications and stronger light; the functions of the rods and cones of the retina, Mr. F. W. Edridge-Green; on the movements and innervation of the stomach, Dr. Page May; a new method for demonstrating cholohæmatin in ox-bile, Dr. W. A. Osborne.

THE *Patent Office Gazette* reports that patents on eleven different parts of wireless telegraphic apparatus have been granted by the U.S. Patent Office to Prof. Reginald A. Fessenden. Among the patents are included a device for signalling by magnetic waves, a current-actuated wave-responsive device, and also a conductor for wireless telegraphy apparatus.

A REUTER message from Ferrol states that on Friday last Mr. Marconi received a number of Spanish telegraphists on board the Italian cruiser *Carlo Alberto*. In the course of conversation, he stated that he was in daily communication with a receiving station near Plymouth and by this means had received news of the arrival of the King of Italy in Berlin. Referring to the prevention of interference of simultaneous messages, Mr. Marconi said that he was able recently to keep constantly in communication with England at the same time that men-of-war were communicating with each other and with the stations situated in the regions of the Hertzian waves.

A NEW York contemporary states that the De Forest system of wireless telegraphy has now been in practical operation for some months between New York and Staten Island. In this system, an anticoherer of the electrolytic type is employed, its chief advantage lying in the fact that it requires no tapping back; a telephone is used in conjunction with this instrument, and the Morse signals are read by ear. The induction coil is eliminated from the sending apparatus, the spark being produced

by a pressure of 50,000 volts obtained by transforming up from the street mains. It is said that a speed of 25 to 30 words a minute is easily maintained. An instance is quoted of two messages having been read at the same time from the same receiver, one coming from an "outside" source, probably a Marconi station. This seems a doubtful recommendation for the system, and shows that the time can not be so very far distant when some consolidation of all the competing systems will be essential. It is to be hoped that this may result, not merely in the survival of the fittest, but in the evolution of a system possessing all the special advantages of the various competitors.

A NEWFOUNDLAND correspondent contributes a lucid and interesting article on "This Year's Arctic Work" to a recent issue of the *Times*. The preparations made for Baldwin's expedition northward from Franz Josef land, which has ended unaccountably in failure, are described with considerable detail, and the unusual completeness of Baldwin's equipment makes the return without substantial achievement all the more remarkable, especially in comparison with the results of the Duke of the Abruzzi's expedition. A short account of Peary's twelve years of Arctic work brings the extraordinary sufferings of that indefatigable explorer into strong relief, and the prospects of his success and safe return this year from what is to be his last Arctic journey are discussed. The safety of the expedition led by Sverdrup, captain of Nansen's *Fram*, which started from Jones Sound in 1899 to explore the vast unknown area beyond the Parry Islands and has not been heard of since, is already doubtful, and unless it returns this summer its position must be one of extreme peril, as it was only provisioned for three years. Should Peary and Sverdrup return safely this season, the Arctic regions will next spring be without a single investigator, a circumstance that has not occurred for more than fifteen years.

WE learn from the *Journal* of the Society of Arts that the Association of German Machinery Engineers of Berlin has offered prizes of 5000, 3000 and 2000 marks (250*l*., 150*l*. and 100*l*.) for a constructive tracing of a locomotive able to pull a train of 180 tons in weight, on a level roadway, at a speed of 120 kilometres per hour (74·5 miles) for a continuous run of at least three miles, the highest rate of speed not to exceed 150 kilometres (93·2 miles) per hour. The close of the competition is fixed for December 1, 1902. Any further particulars may be obtained by applying to the secretary of the above association, Herr Geheimer Kommissionrath, F. C. Glaser, Lindenstrasse 80I., Berlin.

OUR American contemporary *Science* protests strongly against the appointment of Captain Colby M. Chester, a naval officer without special knowledge of astronomy, as superintendent of the U.S. Naval Observatory. The institution is regarded as the national observatory of the United States, and the opinion is expressed that an astronomer should be at its head instead of a naval officer. Our contemporary adds: "The institution has no rational purpose of existence except a desire on the part of the American people that our nation shall, in its public capacity, do its full share in the promotion of those branches of astronomy which have to be pursued under public auspices. The leading position which our country has taken in the extraordinary development of astronomic science during our generation can alone justify the unparalleled expenditure of our Government upon its observatory. The results of this expenditure through the ten years since the completion of the new observatory should have been its general recognition as the leading observatory of the world in at least some important field of the sciences. With its great advantages over old-fashioned Greenwich and Paris, it should have left both these institutions in the rear."

M. DE FONVIELLE informs us that M. Camille Pelletan, Minister of the French Marine and of the Colonies, has placed the *Epée*, a torpedo destroyer, 306 tons, 62 men, at the disposal of Comte de la Vaulx for purposes of aëronautical manœuvres on the Mediterranean, with a new balloon. It may be remembered that last year Comte de la Vaulx tried to cross the Mediterranean from Toulon with a large balloon made captive by floating pieces of wood. The experiment, although interesting, proved a failure, owing to the wind blowing eastward. This year the experiments are likely to begin from Palavas, a point near the place where, in 1901, the trip ended. The *Epée* is to join the balloon there on September 10. The new balloon will carry in its car a propelling petroleum engine, which, however, will be used only in the second series of manœuvres. On Sunday, August 24, M. Heureux, a young and promising aëronaut, tried on a smaller scale similar performances in the Channel. He proved by an ascent at Dunkerque that a tug-boat can conduct a balloon against a strong wind. The balloon *Alcor* was sent up in the direction of the sea and for same time was lost to view in the clouds; but, after having run some miles, the valve was opened and the balloon descended close to the waves. M. Heureux dropped his cone-anchor and waited until a tug-boat, sent out especially from Dunkerque, threw a rope to the car, by which the balloon was tugged easily and reached Dunkerque fully inflated.

AT the annual meeting of the Société d'Encouragement pour l'Industrie nationale, the president announced the mode of distribution of the grants at the disposal of the Society for research work bearing upon industry. The gold medal of the Society for work which has exercised the greatest influence on French industry is awarded to M. V. Steinlen for his researches on the invention and construction of machine tools, M. Rabate receiving the Parmentier prize for his original studies on the resin industry. Money grants were also given to M. Fremont (3500 fr.) for his work on the testing of metals, to M. Gutton (3000 fr.) for his work on the fragility of materials, to M. C. Brioux (2000 fr.) for his geological and agricultural study of Basse-Bourgogne, to M. C. Urbain (500 fr.) for his work on the acetylacetonates, to M. Guyot (500 fr.) for his researches on colouring matters, and to M. Canovetti (1000 fr.) for his work on air resistance. The total amount of the grants for research made by the Society for the years 1902–1903 is twenty thousand francs. The president expressed the hope that the industries which benefit by this sacrifice will lend assistance in their turn in providing for the commencement of new studies which the Society has not as yet been able to attempt for want of sufficient funds.

ON the occasion of the recent meeting of the members of the British Pharmaceutical Conference at Dundee, the president, Mr. J. C. Druce, summarised in his address the progress of Scottish botany. The review begins with an account of the work of Robert Sibbald, who lived in the latter half of the seventeenth century and compiled the work known as "Scotia Illustrata." After him, the more important systematic botanists referred to are Dr. Lightfoot, the author of "Flora Scotica" (1777), Sir James E. Smith, whose "English Botany" is a standard work, George Don, famous on account of his botanical explorations (1800), Sir W. J. Hooker, who also published a "Flora Scotica" (1821), and Mr. H. C. Watson, to whom we are indebted for the "Cybele Britannica" (1847–1860). The most impressive part of the address is the vivid sketch of George Don, who, humbly born and poorly educated, devoted himself with untiring energy to scientific, more especially botanical, observations, and was the first to explore many Highland districts now famous, but at that time quite unknown. Owing to unfortunate circumstances, many of Don's discoveries have been called into question,

but later investigations tend to re-establish his reputation. There is no doubt that, owing to the fact that he sent out specimens from his garden, and that his references to localities were at times inaccurate, his records are not always trustworthy; on the other hand, some of his doubted specimens have since been re-affirmed, of which Mr. Druce mentions *Salix doniana*, *Triticum alpinum* and *Carex ustulata*. The concluding part of the address furnishes a list of species peculiar to Scotland, and an account of species characteristic of counties or districts.

NOW that autumn is approaching, and it is time to be planting bulbs, those growers who require daffodils will be interested in the catalogue issued by Messrs. Barr and Sons. This firm has for a long time made a speciality of these flowers, and offers all varieties, from the inexpensive kinds suitable for planting in woodlands to the select and rare hybrids which require several years to raise from seed.

THE report on the St. Kitts-Nevis Botanic Station, for the year ending March 31 last, states that in August, 1901, an experiment with tobacco was successfully established on half an acre of ground. Plots were also started on four estates, advice and assistance being constantly given to those in charge, and the planters invited to witness each operation in progress. With seed procured from England, another attempt was made to cultivate potatoes, but the results went to show that instead of producing what we know at home as "new" potatoes, the crop when reaped was found to have precisely the flavour and conditions of old potatoes. For the purpose of destroying grass-hoppers, an endeavour was made to acclimatise the Barbadoes blackbird. Several consignments of birds were received, but nearly all disappeared, a few being seen only in one or two places where they are regularly fed.

THE *Journal* of the Royal Microscopical Society for June contains an interesting paper, by Mr. C. F. Rousselet, on the genus Synchæta. Some of the members of this genus are amongst the commonest rotifers inhabiting fresh-water lakes and ponds as well as brackish tide pools and the open sea. Pastor Eichhorn (1761) and F. O. Müller (1786) are probably the earliest authors who have left sketches probably representing species of this genus; but our real knowledge of these rotifers dates from 1831 to 1834, when Prof. Ehrenberg described four species of Synchæta. Mr. Rousselet now records sixteen different species, of which five are new, viz. *S. kitina* (in fresh water), *S. littoralis* (in brackish water), *S. cecilia*, *S. vorax* and *S. neapolitana* (marine).

A NOTE by Prof. Garbasso, of Turin, contributed to the *Nuovo Cimento*, 5, ii., deals with a phenomenon observed by Prof. Manuelli, viz. the action of sunlight in facilitating the passage of electric sparks, an effect closely resembling, if not identical with, Hertz's phenomenon. Prof. Garbasso has made experiments which show that even diffused sunlight has a considerable effect. In one experiment he counted 24 discharges in 30 seconds in the light as against 8·8 in darkness; in another experiment the numbers were 18·1 and 6·3. The effect of the light seems to last for a certain interval after the illumination is cut off. Experiments were made first with a lens and next with a mirror used for concentrating the rays; and it was also found that when the light was brought to a focus on one of the electrodes, an uninterrupted current was obtained even at distances beyond the sparking distance in the dark, but the effect was greatest when the light fell on the negative pole. This influence of solar light is unaffected by the passage of the light through quartz or Iceland spar, but is destroyed by a few films of mica, a thick glass plate, or a vessel of water or alum solution 4 cm. thick. These results point to the view that the effect of Manuelli is due, not to the presence of ultra-violet rays, but rather to the heating of the electrodes.

Bulletin No. 51 of the U.S. National Museum will be exceedingly useful to working naturalists, since it contains a list of the publications of that institution from the year 1875 to 1900, drawn up by Mr. R. L. Geare.

THE last issue of the *Transactions* of the South African Philosophical Society, comprising pp. 561 to 896 of vol. xii., is entirely devoted to a continuation of the valuable descriptive catalogue of the beetles of South Africa. A very large number of new species as well as some new genera are described in this fasciculus, the diagnoses of which appear to be well and carefully drawn up. We think, however, it would have been better had the dates been added in all cases to the references to previously named genera and species.

Science for August 15 contains a full report of a long address on the history of ichthyology, delivered by Prof. Jordan before the zoological section of the recent meeting of the American Association, held at Pittsburg. Commencing with Aristotle, the lecturer gives a full account of the gradual progress of our knowledge of recent and fossil fishes, in the course of which he allows full credit to the efforts of the earlier workers, especially Artedi, whose list of genera is given at length. The British Museum catalogues of fishes, recent and fossil, receive a large share of commendation. Of one of these the lecturer speaks as follows:—"The chief criticism which one may apply to this work concerns most of the publications of the British Museum. It is the frequent assumption that those species not found in the greatest museum in the world do not really exist at all." We venture to doubt whether this sweeping criticism is deserved. Readers with a knowledge of British fish-literature will not fail to notice that the first appearance of Yarrell's work is misprinted 1859 (in place of 1839) in the report of the address.

In the August (third) number of the *Field Naturalist's Quarterly*, the editor devotes the opening paragraphs to a discussion of the present form of nature-teaching in schools, and the manner in which this may be improved. It is essential that the lessons should be simple and practical, and the author recommends that a child should be encouraged to watch and describe the life-history of a common insect, or the daily development of a flowering plant. Later on in the same number, Mr. R. Haines discusses the difficulties in connection with the establishment of an "Arbor-day" in this country. The main idea of such an institution is that on a certain day each inhabitant of a village or town should plant a tree; and the author very pertinently inquires who is to provide the trees and the land on which they are to be planted, and the kinds of trees to be selected. He might have asked who is to be responsible for the attention and care they will certainly require during the earlier years of their growth.

WE have received from Dr. H. Hergesell the year-book of meteorological observations taken in Alsace and Lorraine during 1898. For Strassburg, hourly or two-hourly readings are published, and the usual observations at ten stations of the second order. Rainfall summaries are given for fifty-eight stations.

THE eighteenth volume of observations made at the Hong Kong Observatory for the year 1901 has been published by Dr. Doberck. The comparison of the daily weather forecasts with the weather subsequently experienced shows, as in previous years, a large amount of success, the sum total (including cases of partial success) reaching 93 per cent. The useful work of collecting observations from ships' logs, for the construction of pilot charts for the eastern seas, has been vigorously continued; the number of entries in 10° squares available for each month of the year save two exceeds twenty thousand. The magnetic and astronomical observations have also been regularly carried on. In the year 1901, the number of transits observed was 3349.

WE have received from Prof. F. Omori the first portion of a memoir on macro-seismic measurement in Tokyo, containing the analysis of the diagrams of 220 earthquakes observed at three places in that city, mostly between September, 1887, and July, 1889. Prof. Omori defines the macro-seismic motion as that part of the earthquake-motion which consists of vibrations the period of which, except in very strong shocks, does not exceed two or three seconds. A discussion of the analysis will be given in the second portion of the memoir.

DURING the past year, we have received the nine parts forming vol. vii. of the *Bollettino* of the Italian Seismological Society for 1901–1902. The description of new instruments or of modifications of old ones is, as usual, a prominent feature of the volume. We have noticed already several of the papers, and need here only call attention to Prof. Mercalli's studies of Vesuvius from July, 1900, to the end of 1901, Prof. Riccò's paper on the central crater of Etna, and the valuable notices of earthquakes recorded in Italy during the year 1900.

THE Home Office has issued the annual report relating to persons employed and accidents at mines and quarries in the United Kingdom in 1901. It is edited by Prof. C. Le Neve Foster, F.R.S., and contains a large amount of interesting information. The total number of persons employed was 933,366. There were 1075 accidents, causing the loss of 1229 lives. Compared with the previous year, there was a decrease of 48 in the number of fatal accidents, but an increase of 52 in the number of lives lost. The general death-rate was 1·348 per 1000, as compared with 1·408, the average for the past ten years. Of the fatal accidents, 43·7 per cent. were due to falls of ground, 11·0 per cent. to explosions, 13·5 per cent. to surface accidents, 7·0 per cent. to shaft accidents, and 24·8 per cent. to miscellaneous accidents underground. The use of coal-cutting machinery does not appear to be making very rapid progress.

THE School of Mines of the University of Wyoming has issued a series of bulletins on petroleum, and of these No. 5 (June) deals with the Newcastle oilfield. Petroleum occurs in the Dakota shales and sandstones near the base of the Cretaceous, and it proves of value for lubricating and for fuel.

AN interesting account of the Darling Downs district in Queensland is given by the Hon. Arthur Morgan (*Proc.* Roy. Geograph. Soc., Australia, vol. xvii.). He dwells especially on the work of Allan Cunningham, who in 1827 discovered the Darling Downs, now regarded as one of the most fertile and healthful tracts, and also as a region of considerable geological interest, for it has yielded remains of remarkable fossil mammalia, gigantic in size compared with the recent representatives.

DR. HENRY WOODWARD contributes to the *Proceedings* of the Bath Natural History and Antiquarian Field Club (vol. x.) an interesting outline of the life of William Smith, the "father of English geology." It is accompanied by a portrait (reproduced from Phillips's "Life of William Smith"), by a photogravure of the bust by Chantry, which stands in St. Peter's Church, Northampton, and by a view of the monument erected by Lord Moreton, at Churchill, in Oxfordshire, the birthplace of Smith.

IN some contributions to South African petrography (*Geol. Mag.*, August), Mr. Frederic P. Mennell, curator of the Rhodesia Museum, refers to the great development of basic lavas and acid plutonic masses. He describes examples of basalt, dolerite, gabbro, syenite, &c., that have been gathered from a wide area in Rhodesia, Bechuanaland and other parts of South Africa. The great granite mass of the Matopos, which forms the backbone of southern Matabeleland, closely resembles the Dartmoor rock, but near Bulawayo it presents appearances of foliation which may be due to movement before complete consolidation.

SOME interesting details relating to the recovery of tin from tin-scrap have recently been published in the *Zeitschrift f. Elektrochemie*. In Germany, several works have been built and operated for carrying out this procedure, the largest of these being that of Goldschmidt, at Essen, where 50–60 tons of tin-scrap are reported to be treated per day. The difficulty of obtaining an adequate supply of raw material has hindered the development of other works, and the anonymous writer of the article we are discussing hints that the supply of tin-scrap is monopolised by one or two of the larger works. The processes used for recovering the tin are based upon the use of the scrap as anode material, in a bath containing sodium chloride and hydrate, or in one containing hydrochloric acid. The advantage of the former is that less iron goes into solution, but against this there is the lower energy efficiency of the process and the more spongy nature of the deposit obtained at the kathode. The failure to produce directly metallic tin is one of the chief difficulties in the operation of both processes, for considerable losses occur in smelting and refining the spongy deposit obtained at the kathode. Under certain conditions, metallic tin can be obtained in the electrolytic bath, and Pfanhauser, in the issue of the *Zeitschrift f. Elektrochemie* for January 16, has stated his opinion that the avoidance of the formation of sponge is simply a question of maintaining the *concentration of the tin salt solution* in the neighbourhood of the kathode. This condition would appear to be difficult to attain in the works treating tin-scrap on an industrial scale, and the problem of producing metallic tin at the kathode is complicated further, by the slow but gradual increase of impurities in the electrolyte. A new works for the treatment of tin-scrap has recently been built at Pfaffstätten, near Vienna, and an electrolytic process for recovering tin from slags is also reported to be in operation at Tostedt, in Germany. In this country we are not aware of any similar works in actual operation, but during 1901 a company was formed with a capital of 10,000*l.* to build and operate a works for the treatment of tin-scrap by a new electrolytic process. A plant for dealing with 50 tons of cuttings per month was to be erected, presumably near London.

MESSRS. WHITTAKER AND CO. will shortly publish a work on galvanic batteries, by Mr. S. R. Bottone. The book will deal with the theory, construction and use of electric batteries, comprising primary, single and double fluid cells, secondary and gas batteries.

MESSRS. NEWTON AND CO. have sent us a copy of a useful catalogue of physical apparatus and accessories manufactured by them. In addition to numerous figures in the text, the catalogue has eight plates containing reproductions of photographs of typical instruments used for demonstrations in the lecture room and practical work in the laboratory. Among the apparatus described, we notice a cyanine prism for showing anomalous dispersion, circular diffraction gratings and photographic gratings, zone plates, new contact breaks, localising instruments for Röntgen ray work, apparatus for wireless telegraphy demonstrations, and for experiments with alternating currents of high tension and high frequency.

WE have just received the annual report of the Government Analyst at Trinidad. The report indicates that in addition to the examination of officially submitted samples, of which more than 2000 were received during the year, a considerable amount of valuable work is being done by the head chemist, Prof. Carmody, by investigation of the mineral deposits of the island. Experiments have also been made at the Government farm on the diurnal variation of cow's milk.

ACCORDING to the report of the principal chemist of the Government Laboratory for the year ending March 31, it appears that during the past twelve months the work of the Customs branch of the Laboratory has more than doubled in magnitude, the increase being due chiefly to the imposition by the Budget of April, 1901, of duties on sugar and cognate substances, and on the numerous articles in the manufacture of which these substances are used. More than 64,000 samples were submitted for test as compared with about 34,000 in the preceding year.

A CAREFUL experimental inquiry regarding the nutritive value of alcohol has recently been carried out in the chemical laboratory of Wesleyan University by Messrs. Atwater and Benedict, a report on which forms the sixth memoir of vol. viii., published by the National Academy of Sciences. The main question studied is the value of alcohol as a fuel in the human body and its comparison in this respect with sugar, starch, fats and other nutrients of ordinary food materials. Collaterally, the question of the effect of alcohol upon the proportions of nutrients digested from the food with which it was taken has also been examined. Metabolic experiments on an elaborate scale have been instituted with the view of investigating the problem, and no expense has been spared to obtain complete and accurate results, a large share of the costs having been borne by the Committee of Fifty for the Investigation of the Drink Problem. The results of the inquiry indicate that more than 98 per cent. of the ingested alcohol was oxidised in the body and that the potential energy of the alcohol was transformed into kinetic energy as completely as that of the ordinary nutrients. Alcohol appears to be very efficient in the protection of body fat from consumption, but not quite so efficient as the isodynamic amounts of the ordinary nutrients in the protection of body protein. The conclusion is drawn that so far as the utilisation of the total energy of the diet is concerned, there is a slight advantage in favour of the non-alcoholic diet, especially when the body is subjected to hard muscular exertion, but the difference is so small as to lie almost within the limits of experimental error.

The additions to the Zoological Society's Gardens during the past week include a Purple-faced Monkey (*Semnopithecus cephalopterus*) from Ceylon, presented by Miss M. Wheatcroft; a Bonnet Monkey (*Macacus sinicus*, ♂) from India, presented by Mr. C. F. Taylor; a Green Monkey (*Cercopithecus callitrichus*) from West Africa; a Bonnet Monkey (*Macacus sinicus*) from India, presented by Mr. R. M. Drury; an Australian Sheldrake (*Tadorna tadornoides*) from Australia, presented by Mr. W. Jamrach; an Egyptian Monitor (*Varanus niloticus*) from West Africa, presented by Mrs. Mary A. S. Deacon; two Cocteau's Skinks (*Macroscincus cocteaui*) from the Cape Verde Islands, presented by Mr. F. Newton; two Axolotls (*Amblystoma tigrinum*) from North America, presented by Mrs. Millicent Summers; a Spotted Salamander (*Salamander maculosa*), European, presented by Mr. R. R. Green; a Common Snake (*Tropidonotus natrix*), British, presented by Mr. E. Crane; a Grand Galago (*Galago crassicaudata*, var.) deposited; a Black-necked Swan (*Cygnus nigricollis*, ♀) from Antarctic America, purchased; a Rufous-necked Wallaby (*Macropus ruficollis*), a Common Wallaroo (*Macropus robustus*), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

CATALOGUE OF NEW DOUBLE STARS.—Mr. W. J. Hussey publishes, in No. 21 of the *Lick Observatory Bulletin*, the fifth catalogue of one hundred new double stars which he has discovered with the 12-inch and 36-inch refractors of the Lick Observatory, all these doubles having distances less than 5″.

Twenty-five per cent. of the five hundred pairs announced have distances not exceeding 0″·50, 48 per cent. not exceeding 1″·00, and 72 per cent. not exceeding 2″·00. The average distance for the five hundred pairs is 1″·52.

HYPOTHESIS ON THE NATURE OF SOLAR PROMINENCES.—Prof. W. H. Julius has described before the Royal Academy of Sciences (Amsterdam) a theory as to the nature of solar prominences.

It may be remembered that Prof. Julius accounted for the doubling of the arcs in the spectrograms obtained by him during the last total solar eclipse, by saying that it was due to the anomalous dispersion of the chromospheric light, and he now applies this theory of anomalous dispersion to account for solar prominences. He abandons the idea of the existence of various layers of different materials in the solar atmosphere, and suggests that "throughout the gaseous body, as well inside as outside the critical sphere, the various elements are altogether intrinsically mixed (granting that in the mixture the quantity of materials with greater specific gravity must grow with the depth)." It is suggested that, in the whirls formed by the ascent and descent of heated gases combined with the rotational velocity of the solar atmosphere, we get anomalous dispersion at the points where two or more of these whirls intersect and break each other; and the author goes on to propose "that the whole chromosphere with all its prominences is nothing but this system of waves and whirls, made visible within shorter or longer distances from the sun's edge by anomalous dispersion of light, coming from deeper layers."

Prof. Julius also points out that this theory abolishes the necessity for supposing the immense velocities which Fenyi and others have observed in connection with solar prominences, because it suggests that there is not a transmission of material, but only successive appearances of the same phenomena at various heights. He likens this to the apparent velocity of the line of foam caused by water waves breaking on a coast which is inclined to their wave-fronts (*Proceedings* of the Royal Academy of Sciences, Amsterdam).

VISIT OF THE ENGLISH ARBORICULTURAL SOCIETY TO COMPIÈGNE.

THE English Arboricultural Society held its annual meeting in London on Monday, August 18, and Mr. George Marshall, of Frimstone, Liphook, one of the members of the Royal Forestry Commission, was elected president for the year, in succession to Dr. Somerville, of the Board of Agriculture. M. Daubrée, Conseiller d'Etat and Directeur des Eaux et Forêts, was elected honorary vice-president, and four other French officers connected with the forests which were to be visited by the Society were elected honorary members.

On August 19, fifty-three members of the Society proceeded *viâ* Boulogne to Compiègne. Among these, besides our president, may be noted Mr. H. J. Elwes, F.R.S., of Colesborne, Gloucestershire; Mr. Coroner Graham, of Durham; Mr. F. W. Beadon, of Longley Hall, Huddersfield; Mr. J. Smith Hill, principal of the Agricultural College, Aspatria; Sir Hugh Beevor; Mr. J. Davidson, the secretary, in charge of the forests belonging to Greenwich Hospital; Mr. E. McA. Moir, late of the Indian Forest Department; Mr. Forrest, agent to the Duke of Bedford at Thorney; Mr. W. Forbes, forester to Lord Masham; Mr. Havelock, forester to Lord Yarborough; Mr. Gillanders, forester to the Duke of Northumberland; Mr. A. C. Forbes, forester to Lord Lansdowne, and many other foresters and nurserymen.

On August 20, the party proceeded to Villers Cotterêts (Aisne), the birthplace of Dumas, and spent the morning in inspecting the extensive timber yards of M. Carpentier and of the Chemin de Fer du Nord. The French band saws are the best in existence, and a very large quantity of fine beechwood is now being sawn up. The beech is sawn green during summer and then carefully seasoned, while oakwood is now being collected for autumn and winter sawing, hornbeam wood being sawn up in the spring. M. Carpentier sells much hornbeam wood in England. The system of creosoting by the Chemin de Fer du Nord is new. It is very effective, and was explained in detail and by practical illustration by the director. Large quantities of beech and oak sleepers are thus prepared, the beech absorbing three times as much creosote as the oak, and, as an experiment, a few maritime pine sleepers were being tried, this species not being yet used by this railway.

After breakfast, the party visited the Forêt de Retz (32,550 acres with a net revenue of 23,698*l.*), on undulating land 200 to 800 feet in altitude, the soil being chiefly a deep and fertile

oam above cerithic limestone, sand and quartzite. It is one of the finest forests in France, containing

Beech	40	per cent.
Hornbeam	40	,,
Pedunculate oak	15	,,
Sallow, poplar, chestnut and elm	3	,,
Conifers	2	,,

During the last thirty years, oak has been extensively planted in the young woods, so that it is hoped to raise the percentage of this species to 33 per cent. We inspected some of the regeneration areas and thinnings, under the guidance of M. Cottignies, Inspecteur des Eaux et Forêts, and his assistants, and were greatly pleased with the results, not a single blank existing in the forest.

On August 21, the Society visited the Forêt de Compiègne (36,072 acres with a gross revenue of 33,480*l*.). It is situated on a poorer and drier soil than that of the Forêt de Retz, half the area being flat and on Eocene sands and clay, the rest hilly (117 to 495 feet altitude) and above nummulitic sand and lime-

FIG. 1.—Sessile Oak in the Forêt de Bellême.
Girth at 4 ft. 6 in. = 9 ft. 9 in. Total height 119 ft. 6 in.

stone. M. Peiffer, Inspecteur des Eaux et Forêts, conducted us through the forest, which, when I saw it in 1871, was overstocked with red deer and rabbits, so that natural regeneration was rendered almost impossible. Although game is still important and produces an annual rental of 3880*l*., yet it is now kept sufficiently in check, and the regeneration of the forest is proceeding satisfactorily, chiefly by natural seed. A practical illustration was given of setting free oak saplings from invasive growth of inferior species. This is done by the forest guards with a crescent-shaped cutting instrument having a handle about 4 feet long, and attracted much attention and commendation.

The party visited the splendid Château de Pierrefonds, which, under Napoleon III., was restored to its former condition in the middle ages by M. Violet le Duc, and from its watch-tower a most extensive forest panorama of the two forests of Retz and Compiègne was seen. We were then joined by M. Daubrée, the chief of the French Forest Department, and by the Conservateurs of Paris and Amiens, MM. Récopé and Molleveaux, and inspected the sessile oaks of the Beaux Monts. Such a mass of huge 300-year-old oak trees is to be seen only in France. A photograph of a French sessile oak taken by M. Granger, one of the Compiègne forest officers, is here reproduced.

The Mayor of Compiègne and the French officials dined with the Society in the covered courtyard of the hotel, which was ornamented with flags, creepers and evergreen trees. Besides the usual patriotic speeches by the president and the Mayor of Compiègne, Mr. Elwes, F.R.S., proposed the health of the French Forest Department in an excellent French speech, which was responded to most sympathetically by M. Daubrée, who invited the party to visit other French forests on some future occasion, and expressed his thanks for being elected one of our vice-presidents.

On August 22, most of the visitors went to Paris, some of whom visited the Forêt de Fontainebleau, but several proceeded to Valenciennes and spent two days in the splendid coppice-with-standards of the State forests of S. Amand (8290 acres) and the private forest of Raismes (3500 acres) belonging to the Duchesse d'Aremberg. These forests are on Tertiary sandy loam above the Coal-measures, and are noticeable for the equable distribution of standards (chiefly oak and ash) from ten to 120 years old. This is less marked in the State Forest,

FIG. 2.—Pedunculate Oak in the Forêt de S. Amand.

owing to wholesale felling of old oaks from 1790 to 1815. The ideal to be aimed at is to have 1400 cubic feet of standards per acre when the underwood is twenty-five years old, and to fell half this volume, leaving 700 cubic feet to grow for another twenty-five years, when it should again amount to 1400 cubic feet. A photograph is here given of one of these old standards, the distinctive growth of which, as compared with that of the oak grown in high forest, being noteworthy. During the Napoleonic wars, a large area in the forest of S. Amand had become mere heather and bracken waste; this was sown with Scotch pine about sixty years ago; the oak has sprung up naturally among these pines, which are being gradually removed every six years, and broad-leaved forest, chiefly of birch under oak standards, results. Each of these forests produces a net revenue of about £1 2*s*. 6*d*. per acre.

A full account of the notes taken in this expedition will be published in this year's *Proceedings* of the Society, the chief object gained being the continual discussion in the forest of interesting points of forestry by the members and the French foresters, and the demonstration of the successful following of a continuous plan through many decades for producing fine timber.

W. R. FISHER.

PALÆOLITHIC FRESCOES AND MURAL ENGRAVINGS.[1]

ATTENTION has already been drawn in NATURE (vol. lxv. p. 299) to the recent discovery of large mural decorations by Palæolithic artists, and as the subject is of such extraordinary interest we do not hesitate to give a further account of the more recent discoveries of like nature.

MM. Capitan and Breuil presented at the meeting of the Paris Academy of Sciences of June 23 a communication describing some paintings on the wall of the cavern of Font-de-Gaume in Dordogne. Of the eighty figures which are painted in red ochre and manganese black on the walls of the cave, forty-nine are of bisons; all are engraved and painted, but sometimes the surface of the rock has also been scraped; a thick layer of stalagmite has covered many of the designs. The original of the figure of the running bison that we reproduce has a length of 1 m. (39½ in.) and a height of 60 cm. (25½ in.); it is entirely painted in a brown colour with a red tint on the forehead. These are the first frescoes recorded for France, as the engraved designs from the cave of La Mouthe, published by M. Émile Rivière in 1895, were rarely and, even so, but partially coloured.

M. Henri Moissan has analysed the colouring matters employed by the Palæolithic mural decorators, and finds that they are ochres composed of oxides of iron and manganese in variable proportions.

At the meeting of the Academy on July 28, M. Émile Rivière drew a distinction between the true frescoes described by the former authors and his own discoveries in the cave of La

FIG. 1.—Fresco of a Bison, Font-de-Gaume.

Mouthe, also in Dordogne. The latter are almost exclusively more or less deep engravings or shallow markings produced by scraping or scratching the rock. Two of the figures present some traces of paint; one of these represents a ruminant, perhaps *Bos priscus*; the contour only of the hind limb is coloured a blackish red-brown, especially at the level of the joints and hoofs; the left flank of the animal is marked with ten spots of the same blackish-brown colour, extending in a line from the shoulder to the upper portion of the thigh. The other design represents a kind of hut, not engraved by a simple line which indicates the contour as in the numerous animals represented upon the walls of La Mouthe, but by a scraping of the rock. Ochre (possibly mixed with manganese) has been applied superficially to portions of the scratches in such a manner that the colour is much less deep than in the former figure; it is laid on in a series of bands approximately parallel and alternately clear and dark. This is the only known drawing of a habitation of primitive man.

M. Rivière does not commit himself as to the contemporaneity, or otherwise, of the engravings of La Mouthe with the paintings of the Font-de-Gaume; but he reasserts that the figures of La Mouthe are undeniably Palæolithic (Magdalenian), and, geologically speaking, of the Quaternary epoch. The prehistoric artist who engraved them was the contemporary of the reindeer and of the mammoth the portraits of which he delineated.

In a recent number of *l'Anthropologie* (t. xiii. Mai-Juin, 1902), M. Emile Cartailhac gracefully acknowledges that he was wrong in doubting the genuineness of the pictographs of animals painted on the walls of the cave of Altamira in Spain. He gives two illustrations of these frescoes, one of which (Fig. 1, p. 351) contains a group of seventeen animals, drawn with spirit and with a considerable degree of accuracy. The Altamira artist, or artists, evidently belonged to the same "school" and period as that of the Font-de-Gaume artists. A. C. H.

[1] "Reproduction des figures paléolithiques peintes sur les parois de la grotte de Font-de-Gaume (Dordogne)." By MM. Capitan et Breuil (*Comptes rendus* Acad. Sci., Paris, t. cxxxiv. p. 1536); "Sur les matières colorantes des figures de la grotte de Font-de-Gaume." By M. Henri Moissan (*l.c.*, p. 1539); "Les figurations préhistoriques de la grotte de La Mouthe (Dordogne)." By M. Émile Rivière (*l.c.*, t. cxxxv. p. 265).

SEA TEMPERATURE VARIATIONS ON THE BRITISH COASTS.

THE Meteorological Office pilot chart for September contains very interesting information relating to the temperature of the sea water round the coasts of the United Kingdom in the month of June last. Over nearly the whole of the Atlantic between the 30th and 50th parallels the temperature for the month was below the average, in many places the deficiency amounting to 5° and upwards. This fact is clearly shown on the general chart, but two small charts have been added to illustrate a remarkable change experienced close inshore. Daily records at a large number of coastguard stations and lightships disclose the prevalence of very cold water during a considerable part of the month, and a rapid increase of warmth towards the close. The extra sketches exhibit the mean results for June 1 to 24 and June 25 to 30 respectively. Along the western and southern coasts, many of the minimum values during the cold

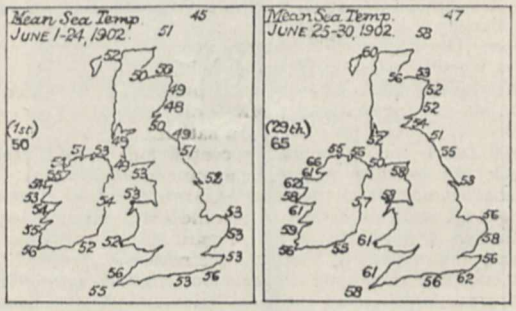

FIG. 1.—Sea Temperature Variations on the British Coasts.

period were as low as 48° to 52°, the lowest in several places occurring as late as the 15th of the month. Off Eastbourne, 54° on the 8th and 9th was the lowest June record in nineteen years. On the east of Britain and west of Scotland the minima were from 42° to 48°. Before the end of the month the west and south coasts were generally above 60°, and the east and north 55° to 60° and upwards. Up the north-western shores the temperatures were higher than in any other neighbourhood, the maxima being registered on the 28th or 29th as a rule. Stornoway and Seafield touched 66°, Ballyglass 67°, Liscannor 68°, Teelin Head 70°, and Blacksod Point 72°. Even the Orkneys reached 60°, while Eastbourne did not pass 62°. Confirmation of these very high readings in the north-west is afforded by the records of ships well out in the offing, the observations in about 55½° N., 11½° W., showing 50° on the 1st and 65° on the 29th.

Judging by the mean results for the two periods, the greatest change took place off Teelin Head, Donegal, where the closing days averaged 12° warmer than the previous part of the month. Blacksod, to the south, was 8°, Arran Island 7°, Seafield 5° and Minard 4° warmer, while Ballydonegan, at the south-west extremity of Ireland, showed no change. Northward from Teelin Head we find a rise of 8° at Stornoway, 7° at the Orkneys, and, curving southward down the coast of Caithness, 6° at Cromarty. The warmth scarcely affected the Shetlands, where the increase was only 2°. Eastward past the north of Ireland the effect diminished rapidly, the rise at Sheephaven being 4°, at Port Rush and Lamlash 3°, and at Ballantrae 1°. For the warm period the Orkneys equalled and the Hebrides exceeded by 2° the result at Scilly, 58°. It must be remembered

in connection with this phenomenon that the country experienced almost the only few days of warm weather of the summer, but while the water was decidedly warmer in the north-west than elsewhere, the air temperature was higher over England than over the south of Ireland, and still higher than in the north of Ireland.

RECENT EDUCATIONAL REPORTS.[1]

THE protracted discussions in the House of Commons, the numerous leading articles in the newspapers and the frequent public speeches of politicians, concerned with the subject of education, with which we have been provided during the past six months, are evidence enough that English people are at least beginning to be interested in the important question of the provision made by the State for the education of its citizens. But interest alone is not enough, it must be intelligent; and to ensure this it is important that the instructors of public opinion should themselves be well informed, both as to what is actually happening in the schools and colleges of our own country and as to the systems of education in other lands. For these and similar reasons, the special reports published from time to time by the Board of Education, under the editorship of Mr. Michael E. Sadler, the director of special inquiries, have a peculiar value just now; while the general reports of H.M. Inspectors serve admirably to remind Members of Parliament that despite the changes which may be necessary in our educational administration, good, thorough work is even now being accomplished in most of our State-aided schools, whether elementary or secondary.

The two volumes dealing with education in the United States of America are concerned more with general principles and tendencies than with specific details as to methods of instruction. Though this will detract from their value to practical teachers, it gives greater opportunities to insist upon the necessity for the possession by our legislators of proper, high ideals as to the function of education. As Mr. Sadler says in a paper he contributes to the second volume, "a national system of education which made money-getting its central aim would deserve all the contumely which history in a more enlightened future would be certain to heap upon it." American educators are showing the world that it is possible at the same time to develop the higher faculties, to have a due regard to the pleasures of cultivated leisure, to encourage "sweetness and light," and yet thoroughly to equip their young men with a knowledge of recent advances in pure and applied science, so that without difficulty they may take an honourable part in the production of those material comforts without which the most cultured would find it hard to live.

Two factors, among many others, preeminently contribute to the success of American education. In the first place, there is the munificence of wealthy Americans. Mr. Percy Ashley, at the end of his article on American universities, tabulates the total amount of benefactions reported during the years 1890–1901. During these eleven years, very nearly twenty-three millions of pounds were given to higher educational institutions, not including libraries and museums, and more than two millions went to the Leland Stanford University alone. These princely sums are largely devoted to the encouragement of research; as Mr. Ashley says:—"In all the arrangements for research work the United States is much under German influence; and it is greatly to be regretted that England should be so far behind . . . In spite of the establishment in recent years of degrees avowedly for research by Oxford and Cambridge, there is still no place where organised research work is carried on in England . . . It must be said that the research work of the American universities is probably the part of their activity most worthy of study by those interested in academic progress in England. It must be admitted, however, that the material attractions to research and an academic career are far stronger in the United States than here."

[1] "Special Reports on Educational Subjects.' Vol. x. "Education in the United States of America." Part i. Pp. 538. Price 2s. 3d. Vol. xi. "Education in the United States of America." Part ii. Pp. 624. Price 2s. 6d. (Eyre and Spottiswoode.)

"General Reports of H.M. Inspectors on Elementary Schools and Training Colleges for the year 1901." Pp. 234. (Eyre and Spottiswoode.) Price 1s.

"General Reports of H.M. Inspectors on Science and Art Schools and Classes and Evening Schools." Pp. 98. (Eyre and Spottiswoode.) Price 5½d.

The second factor in the success of American education to which reference has been made is the recognition of the existence of a science, as well as an art, of education. Sir Joshua Fitch points out in his introductory paper that "America may be regarded as a laboratory in which educational experiments are being tried on a great scale, under conditions exceptionally favourable to the encouragement of inventiveness and fresh enthusiasm, and to the discovery of new methods and new truths." The experimenters are, moreover, well trained for their work. There is little scepticism as to the value of training for teachers in the minds of American authorities, and some idea of the pains taken to make the training as helpful and practical as possible can be obtained from Dr. Russell's account of the admirable Teacher's College of Columbia University, included in Part i. of the report. Among the numerous proofs, contained in these pages, of the success attained by the teachers proceeding from American training colleges, President Hadley's opinion may be quoted:—"Our best American schools of technology are no longer places for shop work, but places for the training of thinkers—of men who may not know how to do the particular things which will first be wanted of them, but who are in possession of that general knowledge which will enable them to learn more thoroughly the real bearings of any new problem as it arises. They have become less technical and more scientific."

The space available allows only the briefest reference to the general reports of H.M. Inspectors. Attention must, however, be called to the remarks of Mr. Pullinger, Chief Inspector of science and art schools in the northern division of England, on the work of evening continuation schools. He finds that many of the pupils in these schools "come for warmth, for the comforts of an attractive, well-lighted room, for the monthly lantern lectures and for the free trip to Blackpool at the end of the session." The schools have been variously described as "gather-'em-in-at-any-price-schools" and as "a sort of shelter for homeless boys and girls." Mr. Pullinger wishes "to state emphatically that the supply of really educational night schools is most inadequate." When it is remembered that the evening classes of our technical schools have largely to rely upon the preliminary training given to their students at these evening continuation schools, the immediate necessity for their improvement becomes evident, and it is to be hoped that the Board of Education will refuse its grants to all schools where the chief aim is recreative.

SNOW-WAVES AND SNOW-DRIFTS.[1]

THE primary object of a visit to Canada at the end of 1900 was to continue the investigation of terrestrial surface waves and wave-like surfaces, without, however, confining attention entirely to the study of such forms or motions of the snow as might be wave-like in character.

In Canada a geographical distribution of the kinds of snow was noticed. Near Montreal the snow was, on the whole, only moderately dry, and during December did not differ very much from what was seen in Scotland, on the Pentland Hills and near Grantown-on-Spey, during February, 1900, except that the freshly fallen flakes did not cling together to form mottling and rippling. The forms of the snow-drifts, or banks, in the neighbourhood of obstacles were not very dissimilar. The same general character of snow was observed as far west as Port Arthur, 1000 miles by rail from Montreal, the surface of the snow being generally soft. Near Winnipeg and westwards, at least as far as Medicine Hat, the appearance of the snow-banks accumulated in the neighbourhood of obstacles was strikingly different. Here the snow was almost perfectly dry and the snowfall light. The prairie was often swept quite bare of snow in the neighbourhood of the banks, and the surface of the snow on the prairie was generally hard and rough. But for its whiteness, the landscape resembled a desert with low isolated sand-hills more than a snow-scene in England. Much of this snow was granular, like sand, as the result of processes which it had undergone since its deposition.

On reaching the Rockies, the snow was seen to resemble more that of eastern Canada, but afterwards it became, apparently, still more moist, so that, in the next range, the

[1] Abridged from a paper by Dr. Vaughan Cornish, read before the Geographical Society on May 12 and published in the August number of the *Geographical Journal*.

Selkirks, perfect examples of the forms which gravity imparts to moist snow were met with.

FIG. 1.—A Snow-mushroom nine feet in diameter.

At Glacier House a tree stump 2 feet in diameter had a cap of snow 9 feet across, the eaves projecting 3 feet 6 inches all round the pedestal. A broken tree with diameter of 4 feet had a snow-cap 12 feet across, the eaves projecting 4 feet beyond the pedestal (Fig. 1). Some of these snow-mushrooms must have weighed a ton.

That the "snow-mushroom" is, on the whole, so remarkably preserved from ruin by overloading may be attributed to bending of the strata under the action of gravity, their inclination to the horizon increasing with the distance from the pedestal.

Waves of drifting snow are only formed in dry snow at a low temperature. They are not so steep as the corresponding sand-waves.

Even when the surface is all covered with fresh snow, an extensive horizontal plain appears to be the best field for the growth of snow-waves, for the liability to local *surcharge* increases with the extent of the field of drifting. The more unlevel is the country, and the more numerous the places of shelter, the shorter is the time during which the wind can drift the snow in waves, and the smaller is the extension of the individual groups of waves.

Snow-fences are commonly erected in Canada to check the rate of snow-drifting. After the first snowfall, a snow bank or drift is produced, having a moderately gentle slope to windward and a cliff or cornice on the lee side. The form resembles that of a sand-dune or any other wave of a drifted powder, which at first suggests that the form proper to a drift caused by the fence is similar to that of freely drifting snow. This, however, is not the case, for the structure is as yet incomplete, owing to insufficient supply of the material. Succeeding snowfalls build out the drift with a diminishing cliff, until we have at last, perhaps not until nearly the end of winter, the completed form in which there is no lee cliff, but a long, gently tapering slope on the lee side, the weather face retaining its original form and *relatively* steep slope.

When we have to do with large bluffs or cliffs, the whole of the winter's snow is not sufficient to fill in the area of eddies on the sheltered side so as to reduce the surface to "easy lines." Thus the largest drifts are never of completed form, but have always a steep face to leeward. Completed drifts, having no shadow-throwing cliffs, are also much less conspicuous relatively to their size. Thus circumstances combine to prevent the casual observer from discovering what is the profile really proper to a snow-drift.

From an examination of the snow-drifts in Canada, the conclusion was reached that a curve of the character shown in Fig.

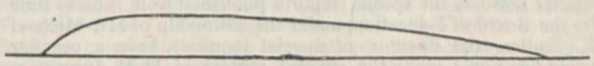

FIG. 2.—The fundamental Curve of Snow-drifts.

2, with the blunt end towards the wind, was the fundamental element of their form.

This, which may be termed the *ichthyoid curve*, is the profile of *completed* drifts in the neighbourhood of obstructions on the prairie.

Inverted, it is the profile of the holes round trees, as observed in the woods near Montreal.

Viewed in plan, it is the curve cut out in the snow round the end of a wall.

Viewed in plan together with its image, it is a boundary curve enclosing the horseshoe-shaped banks round houses near Winnipeg, and equally the hollows round trees or stones.

This doubled curve has the generalised form of a fish,[1] or if it be spun round so as to give the outline of a solid body, we have the modern Whitehead torpedo with the blunter head now preferred to the older sharp-nosed form.

The analogy to the fish-form is still more striking if fishes are looked at from above instead of viewing them in profile.

FIG. 3.—Stratification of Snow revealed by Wind Erosion.

The completed snow-drift in the neighbourhood of an obstruc-

[1] The profile of the snow-drift resembles the profile of a sole or other flat fish.

tion may be regarded as a filling in of the eddy-space in such a way as to provide easy lines for the flow of the wind.

In waves into which freely drifting powders fall, the steep side is on the leeward instead of upon the windward, and this signifies that the eddy-space is *never* filled up. The whole eddy-space is, in fact, free to move forward, and does so when the snow is drifting, and this progression is the wave motion.

The relation between the profile of the snow-drift and that of the waves of drifting snow and sand may be further illustrated by drawing the profile of the wave, not in the usual way, from trough to trough, but from crest to crest. It is then seen that the unfilled space between the two ridges has the blunt nose and fine tail profile; that it is the profile of the hollows in snow round trees and of the fuljes of sandy deserts, tbe form proper to an eddy space.

The powder, when drifting in waves, has the "fine nose and blunt tail form," which is that of greater eddy-making resistance (the nose being that part turned towards the wind), and the powder, when in its complete accumulation near fixed obstructions, assumes the "blunt nose and fine tail" form, which is that of less eddy-making resistance. Both forms are simultaneously produced on a snow-field, and both are compatible with the removal by the wind of the maximum quantity of snow in the course of the winter. Thus, on the one hand, the maintenance of strong eddies in the drifting waves evidently increases the power of the wind to drive the snow before it; and the hindrance offered by a fixed obstruction is best minimised by filling in its eddy-space with a structure which shall thereafter absorb as little energy from the wind as possible.

Sometimes the freely drifting snow is accumulated in isolated hillocks, which have been called barchans or medaños. Sometimes their development from patches of drift snow can be observed. These patches have in ground plan a fine nose towards the wind and a blunt tail or lee end—a sort of delta shape, but with curved sides. The same thing may be seen in sand. This is in accordance with the habit of the freely drifting snow to adopt a fine nose and blunt tail arrangement in vertical profile.

Freely moving barchans of less or greater elongation probably fill in less or more of the narrow end of the ichthyoid curve. The crest of the cliff will be lower than the summit of the barchan if the former be beyond the broadest part of the curve. The erosion forms produced by wind when acting upon consolidated snow were also studied. Fig. 3 shows how the minute stratification of the snow is revealed by the action of the wind.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

THE following list of candidates successful in this year's competition for the Whitworth scholarships and exhibitions has been issued by the Board of Education, South Kensington:—Scholarships, 125*l.* a year each (tenable for three years):—William M. Selvey, London; Leonard Bairstow, Halifax; Isaac V. Robinson, West Hartlepool; Arthur Baker, Gosport, Hants. Exhibitions, 50*l.* (tenable for one year):—Charles Cook, Landport, Portsmouth; John S. Mitchell, Uddingston, near Glasgow; Charles J. Stewart, Fratton, Portsmouth; Arnold H. Gibson, Sowerby Bridge, Manchester; William E. W. Millington, Hollinwood, Oldham; Neil J. Maclean, Kelvinside, Glasgow; Henry J. Jones, Southsea; Harold Rawstron, Oldham; George H. Childs, Portsmouth; Norman L. Ablett, London; William E. F. Curror, Ilford, Essex; Walter L. Port, Brighton; John Alexander, Glasgow; Louis D. Stansfeld, London; Robert J. A. Pearson, Sheffield; William L. Perry, Plymouth; Arthur S. Angwin, London; Francis G. Steed, Devonport; Henry A. Bagg, London; Frederick J. Crabbe, Southsea; Arthur Garrard, Forest Gate, E.; Benjamin J. Thomas, Devonport; Maurice B. Dalby, Gateshead; Thomas Wadhams, Wolverton; Oliver S. Spokes, Crewe; James Crone, Charlton, Kent; Alexander B. Sowter, Glasgow; Fred Sykes, Huddersfield; Frederick E. Rebbeck, Belfast; Frank W. Harris, Swindon.

THE metropolitan and most of the provincial medical schools will be opened at the beginning of October. Among the addresses to be delivered, the following are announced:—*Charing Cross Hospital.* The fourth biennial Huxley lecture on "Recent Advances in Science and their Bearing on Medicine and Surgery," by Prof. W. H. Welch, of the Johns Hopkins University, Baltimore. *St. George's Hospital.* Address by Dr. T. T. Whipham. *St. Mary's Hospital.* An address by Sir A. W. Rücker, F.R.S. *Middlesex Hospital.* Mr. Stephen Paget will give an address. *University College.* An address by Mr. Percy Flemming. *London (Royal Free Hospital) School of Medicine for Women.* Address by Mr. Charles Burt. *School of Pharmacy.* Address by Dr. W. Palmer Wynne, F.R.S. *Royal Veterinary College.* Address by Prof. Bottomley. *Yorkshire College, Leeds.* Address by Mr. A. W. Mayo Robson. *University College, Sheffield.* Address by Sir H. G. Howse. *Owens College, Manchester.* Address by Sir Dyce Duckworth. *University College of South Wales and Monmouthshire, Cardiff.* Address by Dr. Berry Hart.

A SUMMARY of the more important recommendations contained in the report of the Indian Universities Commission, which has now been published in India, is given in the *Pioneer Mail* of August 8. Among other points, it is recommended that in addition to holding examinations, all universities should be recognised as teaching universities, and that there should be no more than five faculties, viz. arts, science, law, medicine and engineering. One regulation is certainly a tribute to the power of memorising possessed by the oriental mind; it is prescribed that "text-books to be read should be so long as to exclude the possibility of all of them being committed to memory"; another lays it down that "students should not be required to pass in science before entering on the University course. Instruction should include practical experimental work, and in examinations for the B.Sc., the practical examinations should be passed independently of the written examinations, and should have a separate minimum of marks. . . . The degree of D.Sc. should require original research." The improvement of the equipment of medical colleges is urged, as well as the establishment of a diploma of sanitary science. The universities are not recommended to undertake instruction in engineering, but are advised to encourage agricultural and commercial studies. We agree with the concluding remark of the commissioners, that "it is better for India that a comparatively small number of young men should receive a sound and liberal education than that a large number should be passed through an inadequate course of instruction leading to a depreciated degree."

SCIENTIFIC SERIALS.

Bulletin of the American Mathematical Society, (2) vol. viii. No. 10 (July).—E. J. Wilczynski, account of the first meeting of the San Francisco section, with abstracts of the papers read.—Mary M. Newson, a translation of Hilbert's lecture on mathematical problems (delivered at the Paris Congress, 1900).

American Journal of Mathematics, vol. xxiv. No. 3 (July).—S. Kantor, types of linear complexes of elliptic curves in space of r dimensions.—R. E. Moritz, generalisation of the differentiation process.—H. D. Thompson, simple pairs of parallel W-surfaces.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, April 24.—"On Skin Currents. Part iii. The Human Skin." By Augustus D. Waller, M.D., F.R.S. (from the Physiological Laboratory of the University of London).

In freshly removed healthy skin, the normal current is always ingoing and the response to electrical excitation by the induction coil is always outgoing. This response, called by Dr. Waller the "blaze," is a sign of its vitality, is independent of the normal current and amounts to from 0·0100 to 0·0400 volt, if tested, within forty-eight hours after removal, by tetanising currents of alternating direction in both pairs of direction.

Moribund skin and skin from post-mortem room give small reactions of variable direction amounting to not more than ten-thousandths of a volt.

In all cases, the electrodes were carefully tested and the skin subsequently killed by boiling, tested and found to give negative results.

The following observation is illustrative. A piece of skin of breast one-and-a-half hours after removal gave 0·0180 and 0·0230 volt in response to single shocks of both directions. On the third day the reactions were 0·0050 and 0·0175, on the fourth day 0·0025 and 0·0035. In all cases, this was abolished by boiling.

A remarkable feature was the great diminution of resistance of living skin caused by tetanisation. The resistance of dead skin is far below that of living skin and is unaltered by tetanisation. Fatigue is exhibited more in human skin than in frog's kin.

As regards the locality of the reaction, Dr. Waller finds that the blaze currents arise exclusively from the malpighian layer of the epithelium, not from the superficial keratinised cells, or from the subcutaneous tissue and the corium; he demonstrates this by means of a three-way key leading off from three electrodes, of which one, A, is on the external surface. B on the internal opposed surface, C on an external indifferent part. Excitation is made through A B and the result is led off from A C and from B C; there is response from A C, but not from B C, showing that the under surface B gives no reaction. The blaze reaction is quite local and is not propagated to any distance from the excited spot, and adjacent portions exhibit different degrees of vitality.

The apparent duration of vitality is surprising, lasting as long as ten days after excision.

The remarkable augmentation of conductivity by tetanisation may be due to, first, a "Kataphoric" migration of water, second, to a dissociation of electrolytes. Dr. Waller is inclined towards the second alternative.

Alterations of temperature produce alterations of resistance as in any moist conductor. In the case of living skin, Dr. Waller has witnessed at the moment of congelation (−4° to −6° of the cooling chamber) a sudden electromotive discharge of 0·0080 volt attributable to the sudden excitation of living matter in the act of congelation. On return of the frozen skin to the original temperature, the resistance was found to be much reduced and the response to excitation was abolished.

PARIS.

Academy of Sciences, August 23.—M. Bouquet de la Grye in the chair.—Short period solar and meteorological variations, by Sir Norman Lockyer, K.C.B., and Dr. William Lockyer. A comparison of the curves, for a period of from fifteen to thirty years, of sun-spots, prominences, atmospheric pressure and rainfall in India. By comparing the solar data with the terrestrial atmospheric pressure, the conclusion is reached that the eruptions of prominences, coinciding with the variations of latitude shown by the spots about every three and a half years, are the true causes of a variation of air pressure on the earth.—The relation between the solar protuberances and terrestrial magnetism, by Sir Norman Lockyer, K.C.B. An examination of Italian observations made during the last thirty years has shown that the epochs of the solar storms classed as great by Ellis are identical with those of the greatest chromospheric activity near the poles of the sun, whilst the general curve of terrestrial magnetic activity is very nearly the same as that of the prominences observed near the solar equator.—The theoretical study of resistance to compression of mortar, by M. Considère.—On the methods of concentrating liquids used for food, and especially wine, by M. F. Garrigou. By distilling wine in a vacuum, it has been found possible to reduce the wine to one-fourth of its original bulk, without losing any of its aroma or alcohol.—Mechanical treatment in the milk industry, by MM. F. Bordas and Sig. de Raczkowski. The number of bacteria in a cubic centimetre of milk capable of forming colonies under plate cultivation was determined in the milk as it left the udder, in the mass of milk 24 and 36 hours after milking, in the one case where it had not been touched by hand, and in the other after the usual amount of handling. In some cases, special antiseptic precautions were taken. The results show that there is no difficulty in keeping the various pipes and taps used in connection with the mechanical treatment sterile, and at the same time there is greater safeguard against accidental contamination.—The structure of the suprarenal bodies of the Plagiostoma, by M. E. Grynfeltt.

NEW SOUTH WALES.

Royal Society, July 2.—Prof. Warren, president, in the chair.—Notes on two chemical constituents from the Eucalypts, by Mr. Henry G. Smith.—In this paper, the author records the results of continued investigations on the ester (geranyl-acetate) contained in the oil of *Eucalyptus Macarthuri*, and also on the oil itself. These data show that the ester does not fall, at any time of the year, below 60 per cent., and that the amount of free alcohol, considered as geraniol, diminishes in amount as the ester increases. The greatest amount of naturally formed ester occurring at any time of the year was 74·9 per cent. in September, but the free alcohol was only 6 per cent., at that time. It has been found from numerous determinations that when the oil is acetylised the ester content will be but little removed from 80 per cent. The oil does not contain phellandrene at any time of the year, and eucalyptol appears to be always absent. Eudesmol is always present, but as it varies in amount the specific gravity of the oil varies also. The crude oil appears to be always slightly dextrorotatory. From the results of investigation of the oil obtained from more than 100 distinct species of Eucalypts, this is the only one found to contain this valuable oil.—The aboriginal languages of Victoria, by Mr. R. H. Mathews.—The parks of Sydney; some of the problems of control and management, by Mr. J. H. Maiden.

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