THURSDAY, FEBRUARY 8, 1912.

PARACELSUS.

The Life of Paracelsus: Theophrastus von Hohenheim, 1493–1541. By Anna M. Stoddart. Pp. xv+309. (London: John Murray, 1911.) Price 10*s.* 6*d.* net.

A PATHETIC interest attaches to this work. It is the last literary production of a gifted woman who had endeared herself to a large circle of friends by the sterling integrity of her character, by her remarkable intellectual power, her breadth of culture, and by her many-sided activities, especially in the educational world. The work itself represents the thought and labour of years, but the author died before it was given to the world, dying indeed a few hours after passing the last sheets for press. Twenty years ago Miss Anna Stoddart determined to devote her literary ability and her considerable linguistic attainments to what she came to regard as a sacred and imperative duty, namely, to rescue from contemptuous oblivion the memory of one whom the great majority of his fellows held to be an extravagant and pretentious charlatan—a bibulous braggart, uneducated, quarrelsome, self-assertive, and disreputable—and, while thus restoring his fair fame, place him in his true relation to the great moral and intellectual movement of the European Renascence.

Miss Stoddart is perfectly frank with her readers. She makes no secret of the fact that her interest in her subject had its sole origin in her connection with the Browning Society. Probably, like hundreds of the poet's readers, until Browning's poem quickened her curiosity, she had never heard even of the name of the alchemist, much less of the story of his life. The poet has admitted that his "Paracelsus," written at the age of twenty-one, was regarded by him simply as "the dramatic revelation of the soul of an imaginary person." Miss Stoddart tells us that many readers and admirers of the poem looked upon it in the same light: they "classed it with others which owed their emergence from subjective chaos to the poet's creative power." Browning, it is true, had equipped himself for his task by reading some of the writings of Paracelsus, together with a few biographical notes—mostly mendacious calumnies, according to Miss Stoddart. But, she adds, the "astonishing fact is that through this paucity of evidence and this cloud of hostile obscuration the poet discerned his greatness."

In grappling with such a subject as Paracelsus, the tentative work of the Browning Society, of the committee of which Miss Stoddart was a member for some years, proved unsatisfactory, and accordingly she sought by her own efforts to substantiate and amplify by historical research that which the creative power of the young man of twenty-one had evolved from "subjective chaos." As the result of her labours, Miss Stoddart has succeeded in producing a book of great interest, and of much literary charm, but whether it will bear the cold, impartial scrutiny of historians or altogether satisfy the sober lovers of truth may be doubted. To write unstinted eulogy is not necessarily to write sound history, and in her too evident desire to invest the real Paracelsus with the attributes of the "sympathetic revelation" of the poet, Miss Stoddart has permitted her zeal to outstrip her discretion, and in her passionate eagerness to rehabilitate her hero has given too little exercise to her critical skill.

The main incidents in the career of Paracelsus are now tolerably well known, and Miss Stoddart does not pretend that her researches have added much to our knowledge of the authentic facts of his extraordinary life. She seems to trust implicitly his own account of himself, and accepts unreservedly his explanations of much that is admittedly dubious in his character and conduct. His contemporaries, for the most part, declined to accept Theophrastus von Hohenheim—for such was his real name—at his own valuation; and the historians of chemistry and of medicine have, generally speaking, seen little reason to disturb the general verdict. At the same time, it cannot be doubted that circumstances, not altogether of his choosing, made of Hohenheim a representative man of his age. He was styled, even in his own time, the "Luther of medicine"—a term against which he vehemently protested, but which has nevertheless a certain basis of justification. He was disdainful and contemptuous of authority; he flung himself impetuously against the settled convictions and prejudices of the *Zunftgeist* of the time, and eventually was worsted in the struggle.

Although unquestionably a forceful character, a man of strong convictions, an iconoclast, reckless and intemperate in speech, he had no real constructive ability. He railed against the systems of Galen and Hippocrates, but his own attempts at reconstruction ended only in obscurity and vague generalities. As an operative chemist he did little; no particular discovery can with certainty be attributed to him. His life, indeed, was too unsettled, his means too precarious, and his wanderings too frequent for him to settle down to the serious pursuit of practical chemistry. Although his published works, or the many posthumous memoirs—some of them issued many years after his death—make mention of various chemical preparations, it is doubtful whether these are actually to be ascribed to him or whether they were not picked up by him in the course of his travels.

The service that Hohenheim rendered to his age was to unsettle and pull down. He left to others the task of reconstruction. He has been regarded as the first of the Iatro chemists—the first to declare loudly and unhesitatingly that chemistry had other aims than the transmutation of metals. Her main function, he taught, was to make medicines and not merely gold artificially. Others before him had dimly recognised that alchemy had gradually restricted herself to a single pursuit. Originally her operations were not limited to the artificial production of the noble metals. It is to Hohenheim's credit that he recalled her, in season and out of season, to her true vocation. He liberated her from the thraldom to which she had gradually subjected herself, and in so doing gave an extraordinary impetus to the study of rational therapeutics.

Miss Stoddart tells the story of his turbulent life in great detail, and she has apparently neglected no means available to her of tracing the successive steps of his chequered career. She has been aided in her search by German scholars like Sudhoff, Hartmann, the Strunzs, and others, and whilst we may deprecate the glamour with which she has sought to surround her subject, we bear willing testimony to the patience and unwearied devotion she has brought to her self-imposed task.

Worn out by persecution, homeless and a wanderer to the last, Hohenheim ended his strenuous life at Salzburg on September 24, 1541, in the forty-seventh year of his age. On a tablet to his memory in the Church of St. Sebastian are the words, "To the living Peace, to the Sepulchred Eternal Rest." What irony! Paracelsus knew no peace in life, and even death brought little rest to his bones. His remains have been constantly disturbed, most frequently in attempts to disprove the allegation that he met his end by violence.

A CARBONIFEROUS FLORA.

Mededeelingen van de Rijksopsporing van Delfstoffen. No. 3. Anleitung zur Bestimmung der Karbonpflanzen West-Europas, mit besonderer Berücksichtigung der in den Niederlanden und den benachbarten Ländern gefundenen oder noch zu erwartenden Arten. By Dr. W. J. Jongmans. Band i., Thallophyta, Equisetales, Spenophyllales. Pp. viii+482. (Herausgegeben von der Staatlichen Bohrverwaltung in der Niederlanden.) (Freiburg in Sachsen: Craz and Gerlach (Joh. Stettner), n.d.) Price 15 marks.

IN this volume Dr. Jongmans states that his aim is to bring together information contained in the very extensive literature relating to West European Carboniferous plants. He asks readers to bear in mind the fact that he would have preferred to deal with the material more critically than has been possible without an examination of the numerous original specimens scattered in European museums, adding that what he has done should be considered as the arrangement of building material rather than as the construction of the complete edifice, a task postponed to a later stage.

The volume is written especially with a view to facilitate the determination of Carboniferous plants, and for this purpose it cannot fail to be of great value. The two bulky volumes on the bibliography of fossil plants published in 1910 and 1911 are in themselves a striking testimony to the devotion of Dr. Jongmans to palæobotany and to his willingness to give his time and energy to tasks which few students would attempt. In the volume before us we have further evidence of the author's industry and of his wide acquaintance with the literature of the subject.

In dealing with fossil plants, an author may confine himself to concise descriptions and a liberal allowance of illustrations in order to furnish students with data for the determination of species, or for the study of distributional problems; or he may treat the subject from the point of view of a botanist who wishes to present facts relating to the structural and general morphological features of extinct types. Dr. Jongmans's book is chiefly of the former kind, and contains a wealth of information culled from many sources, together with first-hand observations.

An inspection of the different sections of the volume raises some little doubt as to the complete success of the undertaking; even a few good illustrations of anatomical features would have considerably increased the interest of the descriptions, and the impressions and casts would have acquired a much greater interest and vitality. A correlation table of Carboniferous strata in different countries would be a welcome addition in a work which will be used by students of stratigraphy; while, on the other hand, one feels that, the author's aim being what it is, the treatment would be more helpful were it more critical.

The perusal of a volume such as this inevitably suggests the question, is the result achieved commensurate with the enormous labour involved? To give an answer in the negative might seem ungracious considering the thoroughness of the work and the undoubted service rendered by the author; but it is difficult to repress a tendency to wish that Dr. Jongmans had not carried self-sacrifice quite so far. To this volume, in which the author has unquestionably performed a welcome service in arranging and presenting in a convenient form a mass of scattered information, one may apply Huxley's words, "It is the organisation of knowledge rather than its increase that is wanted just now," though from a scientific point of view one cannot help feeling that the elaborate treatment of the *disjecta membra* of Carboniferous plants as represented by fragmentary casts and impressions may endow them with an importance greater than they deserve.

The tables scattered through the book, designed to assist the systematist in distinguishing between allied species, are a new feature, and should prove useful in practice, even though many of the characters on which supposed species are founded are altogether insufficient if scrutinised in the light of modern plants.

It is impossible in a short notice to do justice to the contents of the volume. The book is essentially a work of reference, and students of Carboniferous plants, whatever may be their views as to such points as I have raised, must acknowledge themselves indebted to one who has produced a well-ordered storehouse of data, valuable alike to those whose interests are chiefly stratigraphical and to those who are primarily concerned with the study of fossil plants as guides to phylogeny.

The account of the Equisetales occupies 350 pages. A short description of the group is followed by a concise description, with figures, of the known Palæozoic species referred to Equisetites and placed in the family Equisetaceæ. Under the second family, Protocalamariaceæ, three species of Asterocalamites are described, and full references and synonyms are given, also the geological horizons. The greater part of the volume is taken up with the numerous species of the genus Calamites, their identification being greatly facilitated by clear keys and well-chosen illustrations.

As the author admits, many of the so-called species and even the subgenera of Calamites are of little or no scientific value; but the reader has placed before him in a convenient and accessible form abundant information from a scattered literature, from which he can form his own opinion as to the value of supposed specific differences, and is enabled to obtain a comprehensive view of the genus as a whole and of its geographical distribution. A. C. SEWARD.

EARLY EGYPTIANS AND ANCIENT CIVILISATION.

The Ancient Egyptians and their Influence upon the Civilisation of Europe. By Prof. G. Elliot Smith, F.R.S. (Harper's Library of Living Thought.) Pp. xvi+188. (London and New York: Harper Brothers, 1911.) Price 2*s.* 6*d.* net.

WE think that "The Early Egyptians and their Influence on Ancient Civilisation" would have been a better title for Dr. Elliot Smith's little book than that which he has actually chosen, "The Ancient Egyptians and their Influence upon the Civilisation of Europe"; for Dr. Smith deals only with the most ancient, the earliest Egyptians, and he traces their influence not only upon the civilisation of Europe, but also, and in the first place, upon that of northern Africa and western Asia. We may say at once that Dr. Smith is less happy in his essay to trace this influence than when he is simply analysing the ethnic constituents of the race which exercised it. In dealing with the complicated question of possible early Egyptian influence upon the surrounding peoples, with regard to which our information is of the scantiest and most nebulous character, he is straying rather off his own ground, whereas in dealing with the early Egyptians themselves he is not only upon his own ground, but upon ground which he himself has made. To read him on this subject is indeed to be enlightened, and every historian must read with attention the remarkable conclusions to which he has been led by his experience in the dissection of mummies (gained in the course of his medical work at Cairo) in connection with the severely scientific archæological work of Dr. Reisner and his assistants at Nag' ed-Deir and in Lower Nubia.

His discovery that a more northern race infiltrated into Egypt, probably from Syria, from the time of the earliest dynasties, and gradually modified the Egyptian "dynastic" type from the beginning, is very illuminating, as it explains the occurrence in Egypt, and more especially in northern Egypt, of the "stumpy," stout, rounder-faced type which we see in the portrait-statues of the pyramid-builders, so different from the lank-faced prehistoric Nilote of predynastic times. Dr. Elliot Smith's arguments are based chiefly upon craniological considerations. Those who recall Prof. Flinders Petrie's incisive criticism of the argument from craniology in his essay, "Migrations," some years ago, may perhaps be a little sceptical of all Dr. Smith's conclusions, yet it must be said that his arguments are reasoned, and his conclusions consistent with themselves and with archæological results. The ancient portraits of the two races agree with the skulls. We may, with him, regard the "predynastic" Egyptian as the true Nilote, akin to the desert tribes of Beja and Bisharin, to the Galla and Somali, and perhaps to the Arabs, while the new "dynastic" type of the north was probably akin to the high-nosed, round-headed stock of western Asia, which von Luschan calls "Armenoid," because the Armenians are the best representatives of it.

The high-nosed Semites of Asia may be a mixture of this stock with the true Arabians of the south, but if the Sumerians of Babylonia are representatives of the southern race, which spread from the Upper Nile to the delta of the Euphrates, and even to India, as Dr. Smith seems to hold, how does he explain their remarkably high noses? I would suggest that they may have been "Armenoids," not southerners, who conquered the original southerners (Semites), to be themselves in turn conquered by the Semites who had imbibed Sumerian civilisation. There are facts which point to the existence of a pre-Sumerian Semitic population in Babylonia. On this view the Semitic speech will belong to the southerners, the true Arabians, and, if so, the very ancient Semitic elements in the Egyptian language and culture will belong to the predynastic people, not to the northerners. But this conclusion conflicts with the fact that the most Semitic cults of Egypt, as, for instance, that of Ra, the sun-god of Heliopolis, belong to the north; the southern cults are the least Semitic, and the predynastic culture of the chalcolithic age is by no means "Semitic" in appearance.

This is a problem raised by Dr. Elliot Smith's book, and it is one of great interest and importance. Less important seems his view that the impulse to megalithic building in northern Africa and western Europe was given by the influence of the great stone buildings of early Egypt. Here it is difficult to follow him, and he seems to exaggerate the extent of the early influence of Egypt on the development of the surrounding civilisations. One is by no means inclined yet to attribute the whole development of early European culture to Egypt; there are many conflicting facts which have to be taken into consideration. It is by no means certain that Dr. Reisner's view that the early Egyptians were the inventors of copper-working is correct. Dr. Smith thinks the fact proved; others may doubt it. We should like to hear the views of Prof. Petrie, Dr. Gowland, and Prof. J. L. Myres on the point. Dr. Smith is dogmatic, of course; how is it possible to be otherwise in a little book of less than two hundred small pages? Were one to give all one's arguments *pro* and *con* in respect to so nebulous a subject as this, one would write volumes. And in a review it is impossible to argue at all on the doubtful points. One can only say that these, while important, are by no means many, for Dr. Smith has told us much that seems incontrovertible, and his book is one of the most important recent contributions to Egyptian archæology. Again, one can only regret its title, which does not explain the book properly.

H. R. HALL.

NATURE-BOOKS.

Round the Year with Nature. By W. J. Claxton. Pp. xvi+302. (London: G. Routledge and Sons, Ltd.; New York: E. P. Dutton and Co., n.d.) Price 7*s.* 6*d.* net.

TO write a satisfactory introduction to natural history for children seems to be a difficult task. After examining some hundreds of attempts and testing them practically, I find that the most successful results are obtained by the following type. This has three characteristics: (1) the number of species described is practically complete for the British Isles—if the more significant foreign species can be included, so much the better; (2) there are pictures of every species described; (3) the descriptions, both pictorial and verbal, are of the diagrammatic order; in other words, rigidly scientific. The more nearly the pictures approach the geometric style, and the language the Euclidean—simplified—the better is the result, both for the child's intelligence and actually for his interest. He wants neither baby-language nor mawkish sentiment, nor teleological moralising; he wants solid fact and plenty of it. Those fine photographs from wild life are rather wasted on him unless they approach diagrammatic completeness. The pictures he gets most out of are those which resemble the best kind of toy, namely, the lay-figure type, which can be taken to pieces. His imagination does the rest. He has also an unvoiced demand for some admixture of the comparative method and of evolutionary theory.

This is no attempt at paradox, but a tested conclusion. The teacher is apt to make two mistakes; he either tries to "get down to the child's level," or assumes that the child has no interest, and that this must be created. As for the first, the child has no difficulty in understanding biological fact or biological theory; his only handicap is unfamiliarity with the abstract words and abstract ideas used so largely by his elders. It is this alone which constitutes the difference of level, and it is the teacher's fault if he cannot make his demonstrations concrete. As for the second, the child's interest needs to be attracted; it exists of itself, and develops by assimilation of material, not of other people's exhortations.

Mr. Claxton's book has the merit of giving the child a mixed diet; facts and pictures, zoological, botanical, and miscellaneous, are judiciously combined. Some children never get beyond "fur and feathers," because other roads have not been pointed out. The country-walk method was also Mr. Barlow's, and it is a good one.

But the author wastes much effort and space. The bulk of the volume consists of poetry—an infallible method of damping the child's interest and of imparting error—of antiquated moralisings, and of attempts to stimulate interest—attempts which are nothing but the notes of exclamation which the child himself may supply. There is far too much admiration of the wonderful wisdom and provision of "Dame Nature." Of the sparrow-hawk Mr. Claxton says:—"I do not think anyone who loves birds can admire this fierce-looking creature, and when I have seen one in a keeper's bag, I have not had much sympathy for her." Yet he waxes enthusiastic over wasp-extermination, otter-hunting, coursing, and pheasant-shooting, and never fails to mention a "luscious" morsel, or something that will make "your mouth water." The nightingale does not haunt the tree-tops, nor was Daphne "one of the most famous of Greek goddesses." He explains that the crocus-corm is not a bulb, but speaks of the gladiolus bulb. To describe the kestrel as "of a greyish colour with a blue tint," and the nightjar's note as "a jarring sound," is scarcely satisfactory. "There are many kinds of elm in England, but possibly the common elm and the wych or Scotch elm are the best known" is somewhat mysterious.

The majority of the bird and mammal pictures are from stuffed specimens. Many of these, as the robin, rook, and swallow, are unfortunate. Many of the plant pictures suffer from indistinctness. The method of Bewick and Sowerby is preferable to this.

A. E. CRAWLEY.

FOOD AND DIETETICS.

Food and the Principles of Dietetics. By Dr. Robert Hutchison. Pp. xx+615. With plates and diagrams. Third edition, revised and enlarged. (London: Edward Arnold, 1911.) Price 16*s.* net.

"THACKERAY is said to have remarked that he got some of his best thoughts 'when driving home from dining out with his skin full of wine.' We need not doubt it, for the statement embodies a physiological truth. It *was* his skin which was full of wine, for alcohol dilates the surface blood-vessels. . . ." Impressed in such a manner, this minor measure of physiological truth is seen on its way towards penetration of the reader's interest and retention in his memory. If any advocate of temperance doubts the sense of judgment which appears to admit the major portion of Thackeray's statement as equally a physiological truth, he will probably change his mind on reading the excellently balanced articles in this volume dealing with this and similar controversial subjects. He will in any case admit the value of the admirable style in which the author's opinions are clearly conveyed, leaving not one of the many "pros" and "cons" swathed in any mist of verbal confusion.

Nor is this quotation quite a fair sample of the many skilful efforts by which Dr. Hutchison has secured attention. The effort is more frequently less obvious and the measure of truth even greater. One might instance cases where his trap is baited with appeals to the special taste more intimately associated with his subject. Thus a tabulated comparison of the chemical constituents of different cheeses and a careful consideration of their economical value follows quite naturally the interest awakened by this palatable prophecy:—

"We may look forward then, perhaps, to tasting cheeses hitherto unknown, and to combinations of flavour as yet unsuspected. We may combine the virtues of Stilton with Gorgonzola, or those of Gruyère with Roquefort, for the artist of the pâlate will have in his hands the precise instruments of science."

If this book was deprived of these special qualities,

in which it is so rich, we should still possess in it a collection of scientific information well arranged in rightful sequence, and as a whole of very direct importance to mankind—of so much importance, indeed, that in some degree it should be at the command of the caterer and the cook, as well as of the physician. The present edition has been specially improved in those parts of more immediate importance to the medical practitioner, and this is natural because of the occupation of the author, but is also probably a consequence of the special market which the book has found. It will, however, be well when such a book reaches the wider market for which it is intended, as will no doubt happen when present efforts to provide an adequate training in "domestic science" have gained a deeper and wider success. When that time arrives "hygiene" will have permanently lifted its head above drain-pipes and fevers, and passed even the limits of interest in rickets and in defective vision.

Developing schemes of public health lead us to anticipate a time when the committal to memory of the symptoms of incipient disease will no longer form part of the responsibility of the general public. So much at least we might infer from the manner in which the medical supervision of schools and workshops, and even of homes, is passing into the hands of inspectors and nurses under the control of medical officers of health. Responsibility for the possession of some of the knowledge contained in this book will, however, never pass away from the individual householder, certainly never until the "State" is actually the householder and the "State doctor" the mother of every family in the kingdom.

In certain unimportant particulars patient scrutiny reveals the fact that faults might occasionally be found in this book, but *cui bono?* The book is sound and comprehensive, the author extremely able and entertaining, the present edition an improvement on its forerunners, and the subject of vital interest to the community. Space should be found for it in the library of every educated family as necessarily as in that of every practitioner of medicine. To the latter it is now no longer needful to plead for its welcome.

J. S. MACDONALD.

THE CONSTANTS OF NATURE.

(1) *Tables of Physical and Chemical Constants, and Some Mathematical Functions.* By Dr. G. W. C. Kaye and Prof. T. H. Laby. Pp. vii+153. (London: Longmans, Green and Co., 1911.) Price 4*s.* 6*d.* net.

(2) *Smithsonian Miscellaneous Collections.* Vol. 58, No. 1, Smithsonian Physical Tables. Prepared by F. E. Fowle. Fifth revised edition. Pp. xxxiv+318. (Washington: Smithsonian Institution, 1910.)

THESE two volumes of newly compiled tables of physical and chemical constants cover very much the same ground, though differing greatly in many respects. The larger volume of 318 pages is a revised edition of the famous Smithsonian tables, bearing on the title-page the name of Mr. F. E. Fowle, of the Astrophysical Observatory, as its compiler. It is issued as an official publication of the Smithsonian Institution. The smaller tables of Dr. Kaye and Prof. Laby are the first issue of an entirely new work by private individuals.

In the prefaces to the larger book, by Dr. Wolcott and Mr. Fowle, it is stated that the earlier tables of Prof. Thomas Gray have been almost entirely rewritten for this fifth edition. Both books claim to be practical and thoroughly up to date; a comparison of them is therefore legitimate and instructive.

(1) Messrs. Kaye and Laby's book of 153 pages is pleasingly got up and very well printed, an enormous amount of material having been carefully dovetailed into a limited space. Heavy type and separation lines are freely used to bring the important features into prominence, thus assisting the eye in finding what is wanted. The work consists of nine sections, entitled —general physics, astronomy, heat, sound, light, electricity, magnetism, radio-activity and gaseous ionisation, chemistry and mathematical tables, together with a good index. One of the most important features, which distinguishes the book from previous compilations, is the fifteen-page section on the constants of radio-activity, a field of work which has grown enormously during the past ten years, and has hitherto been entirely neglected by compilers of tables. This section bears the marks of expert treatment. In the case of most of the important constants the names of the authorities are given throughout the book, with dates and references to original papers. The introductory paragraphs to the tables are many of them especially good, and great discrimination seems to have been shown in the selection of the best determinations for the tables instead of loading them up with matter which only deserves a place in a detailed historical *résumé*, and has long since for practical purposes been relegated to the scrap-heap. The values of the constants given are, so far as we have seen, thoroughly up to date. Thus in the tables of melting points of the elements only ten of the determinations for which the year is given date from earlier than 1900, while sixty-five fall within the present century.

We have submitted the book to a very close examination, and found in it extremely few mistakes. Among these may be mentioned a conspicuous one on p. 47, where, in the thermoelectric tables relating to 10 per cent. platinum-rhodium and platinum-iridium couples, the values of the E.M.F. shown should all be multiplied by 10. On p. 64 the calorific value of illuminating gas is given 1000 times too small, and in the section on electrochemical equivalents on p. 123 the figures for copper and hydrogen require correction to 0·0003295 and 0·00001045 respectively.

The compilation of a book of this kind must have involved immense labour, and every credit is due both to authors and publishers for the result accomplished. We have no hesitation in most cordially commending the work to physicists, chemists, and engineers as by far the best small book of its kind, and likely to prove exceedingly useful. In view of its very moderate price teachers of experimental science would, we think, be well advised in prescribing this volume of constants as a necessary text-book for those attending their courses.

(2) Turning now to the Smithsonian volume, and having in advance set up a high standard of expectation, we must confess to a feeling of some disappointment on a critical examination. Comparing the present edition with that of 1896, the work of revision does not seem to have been as drastic as might have been expected, and some of the changes appear to the writer to be doubtful improvements. For example, most of the conveniently arranged tables of conversion factors occupying the first twenty-seven pages have disappeared.[1] While not wishing to criticise unfairly so famous and eminently useful a work as these tables have been, we notice throughout a good deal of carelessness in detail, which might easily have been obviated by more critical proof reading. One of the most serious general blemishes is a pronounced tendency continually to misspell proper names, and an extraordinary lack of system seems to have crept in regarding the way of indicating joint authorship of a paper. In about half the instances noticed, the names of the two authors have been hyphened together with, at times, curious results. "Roberts-Austen" we know, but who is Mr. "Baly-Ramsay" or Mr. "Thorpe-Rogers"? With "Thomson-Houston" everyone is acquainted, but we confess to learning with considerable astonishment that specific heat determinations were made by Mr. "Barnes-Regnault." On the other hand, Ayrton and Perry, Heycock and Neville, Perot and Fabry remain "dissociated."

There is a considerable lack of critical faculty in the choice and mode of presentation of some of the data. From a comparison of the gravity tables in Kaye and Laby with this volume the meaning of this criticism will at once be evident.

In the chemical sections of the work the nomenclature is often lacking in system. Thus we find on p. 232 "Nitrogen *tet*roxide NO_2," and on p. 212 "nitric *per*oxide N_2O_4." The hydrocarbon C_6H_6 is spoken of as "benzene," "benzol," and "benzole," and is also probably intended in at least one instance when spelt "benzine." This last name is used, in this country at all events, for a quite different body, which is a mixture of saturated paraffins of low boiling point, variously called benzoline, petroleum-ether, and petrol.[2]

A chemist travelling with his impedimenta, say on the South-Eastern Railway, will be able to ascertain from the table on p. 85 that if he took with him a cubic foot of cæsium, he would have to pay excess luggage, that quantity being stated to weigh 117 lb. The only mention of radium or radio-activity or of the rarer gases of the atmosphere except argon is in the table of atomic weights, and ionisation is only treated in the chemist's and not the physicist's sense of the term.

The table of melting points of inorganic compounds is misleading in that from it one would imagine that many of these substances melted over a range denoted by the limits "max." and "min." rather than at a point, and the column headed "average" value on p. 211 becomes the "probable" value over the leaf.

In table 226 it is twice stated that "1 joule = 1 watt per sec.," and in the appendix some curiously unfamiliar units are mentioned. Few people will be able to define a "metret" or a "barad."

The value of the Wien constant to give a platinum melting point of approximately 1750° C. is not 14,000, but more nearly 14,500, and the table for reduction of platinum thermometer readings mentioned in the title on p. 235 seems to have dropped out.

After mentioning these defects it should, however, be stated that the book has many good points, the mathematical tables comprised in it being in particular a very useful selection.

A considerable list of minor misprints and inaccuracies, too long for insertion here, has been prepared, and is being forwarded to the author.

J. A. HARKER.

[1] In table 31 of the old edition, "Conversion of quantities of heat," many of the figures given were wrong by 10^6; thus, 1 B.T.U. = 252 grm.-calories—not 0·00025 as stated.

[2] Strictly speaking, these terms are not synonymous, but are applied to different fractions of the same product.

PRACTICAL AND THEORETICAL PHYSICS.

(1) *Notes on Practical Physics.* By Dr. A. H. Fison. Pp. viii+144. (London: Edward Arnold, 1911.) Price 3*s.* 6*d.*

(2) *College Physics.* By Prof. J. O. Reed and Prof. Karl E. Guthe. Pp. xxviii+622. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1911.) Price 12*s.* net.

(1) THIS little book treats of such an elementary course of practical physics as is usually prescribed for medical students in their preliminary scientific training. As its title suggests, no attempt is made to give an account of the theory of each experiment or even a complete description of how to conduct it, but there is enough to save a demonstrator much wearisome repetition, and allow him to devote himself more to a discussion of each experiment, and to removing the difficulties of individuals. There is no "spoon-feeding," but, on the contrary, attention is directed to the principles involved and to possible difficulties and errors in a way calculated to encourage thought on the part of the student. The book should prove decidedly useful, and, if properly used by teacher and class, should increase the educational value of such a course of practical physics.

For each experiment an important indication is given of its general character as regards accuracy, and the author insists on the importance of considering the degree of accuracy attainable and of seeking that, and paying attention to no more than that, in the various observations and measurements to be made.

Some improvement in details is desirable. The treatment of mirrors should be independent, and not derived from or made analogous to that of lenses. If necessary, space for this could be obtained with advantage by omitting such an experiment as the determination of the earth's horizontal component of force, which could only be treated very partially. There is an occasional pandering to students' weaknesses, as in permitting the use of a chosen length for a simple pendulum in order to save arithmetic, or as in taking 100 c.c. of water in a calorimeter and

removing the thermometer from the calorimeter during the introduction of a hot body, though the calorimeter is weighed to 0·1 gram. The use of a thermometer as a stirrer is scarcely to be commended, except it be from the manufacturer's point of view.

(2) This is a well-arranged and concise presentation of the facts of physical science and of the accepted principles underlying them. It deals first with mechanics, hydrostatics, molecular phenomena, and sound; then with heat, magnetism, current electricity, and electrostatics; it gives an account of radio-activity and the electron theory; and finally treats of light and radiation in general. In each of these branches there are few subjects or experimental methods to which some reference is not made, and it is surprising to find so much information in a book of the size. It would not be fair to describe it as a mere compilation of facts, as it gives accounts of current theories and usually the "reason why" for any statement. But these are necessarily so concise and brief that beginners, and many who could scarcely be termed beginners, though they might learn the facts, would scarcely appreciate the reasoning or form an adequate conception of the theories and the relation of facts to them. Anyone with considerable previous knowledge of the subject who is looking for an account of the present state of physical science will find it here given in a sound, clear way; and the book should be of value to honour students, if read as an introduction to those in which theories are more fully dealt with. The authors frequently point out the necessity for this, but the difficulties connected with theories or their incompleteness are not sufficiently presented. There is so much apparent plain-sailing that it is to be feared that too many will think that the book contains enough for them. However, the authors' warnings may, and lecturers should be able to, prevent students making this mistake.

The book is intended to be read along with the "Manual of Physical Measurements," by the same authors, to which students are referred for details regarding experiments.

Numerous references to original papers are given.

OUR BOOK SHELF.

Elements of Agriculture: a Text-book prepared under the Authority of the Royal Agricultural Society of England, by the late Dr. W. Fream. Eighth edition, Edited by Prof. J. R. Ainsworth-Davis. Pp. xiv+692. (London: John Murray, 1911.) Price 5*s.* net.

WHILE British agriculture is, by common consent, at least as highly developed as any system that can be found in any other country, it has by no means a copious modern literature. Among the comparatively small number of text-books on the subject one by Dr. Fream has for many years stood pre-eminent, and has, indeed, become a traditional part of our agricultural education. The book might have defects, and it was undeniably out of date in many places, but it had served for generations of students, and must therefore have merit. And further, as time went on, no competitors arose, so that it has remained in possession of the field.

To revise even a small agricultural text-book is not a task to be lightly undertaken. The professor of agriculture is very unreasonably expected to be an authority on botany, chemistry, geology, physiology, and "other sciences underlying the production of crops and live stock and the cultivation of the soil." But to so experienced an editor as Principal Ainsworth-Davis these difficulties are not serious, and the revision of the separate chapters appears, so far as one man can judge, to have been satisfactorily accomplished. It would have added to the interest of the book, and enabled the discriminating teacher to evaluate the different sections, if an indication could have been given showing who was the reviser in each case.

It is, however, a very difficult matter to piece new material into old and make the whole into a coherent story. Thus in the chapter on "Soil" p. 15 tells the old tale and p. 17 the new. "Clay," on p. 15, is used in the rather indefinite sense in which Schübler used it in 1838, which meaning it retained until Warington in 1900 introduced the newer and more definite conception from America. "Clay" on p. 17 is something altogether different; the word is here used in the modern sense of material the particles of which are below a certain arbitrary size; hence the numbers on p. 15 are wholly inconsistent with the use of the word on p. 17. A sandy loam, for instance, does not contain more than about 10 per cent. of what is now called clay, although on the old view it might contain 40 per cent. Probably no soil contains more than 45 per cent. of clay in the modern sense, and yet in the old days (and on p. 15) certain soils were said to contain 95 per cent. Difficulties of this kind, however, are almost inevitable with words that have changed their meaning, or, still worse, as in the present case, taken on an additional meaning.

A remarkable feature of the book is its cheapness. The book runs to 700 pages, is well illustrated, printed on good paper, and nicely bound, and yet only costs 5*s.* It is therefore within the reach of the agricultural student (who is not naturally a book buyer), and may reasonably look for a long lease of life. Principal Davis has certainly made it once more the best British text-book on agriculture. E. J. R.

Annual Report of Recent Advances in Pharmaceutical Chemistry and Therapeutics. Vol. xxiv., pp. 419. (Darmstadt and London: E. Merck, 1911.) Price 1*s.* 6*d.*

THIS work is a very complete summary of researches carried out during the year 1910 in therapeutics, and, to a less degree, in the chemistry of drugs. Full and interesting accounts of the cacodylates and of kephir from their introduction into therapeutics occupy a considerable part of the volume. From the references to arsacetin and atoxyl the latter appears to have certain advantages over the former, especially in cases of trypanosomiasis. Messerschmidt's benzidine test for blood is discussed in detail, and seems to have value as a negative rather than as a positive test. Light is thrown upon the mode of action of chrysarobin in skin diseases by Unna and Goldsetz's observation of its oxidation on the skin to oxychrysarobin and chrysaloxin. The introduction into the German pharmacopœia of the formaldehyde sulphuric acid test for chloroform is commended, although admittedly the nature of the impurities excluded by it are not known. In view of the fatal effects that are from time to time reported of the use of chloroform as an anæsthetic, it is essential that stringent tests to ensure its purity should be adopted. The report should prove especially valuable to medical practitioners and to pharmacists, as it contains in readily available form abstracts from journals, many not easily accessible, relating to the constitution and action more particularly of modern synthetic remedies.

HENRY G. GREENISH.

Tennyson and his Friends. Edited by Hallam Lord Tennyson. Pp. xiii+503. (London: Macmillan and Co., Ltd., 1911.) Price 10s. net.

THIS interesting collection of articles and reminiscences, nearly all by the personal friends of the late Lord Tennyson, and brought together by his son, will be a valuable addition to the Tennyson literature.

The book may be looked upon as a supplementary volume to the Memoirs, which appeared about four years after his death, for it gives a still further insight into the life, friendships, and opinions of the great poet.

A description is given of the early days in Lincolnshire and of the Somersby friends; also of his two brothers, Frederick and Charles, who were nearest him in age, and with whom he was most closely associated in school and college days.

Other articles give his intercourse with Lushington, Fitzgerald, Carlyle, Thackeray, Clough, and many others.

Tennyson's attitude towards science is shown in articles by Sir Norman Lockyer and Sir Oliver Lodge. The former points out "his unceasing interest in the causes of things, and in the working out of nature's laws," and compares him with Dante in this respect, more especially in the way he kept abreast of his time.

To the articles, some of which are reprints, are added several of the poems written by Tennyson to his Cambridge friends and to those of later years. The collecting into one volume of these many writings of interest cannot fail to give pleasure to all his admirers.

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.*]

Microscope Stands.

THE discussion on microscope stands will do little good if it is directed towards the production of a universal type of instrument. As a maker of microscopes, I come into close contact with many branches of work the requirements of which are totally different. To make but one form would be a fatal mistake. The metallurgist cannot use the instrument which is best suited for the bacteriologist, neither will the Rosenhain metallurgical microscope suit the biologist. The Dick petrological microscope is quite unsuitable for the entomologist, and the binocular instrument, which demands long tubes and a great range of focus for the use of the lowest powers, will not satisfy the chemist. For the use of botanists, zoologists, and bacteriologists there is a certain similarity of requirements, but even here it would be unwise to endeavour to make all microscopes on one model. The work of the student in the botanical laboratory is totally different from that of the research worker who is making photomicrographs with the highest power immersion lenses.

The development of the microscope in the future will probably be in the direction of producing specialised types for specific work. Thus discussion on microscopes in general rather than of definite types is difficult, and is liable to become discursive. It can also only be misleading to set up a false comparison between English and Continental types. No such types exist at the present time.

English microscopes are made which are almost facsimiles of instruments of Continental manufacture, and although Continental makers were slow to realise the advantages of the more perfect adjustments provided from the earliest days in English microscopes, they have commenced to do so. The so-called Continental mechanical stage was invented by John Mayall, and placed on the market by at least three British firms before it was applied to foreign microscopes, and therefore the terms English and Continental have no meaning as describing types of instruments. A few questions which apply to all microscopes may be discussed generally, but the more definite points must be considered in connection with the branch of work for which the instrument is required.

The comparison of rigid as against spring fittings for the adjustments applies to all classes of the instrument, and a full discussion of this point can, in my opinion, only lead to one conclusion. The microscope must, above all things, have adjustments which are rigid and free from spring or tremor. They must be absolutely firm, and yet must respond to the slightest movement without either backleash or sag. The adjustments consist of metal slides worked by a screw, either direct or by means of a lever or cam, or by a rack and pinion. For the fine adjustment the sliding portion must be kept up to its work by a spring to prevent backleash. The slides or fittings of a microscope must be the very finest that skill can create, and to secure this they must fit throughout their entire length or the greater portion, and not at a few small points; being scraped or ground, so that the whole of the surfaces bed together; thus only can a perfectly rigid slide free from swerve, backleash, and tremor be obtained. If this is done, the wear that takes place during many years' constant use will be quite inappreciable, as there is no load on such fittings. The provision of spring pieces to take up wear is not only unnecessary, but injurious, because once such spring pieces come into play, the fittings will henceforth depend on the friction at a few points instead of a large surface.

Such fittings are not stiff, and become loose because they bear at a few points only, and are held up by screws which are liable to shake loose. It may be argued that if the slides were fitted accurately and the spring pieces were inoperative, only being there for use in case of wear, an advantage would be gained. That is not done in practice, for if the screws holding the spring pieces of a slide so made are released, it will be found to be quite loose. Moreover, it requires a skilled workman to set up the slide of a slow motion fitted with such spring pieces to obtain a perfect motion free from backleash or sag, and it is much better that he should refit the original well-fitted slides. Spring fittings are mechanically wrong for this purpose. Who would think of having an adjustable spring fitting for a theodolite centre? The quality of the adjustments, more especially the fine adjustment, has scarcely been alluded to, but this is the most important adjustment of the instrument. I am of opinion that the original form of a micrometer screw and a lever has never been equalled by the more elaborate cams recently introduced. The smaller the number of parts that go to make the mechanism, the fewer the points of contact or bearings to give that slight sag at the reversal of the motion which makes it so difficult to obtain the best focus with high powers.

As to the form of a microscope, its stability does not depend upon whether the base is of the tripod or so-called horseshoe pattern. It is universally admitted that it should stand on three points, and the test of stability that should be applied is, at what angle will it upset, and what force is required to make it do so.

Some tripods are more unsteady than some of the horseshoe-pattern stands, and *vice versâ*. It is merely a question of the position of the three points on which the instrument stands compared with its centre of gravity and weight. As probably nine-tenths of the small compact microscopes sold are of horseshoe and pillar pattern, it may be concluded that an overwhelming opinion exists in favour of this type for ordinary botanical and medical work. This is probably because the substage is rendered more accessible, and the stability produced by a heavy base is preferred in a compact instrument to that obtained by a lighter stand with a greater spread to the feet, which also occupies a larger space. The large tripod base as supplied on some of the best research microscopes is probably the most perfect stand for stability, but the lateral legs are more or less in the way of the manipulation of substage apparatus. The design of the mechanical stage is an illustration of the necessity of specialised stands for different classes of work. If the mechanical stage is incorporated in the instrument its travel is greatly limited, as it fouls the condenser or the large illuminating

apparatus required for dark-ground illumination. No one who works with serial slides or large blood films can put up with the small amount of motion which suffices for examining a minute drop of fluid. The examination of large culture plates is also difficult if the mechanical stage is not removable. Mr. Barnard has pointed out that the adjustable object-glass holders cannot, and are not intended to, replace the centring adjustment of the substage condenser. Such a suggestion surely originated from one who had never tried to centre his light in this manner. The centring of the substage condenser is considered by many at the present time to be an unnecessary refinement, and for those who are content to use such a badly corrected appliance as the so-called Abbe condenser it may be so. It is to be hoped that the proper use of a well-corrected achromatic condenser will be more widely appreciated in the near future, and we shall hear less criticism of the so-called dilletanti to whose labours the perfection of the instrument is largely due.

Amongst the minor points that have been raised, I noted with interest the suggestion that the mirror should be fixed in the optic axis. No doubt the mirror is seldom, if ever, used out of the axis, but it should not be overlooked that to be able to swing it entirely to one side for changing the apparatus in the substage or for taking the illumination direct from the source of light is a great convenience. It is rather surprising to see such stress laid upon a large body-tube as preventing internal reflections. I know of no optical instrument in which a large tube is supplied for this purpose, for the very good reason that the reflections are much more efficiently stopped by a series of diaphragms in the tube. There is no virtue in a large body-tube when it has within it a small draw-tube extending almost its whole length. The object of the large tube is to enable low-power photographic lenses to be placed in it when wide-angled views of large objects are required, the draw-tube at one end and the nosepiece at the other being removed for the purpose.

As an English manufacturer I am not prepared to discuss the opinion that is said to exist in some quarters that Continental instruments are more suitable to scientific needs than those made in our own country. I would merely ask that if any hold this opinion they will patriotically assist the industry by letting the British maker have an exact specification of their requirements, and I believe they will find us at least as adaptable as any in meeting their wants.

CONRAD BECK.

68 Cornhill, London, E.C.

I HAVE read with much interest the letter from Mr. Barnard on the above subject, which appeared in NATURE of January 25. Being the writer of the third section of the article which appeared in NATURE of December 21, I should like to reply to several points raised by Mr. Barnard contradicting some of my statements.

In the first place, it must be mentioned that Mr. Barnard takes certain statements as inferring far more than they are meant to, or do, imply.—There is nothing in my statements to imply "that the present-day English microscope is a degenerate form of what was originally a complicated and massive piece of mechanism." I stated it was a *simplified* form of its predecessors—a virtue indeed, therefore an advantage over the old English type.

I still maintain that the Continental instrument, having evolved from an exceedingly simple design, is a more highly satisfactory instrument. It is obvious that Continental makers have copied many ideas from the English, but it is equally obvious that the English makers have copied the Continental in many respects. If we compare the current catalogues of the principal makers in all countries where microscopes are constructed, it would be exceedingly difficult to define nationality in regard to design. Perhaps the least said respecting the country of origin the less likely one is to offend possible feelings of patriotism. The subject before us, however, is the question as to whether the English or the Continental microscopes are the superior, and in the article referred to I have dealt with the instruments as they are generally produced at the present day.

As regards the base, it is generally admitted that the horseshoe form is more convenient for the average worker than is the tripod, mainly on account of his having to employ the instrument more frequently in the vertical position; therefore a well-designed horseshoe, or modified horseshoe, as is generally found in the leading Continental stands, serves the purpose equally as well as the tripod. Only when the instrument is placed in the horizontal position does the tripod prove superior as regards rigidity.

The microscope is very rarely used horizontally, excepting in photomicrography, a work which does not concern the average microscopist; consequently, the greater rigidity in the tripod base is of no practical advantage. In other words, it is similar to making a 40-foot ladder to reach a height of 20 feet. Even when the microscope is considered for photomicrography, there is no practical advantage in the tripod over the horseshoe. (In the term horseshoe, I wish it to be understood that the models which Mr. Barnard mentions as having no rigidity or firmness in any position are excluded from the argument.) If the tripod base is not screwed or clamped to the photomicrographic apparatus, or held in position by other means, it cannot possibly remain in proper alignment for any length of time. Having occasion to use both the horseshoe and the tripod base in photomicrography, I fail to find any difference in respect to rigidity when the stand is securely fixed in position. When vibration was purposely set up I failed to observe it less in evidence in the microscope with the tripod base.

In the case of the tripod, I have it securely fixed in position by three carefully fitted recesses in the base-plate of the photomicrographic apparatus, and when the microscope is removed for visual work it can be easily and quickly returned to position for a photographic record to be made. On the other hand, the horseshoe base is securely clamped down on the base-plate, and thereby the two pieces of metal form, as it were, a solid mass. Provision is also made for quickly and accurately replacing the horseshoe upon the photomicrographic apparatus.

If the instrument built upon a horseshoe base was constructed of light or springy material, I could understand Mr. Barnard's contention that "the instrument is under considerable strain and tension."

In regard to the substage and the question of centring condenser *versus* centring objectives, Mr. Barnard's remarks amount to an admission as to the imperfect construction of the instruments he has employed. Such remarks would cause a careless or otherwise incapable mechanician to heave a sigh of relief in the expectation of the inferior workmanship that would evidently be accepted. The statement refuted by Mr. Barnard is that greater accuracy is obtained, especially in photomicrography, by having centring screws controlling the objectives instead of the substage condenser.

I cannot look upon the substage condenser of a microscope as being "an independent optical system carried on a separate part of the instrument and extremely difficult to ensure accurate alignment," but rather that it forms part of the system. In the best Continental instruments the dove-tail groove carrying the substage is formed out of the solid metal which constitutes the limb; that is to say, the limb of the microscope supporting the body-tube, coarse and fine adjustments, is carried down below the stage, and also supports the stage and substage fittings, therefore, is made out of a solid piece of brass giving the utmost strength and rigidity. When it is possible for the mechanician to provide accurate alignment in the body-tube for the highest power objectives, surely, then, it is less difficult to provide substage mechanism to carry a condenser, "even of the finest construction, which does not focus within such narrow limits." Continental microscopes are provided with substage mechanism in accurate alignment, and maintain alignment equally as well as the mechanism carrying the body-tube. Considering that condensers do not focus within such narrow limits as objectives, it is a less difficult task to adapt a series of condensers to the optic axis. Consequently, the substage condenser and the eyepiece become two fixed points in the optic axis of the microscope. As the leading makers provide objectives so well centred that the differences are but slight, the adjustments in the objective sliders effect all that is necessary to obtain the most accurate centration,

and with a considerable saving of time and trouble. Once the position of the substage condenser is altered the whole system of illumination from the substage condenser to the source of light is displaced, which must again be adjusted, so that we have to effect centring at various points on the optical bench. This is entirely avoided by having the substage condenser supported in a fixed sleeve, and the centring screws attached to the objectives or the nose-piece.

As regards the draw-tube, the point is that the use of the mechanical draw-tube is advocated more in England than are the correction collars, but *vice versâ* on the Continent. When one is using an objective without correction collar, which is extremely sensitive to differences in thickness of cover glasses, it is not at all necessary to resort to a mechanical draw-tube if one's instrument is fitted with a carefully made simple draw-tube as is generally provided in the best Continental stands.

It may be mentioned, however, that still better results would be obtained by resorting to the use of a cover-glass gauge, an instrument which is very valuable and inexpensive, but rarely used by workers. In dealing with the standardisation of the microscope, the matter of cover glasses, which is a serious one, should also be considered with the view of providing microscopists with covers of much more uniform thickness.

Mr. Sutcliffe, in his letter which appeared in NATURE of January 18, asks if there is any evidence obtainable that the English instrument has lost its premier position. We have not far to seek the necessary information, and when the facts are known we cannot consider the English instruments "degenerate," as the present models are much superior to their predecessors. The best English microscopes are a credit to any well-organised manufactory. The Germans, however, have advanced further in the direction of providing more perfect instruments, which are produced in works better organised and with more highly scientific arrangements.

The instruments that combine in the highest degree simplicity, efficiency, and durability are the most valuable to the serious workers, and these features are strongest in the best Continental microscopes.

I do not believe any amount of discussion would bring us to a decision so satisfactorily as a close examination of instruments which have been in use for a number of years in the principal laboratories throughout the world. In fact, we need hardly look outside our own little island for the result, as there is plenty of material at home to deal with for a settlement of the dispute in a most practical manner.

J. W. OGILVY.

18 Bloomsbury Square, London, W.C., January 30.

The Mnemic Theory of Heredity.

IN a review of the third edition of Prof. Richard Semon's well-known book upon this subject, in NATURE of January 18 (p. 371), the reviewer writes as follows:—"The mnemic theory, which is based upon a belief in the inheritance of acquired characters, naturally does not appeal to those who deny the possibility of such inheritance." From the point of view of modern embryological research, both of these statements are open to challenge. The founder of this mnemic theory, or "memory as a general function of organised matter," has indeed written very little upon the subject, which he first broached in a public lecture in 1870. At the date named, when Prof. Ewald Hering, now of the University of Leipzig, gave his classic address, I imagine that the question of the inheritance or non-inheritance of acquired characters had hardly been raised. By a curious coincidence, it was in the same year that Prof. W. Waldeyer in his researches set up the doctrine of the somatic origin of germ-cells from the "germinal epithelium," and obviously this doctrine of the somatic or bodily origin of germ-cells is demanded by the view of an inheritance of acquired characters. The history of embryological research upon the germ-cells during the present century demonstrates clearly that in his researches in the lower vertebrates the writer first established—in 1900—an actual tangible continuity of germ-cells from generation to generation, and the absence of any genetic connection between Waldeyer's "germinal epithelium" and the germ-cells, that in many other cases these finds have been, and are still being, confirmed by the investigations of other observers, and that Prof. Waldeyer himself some years ago withdrew his former researches in favour of such a continuity of germ-cells as underlying the life-cycle. Indeed, he wrote:—"The consequences of this doctrine of the continuity of germ-cells are almost incalculable for every branch of biology"; so that now for animals a fundamental postulate of the doctrine of an inheritance of acquired characters has vanished.

But, as a fact, the inheritance of acquired characters is more a botanical doctrine than a zoological one. In plants this apparent inheritance of such characters is confined to *the asexual generations*, in which, if the term "individual" be used, it must apply to *all the products*, asexually produced, of one original plant—that is, in this sense they would all form a single individual. As an instance, in this way all the countless plants of the white chrysanthemum, Niveus, would form a single individual. The doctrine of an inheritance of acquired characters does not, and cannot, apply to *the sexual generations of animals*. Moreover, here it is refuted by the positive finds of embryology, which demonstrate, under an actual continuity of germ-cells from generation to generation, that nothing at all is handed on from parent to offspring. As this is the case, nothing acquired by the parent can be inherited. That is, there is in the sexual generations of animals no such thing as an inheritance of acquired characters.

I do not now remember when I first came to know of Prof. Hering's theory of heredity as based in the unconscious memories of germ-cells, but it must be a long time ago. As Samuel Butler remarks of Charles Darwin and the doctrine of natural selection, it must have become an "unconscious memory" to me, for in my researches into the history of the germ-cells I evolved it anew. As showing this, and as affording a simple statement of the main lines of the theory, I may quote the following,[1] written by me in 1904:—"From its nature it (the theory of heredity advocated by me) might be termed 'the Understudy-Theory of Heredity.' Given in a certain life-history the period of formation of the primary germ-cells. Of these let there be, for simplicity, but two, AB and BA. On one of these falls the lot of developing into an embryo: to which of the two this happens is not of consequence for the argument. In all its essential characters the remaining primary germ-cell (whose immediate destiny it is to become the founder of the 'sexual products' of the said embryo) is the exact counterpart of the developing one. So much so is this the case that, if both form embryos, these are identical twins. In the ancestry neither of the primary germ-cells, AB and BA, had ever been a higher animal; neither they nor their ancestors had ever formed part of the body of a higher animal. But their ancestry is continuous with a long line of germ-cells, and at regular intervals these were exactly like certain sister-cells, which did develop and form higher animal individuals. Although the cell AB does not itself give rise to an embryo, in the meantime it retains for itself, and also for all its immediate progeny, the properties of BA, those characters or potentialities which, were it or any of its progeny to develop, would make it or them identical twins with BA, the other cell which did develop. *This is the greatest wonder in embryology!* In the drama of heredity there are always understudies, which for a certain essential period are endowed with all the identical properties (potentialities) of that germ-cell from which the player arises. These understudies, the primary germ-cells, are never employed upon the stage as such—except in the instances of identical twins, triplets, &c.—but some of them in new guises and after new conjugations or unions are the immediate ancestors of those which become the acting characters in new scenes of the cyclical drama of Life."

The original German of Prof. Hering's lecture, like Austrian German in general, is difficult, and probably the original is little known in this country, although an excellent translation was published in Butler's "Unconscious

[1] Beard, J., "A Morphological Continuity of Germ-Cells as the Basis of Heredity and Variation," in *Review of Neurology and Psychiatry*, vol. ii., 1904, p. 141.

Memory" (1880, new edition 1910). To me, as an advocate of this theory of heredity, it comes as something new—and strange—that underlying it there should be the assumption of an inheritance of acquired characters. I would rather conclude that, like Francis Galton, this illustrious physiologist—with the "prevision" of which Pasteur so often spoke—foresaw that the individual was not at all "a chip of the old block," but that at the basis of all development there was a continuity of germ-cells. For on p. 17 of Ostwald's reprint of the original lecture Prof. Hering writes:—"From this point of view the whole individual development of a higher organised animal forms a continuous chain of memories of the development of that great series of beings whose final link this animal represents."

Like the late Samuel Butler, the writer rediscovered this theory of heredity, and except that author he was the first to advocate it, upon grounds of observation, in this country. As undoubtedly it is of all theories of heredity *the theory* which is capable of accounting for and explaining all the facts, I venture to ask the courtesy of the insertion of this brief account of it in your pages. In the light of this overwhelmingly important theory the "Mendelian discovery," for example, sinks into its proper place as a small but interesting episode in the history of heredity.

J. BEARD.

8 Barnton Terrace, Edinburgh, January 22.

I AM unable to agree with Dr. Beard that the mnemic theory of heredity does not involve acceptance of the doctrine of the inheritance of acquired characters. Certainly the theory as enunciated by Prof. Semon, which formed the subject-matter of my review, is based upon such acceptance, to justify which weighty evidence is brought forward. Can an organism, or a germ-cell, be said to remember events of which it has had no past experience, direct or indirect? If, as Dr. Beard holds, neither the primary germ-cells nor their ancestors have ever formed part of the body of a higher animal, can they be supposed to remember events in the ancestral history of the race, unless, of course, they have received information as to such events (engrams) from the bodies in which they are, or were, enclosed? The power of transmitting such engrams to the germ-cells is the fundamental conception of the doctrine of the inheritance of acquired characters, as it is also of the mnemic theory as expounded by Prof. Semon. If, however, Dr. Beard holds that the germ-plasm does not receive engrams from the body at all, but is merely a continuous stream of living matter which has the power of producing some particular type of body at intervals and under appropriate conditions, I fail to see where the idea of memory comes in, any more than in the case of the periodic waves produced by the tide.

I cannot see that the doctrine of the somatic or bodily origin of the germ-cells has any necessary connection with the doctrine of the inheritance of acquired characters. Even if we adopt the opposite doctrine, that the germ-cells form a continuous chain from generation to generation and are separated from the somatic cells at the very commencement of individual development, such a view does not seriously affect the question, for there is no valid reason for supposing that the germ-cells could be influenced by the somatic cells only through some protoplasmic connection.

Again, why should any distinction be drawn between plants and animals with regard to the problem under discussion? It would indeed be strange if the two great divisions of the organic world should differ in this respect. Of course, in the higher plants, the sexual generation (gametophyte) is very greatly reduced, but none the less a true sexual process intervenes between each asexual (sporophyte) generation and the production of the ripe seed. The case of the peach trees quoted in my review is in no way comparable to Dr. Beard's chrysanthemums, for the embryo plant within the seed is developed from a fertilised egg as truly as in the case of any animal. It is obvious, moreover, that in the case of the higher plants Dr. Beard's view as to the relations of the germ-cells cannot be maintained, for the whole sporophyte generation intervenes between each two successive sexual generations, and the latter develop each from a single non-sexual cell, the spore, produced by the sporophyte generation after it has attained maturity. Here, at any rate, there is no continuous chain of germ-cells distinguishable from somatic cells.

Dr. Beard's views on the subject of identical twins are new to me. I was under the impression that such twins were supposed to result from the complete division of a single fertilised ovum. This, at any rate, is the view adopted by Weismann.

ARTHUR DENDY.

The "Isothermal Layer."

I AM inclined to doubt whether Commander Hepworth's suggestion (NATURE, January 25) that the so-called "isothermal layer" is simply due to radiation from the material, solid or gaseous, which circulates round the sun with an orbital motion and gives rise to the zodiacal light, can be reconciled with the configuration of the surfaces of equal temperature in the upper air which show a progressive increase of temperature from low to high latitudes. It seems more probable that this increase, and the fact that above a certain height in these latitudes the temperature no longer diminishes with the altitude, are the result of the prevalent movement, outside the equatorial belt, of the higher portion of the atmosphere from west to east with comparatively great velocity, which increases with the latitude and altitude, and extends to lower levels as the distance from the equator becomes greater. This movement, which gives the upper atmosphere greater angular velocity than the lower and the earth beneath, partially counteracts the force of gravity and causes the air to rise and expand without doing work, and therefore without suffering a decrease in temperature. At the equator there appears to be no satisfactory evidence of an "isothermal layer."

But although the radiation from the orbital interplanetary matter of the zodiacal light may not afford an explanation of the "isothermal layer," it must be taken into account as a climatic factor. Maurer has shown that the earth receives at night radiated heat to the extent of 0·37 of a calorie per square centimetre per minute. This is attributed—no doubt in the main correctly—to radiation from the carbonic acid and water vapour of the atmosphere, but some portion must have an external source. It is possible that the radiation from interplanetary material may at present be almost as inconsiderable as that from the planets or the fixed stars; but if, as we have every reason to believe, there has been a gradual approximation of this diffused orbital matter towards, and absorption in, the sun, there must have been a time when so much was present beyond the earth's orbit that the radiation received from it balanced to a considerable extent the radiation from the earth into space, and rendered not only the daily and seasonal variations of temperature, but also the permanent differences of temperature between high and low latitudes, much less marked than they are at present.

I have for some time thought that it was in this direction we ought to look for the explanation of the comparative uniformity of temperature that appears to have prevailed in different latitudes in Palæozoic times, a uniformity that seems to have existed as much in periods of cold as of high temperature, and the absence of marked seasons even in the far north, evidenced by the fact that the remains of stems with exogenous growth show little or no trace of annual rings. In the long Arctic night, not only heat, but light, would have been continuously received from this source. How considerable, even at present, is the illumination given by the zodiacal light can only be realised by those who have travelled in moonless nights in the tropics. Even in forest country with a cloudy sky the darkness of midnight is changed about 2 a.m. to a twilight, which is quite sufficient to render the track visible until the true dawn appears.

Nordenskiöld has given reasons for believing that fine cosmic dust revolves round the earth itself as centre. If this be the case, its climatic influence in the past may have been similar, but it was probably of much less importance.

JOHN W. EVANS.

January 27.

Are Eyes ever Autophanous?

I VENTURE to suggest the following simple explanation of the phenomenon described by Colonel Herschel in NATURE of January 18. At the distance at which his experiments were made the light from the lantern or other source enters the lens practically as a pencil of parallel rays, which is concentrated as a bright spot on the retina. The divergent light from this bright spot, which passes backwards through the lens, is again made into an almost parallel pencil. If the retina is exactly in the focal plane of the source of light, and the image an absolutely sharp one, the whole of the light is again concentrated on to the bull's-eye of the lantern, and without the use of a transparent, but partially reflecting, surface, it must be impossible to see it. But the least blurring of the image, from whatever cause, leads to a slightly divergent pencil, which, however, is still narrow enough to concentrate the returning light within a degree or so from the direction of the original source. To an observer within this cone of rays the bright spot on the retina will appear to fill a part or the whole of the pupil, just as a black dot may be made to fill the whole aperture of a lens to an observer at a distance by holding the lens at its focal distance from the point in question.

A cat's eyes when in shadow may often be seen by a watcher, himself in the light, to be filled with a faint luminescence, which disappears when the watcher's own eyes are shaded. The source in this case must be the bright surface of the face of the observer, possibly combined with the reflected point or points of light on the *external* surface of the observer's eyeball. The phenomenon is rather a curious one, and may account for a certain number of the cases in which an animal's eyes are supposed to be autophanous.

E. M. ANDERSON.

Edinburgh, January 27.

Chalk and Ice.

Two nights of hard black frost, following upon the recent wet weather, has resulted in pieces of chalk resting upon a wet clay soil becoming curiously coated with ice. This occurs only in the case of chalk, other stones—except fragments of brick, which have a thin veneer of ice on them—and lumps of clay being free from it.

A piece of chalk 2 in. × 2 in. × 1 in. embedded in the soil is covered with ice as in Fig. 1. The ice is fibrous. Small pieces of chalk give forms as in Fig. 2. The central figure evidently illustrates two nights' growth, the upper

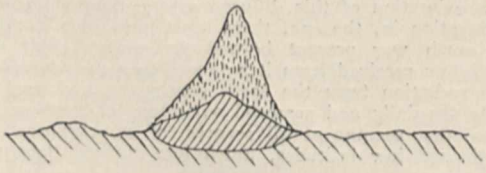

Fig. 1.

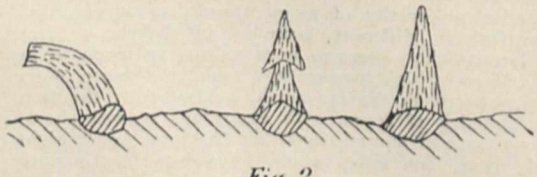

Fig. 2.

cone having been thrust off the chalk by the growth of the one below.

The moisture has evidently frozen on the chalk, fresh moisture rising from the ground and passing through the chalk, thus keeping up the supply. The chalk itself is not frozen, and can be broken easily by hand, but the pillar of fibrous ice is firmly frozen to it.

We also noticed tooth-like pieces of ice projecting from the lawn, and in every case these were found to rest on pieces of chalk beneath the surface. An examination of the flower beds revealed bosses of ice coming up through the soil, the ice in all cases resting on lumps of chalk beneath the surface. The rising water in the chalk tends to prevent the latter freezing, the cold spending itself in producing the ice resting upon the chalk.

It is conceivable that a stratum of stones and clay, resting upon chalk, might in a severe climate become separated from the chalk by an ice layer. The formation of ice below the surface in this way may account for the "soil creep" which has occurred in the past, and the effects of which are now so noticeable in chalk districts.

R. M. DEELEY.
D. DEELEY.

Inglewood, Longcroft Avenue, Harpenden.

Glazed Frost.

THE deposit of "glazed frost" sometimes attains remarkable thickness in Newfoundland, and the great weight of ice formed causes considerable flexure of even thick branches of trees.

I have seen every twig and every blade of grass duplicated on the windward side in clear ice, the ice "twig" often having a diameter two, three, or even more times that of the twig on which it was formed.

Thick slabs of ice appear on the windward sides of tree trunks, palings, and even of walls. In Newfoundland the rain is often followed by bright sunshine, when the effect is most beautiful, and is aptly described in the local name "silver thaw." The explanation of the phenomenon, quoted from "The Observers' Handbook" in Mr. Harding's letter to NATURE of January 25, would seem to be justified by the *thickness* of the deposit formed on twigs and on blades of grass; it would be difficult to account for a *thick* deposit of ice if the raindrops were not supercooled before touching the trees or ground.

E. R. MARLE.

Hartley University College, Southampton,
January 29.

The Thawing of Frozen Water Pipes.

As the present frost is causing serious inconvenience in many houses, I should like to direct attention to a method of thawing ice in pipes which I have frequently put into practice and found effective. It is based on the principle that strong brine eats its way into the ice like an acid, and that the resulting diluted brine rises and makes room for the denser fluid. Close the main tap, and with a spanner unscrew the top of the valve of the frozen water-pipe and remove the small valve. Ball taps to cisterns may have to be unscrewed altogether. Insert a few feet of one-eighth inch rubber or lead tubing into the pipe, and pour concentrated brine into it through a small funnel. Replace the valve and cover, but leave the valve open; also open the main valve, and wait. If the ice plug in the pipe is only 1 or 2 feet long it will have been eaten through in about an hour's time; if longer, the above operation should be repeated several times. The brine is prepared by boiling an excess of salt in water, say half a pound per pint; it should, if possible, be used hot, and renewed frequently.

West Didsbury, February 5. C. E. STROMEYER.

The Names of Fossil Plants.

EVERY botanist must agree with Dr. Marie Stopes that there should be some ready way to distinguish between the fossil plants which are referred with reasonable assurance to their genera, and those which are merely placed in genera which they seem to resemble, but to which they very probably do not belong. We must also agree that it is unsatisfactory to call every doubtful leaf "Phyllites," without any serious attempt to indicate its affinities. The use of Gothic type, suggested by Dr. Stopes for the doubtful genera, has some disadvantages, one of them being the inconvenience to the printer. Would it not be simpler to use quotation marks, in the case cited by Dr. Stopes writing "*Ophioglossum*" *granulatum*? The generic name only should be enclosed within commas, as it alone is supposed to be in doubt. The method proposed has the advantage of being already more or less current, and readily understood by any reader.

T. D. A. COCKERELL.

University of Colorado, Boulder.

THE PEOPLE OF SOUTH CENTRAL CONGOLAND.[1]

MR. HILTON-SIMPSON'S interesting book is a valuable supplement to the monumental work recently published by the Colonial Department of the Belgian Government on the "Ethnography of the Bushongo and Allied Peoples," a work written in French by Mr. Emil Torday, the celebrated Hungarian explorer, and Mr. T. Athol Joyce, of the British Museum. The Torday-Joyce contribution to ethnology adopted necessarily a somewhat impersonal aspect, and the work of Mr. Hilton-Simpson now gives us a more popular and personal account of the expedition so ably organised by Mr. Emil Torday. At the same time, though the "Land and Peoples of the Kasai" may be described as "popular" in style, it is fraught with scientific interest. It contains many valuable illustrations, "prises sur le vif," the untouched photographs of the author, besides the beautiful and accurate drawings in colour by Mr. Norman Hardy, who accompanied the expedition during the first half of its stay in Congoland. Amongst these last must be mentioned with special praise for their artistic charm as well as their absolute accuracy, "Wissmann Pool" and "An Incident at Pana" (a charging buffalo).

The party of which Mr. Hilton-Simpson was a member arrived at Boma, the capital of the Independent State of the Congo, at the close of 1907. Here they had to visit the offices of the Etat Civil, where they filled up "matriculation" forms dealing with their ages, their occupations, and the dates of their parents' birth, and other "such matters of great interest to the authorities," who in the Congo State still too often belong to that narrow-minded bureaucratic class which is rapidly becoming extinct in Germany, Holland, and France. Nevertheless, the Belgians gave the kindest and most whole-hearted assistance to Mr. Torday's expedition. Their mission was officially recognised by the Government; they were spared all hindrances and given all due protection. And when it is remembered that their avowed object was to collect for the British Museum, and they came at a time when English public opinion, with much justification, was showing great indignation with the Leopoldian *régime*, it must be admitted that the Belgian authorities on the Congo knew how to rise above considerations of narrow nationalism and to remember that they were there to govern a State which at that period was still international in its avowed character.

From the Lower Congo the party was conveyed by railway and steamer to the Kasai. This river at once contrasted with the main Congo by "simply teeming with hippopotami, crocodiles, and innumerable varieties of aquatic and other birds"; for owing to some unexplained reason the destruction of animal life along its banks had been very little compared with the devastation which has fallen on the main Congo through the acquisition of guns by the natives and the thirst for killing which has so long animated all white pioneers, settlers, and steamer passengers in that region. An interesting description is given of the headquarters of the Kasai Company at Dima, near the confluence between the Kasai and the Kwango (the Kwango was the first of the great Congo tributaries which entered into history, and was reached by the Portuguese as early as the seventeenth century, though its lower course remained unexplored and mysterious down to the close of the nineteenth century). It is interesting to note that at Dima, as elsewhere in the Congo, Belgian enterprises are obliged to have recourse to the employment of educated British negroes from West Africa—Sierra Leone, the Gold Coast, and Lagos. Here is a sufficient answer to the ignorant folk who sneer at the education of the negro. As a matter of fact, public education in the British West African colonies is far too much neglected by the British Government, especially in the Gold Coast. If it were improved, there is no saying how far it might not extend British influence and the spread of the English language throughout West and Central Africa.

FIG. 1.—Head of *Bos caffer simpsoni*. From "Land and Peoples of the Kasai."

The party continued its journey up the Kasai, noting on the way an extraordinary epidemic of

[1] "Land and Peoples of the Kasai." Being a narrative of a two years' journey among the cannibals of the equatorial forest and other savage tribes of the south-western Congo. By M. W. Hilton-Simpson. Pp. xx+356. (London: Constable and Co., Ltd., 1911.) 16s. net.

disease which had broken out amongst the hippopotami on the Kasai and Sankuru. The loss of life amongst the hippopotami had been so great that the Europeans had been obliged to employ men with canoes to push out into the current the carcases which were continually being stranded on the shores of the river, the stench from which was appalling. Then follows a description of the Sankuru and the marvellous forests on its banks, its red, rocky cliffs rising in places to a height of 200 feet, in the crannies of which nested innumerable grey parrots. The mysterious yuka referred to by the author as a tree-dwelling nocturnal beast uttering a weird cry was probably a tree-hyrax.

The Basonge, the Batetela (and their love of painting pictures and use of signalling gongs), the Bakongo of Central Africa (not to be confused with the quite distinct Bakongo of western Congoland), the cannibal Bankutu, the Batwa dwarfs, the Batende, Babunda, Baluba, Basongomeno, and, above all, the aristocratic Bushongo, are most interestingly described. The Batwa dwarfs seem to have varied from four feet eight to five feet in height (a photograph is given of them). The journey through the Bankutu cannibals was not devoid of risk; the travellers owed their safety probably to the curiosity excited by their presence without an escort, yet well supplied with means. On p. 147 an accurate and very effective description is given of the "airlessness," disheartening mist, and excessive damp, of the dense forest. "In the daytime the atmosphere of the woods resembles that of a hothouse; at night that of a well."

FIG. 2.—An Akela cutting up his food. From "Land and Peoples of the Kasai."

The zoological discoveries of the expedition due to the author of this book, consisted mainly of a new species of very small duyker antelope (*Cephalophus simpsoni*), and an interesting transitional type of buffalo, a subspecies also named after Mr. Simpson, which differs from the dwarf buffalo of the Congo in being black-haired (chocolate in the females) and not reddish-brown, and in having horns set much wider apart than those of *Bos caffer nanus*. The bosses of the horns in the male are almost completely joined over the forehead.

Mr. Hilton-Simpson's photographs of the negroes of South-Central Congoland will be of much interest to anthropologists and ethnologists. Although mostly small, it is evident that many of them would bear enlargement and prove very useful to the picture galleries of museums. H. H. JOHNSTON.

THE EFFECT OF GRASS ON FRUIT TREES.[1]

AMONG the many interesting results obtained at the Woburn Experimental Fruit Farm perhaps the most remarkable is the discovery that growing grass exerts a deleterious effect on fruit trees. This was one of the earliest observations, and was dealt with at some length in the third report in 1903, but a number of experiments have since been made, and are described in the thirteenth report recently issued.

The general result of grassing the ground after the trees have been planted is the arrestation of all healthy growth and the absolute stunting of the tree. The leaves become light in colour and unhealthy, the bark similarly becomes light coloured, while the fruit loses its green matter and becomes waxy yellow or brilliant red. This effect is particularly marked in the case of apple trees. If the grassing is done gradually the trees accommodate themselves somewhat to the altering conditions, and finally make growth and yield fruit, though they never do so well as when grass is absent.

A number of hypotheses have been examined to account for these phenomena. The grass roots affect the aëration of the soil, the amount of carbonic acid present, the soil temperature, moisture, food supply, &c., and they may, as the United States Bureau of Soils claims, excrete poisonous substances. The earlier investigations showed that neither the aëration nor temperature effects played any part in the matter, so far at least as tree growth is concerned; the present experiments are therefore directed to the investigation of the other factors. Several results proved that the harmful effects on the trees were not due to any abstraction of moisture by the grass. The affected trees exhibited none of the signs of suffering from drought or of recovery during wet seasons, while determinations of the water content of the grass and tilled soil at intervals throughout a year revealed no differences sufficient to account for the effects. Still more conclusive evidence was obtained by growing trees in pots, some with, others without, grass, and keeping all equally moist; the deleterious effect of the grass remained equally marked.

It is more difficult to test the effect of grass on the food supply of the tree, because our knowledge of what constitutes the food either of fruit trees or of grass is still far from complete. Pot experiments with the ordinary nutrient substances all led to negative results, and the conclusion is drawn that the effect on the food supply is not the determining factor.

Nor did it appear that the growth of grass caused any sufficient physical alteration in the soil to account for the results. There remains only the hypothesis that plant roots excrete some substance toxic to the tree roots, and for this the authors claim to have a fair amount of indirect and some direct evidence. When perforated trays of sand containing growing grass were placed on the surface of the soil in which the trees were growing, so that the washings from the grass reached the tree roots with practically no exposure to the air, they had a deleterious effect nearly, if not quite, as great as when grass was

[1] Thirteenth Report of the Woburn Experimental Fruit Farm. By the Duke of Bedford, K.G., F.R.S., and Spencer U. Pickering, F.R.S.

grown above the roots of the tree in the ordinary way. The conditions of the experiment seem to have precluded any sufficient contact of the grass roots with the tree soil to allow of the abstraction of plant food, and, if the result is confirmed, it is difficult to avoid the conclusion that the grass roots have actually excreted a toxin.

As already stated, the United States Bureau of Soils has long upheld the view that plants can excrete toxic substances, but it has been generally supposed, in this country at any rate, that the experiments of Daubeny and others put the hypothesis out of court. But Mr. Pickering has discovered an important property which the toxin (if it exists) must possess; it is extremely transient, and disappears very rapidly from the soil. No toxic effect can be detected in soil removed from round grass roots, while even the washings from the trays above mentioned failed to have any bad effect if they were exposed for a short time to air.

A very interesting problem has been thus opened up, the development of which will be watched with interest. E. J. R.

THE BIRDS OF HOMER.

THE advantages of the application of scientific knowledge to the literary problems of the Homeric poems are well illustrated by an article contributed to the second part of the "Journal of Hellenic Studies" for 1911, by Mr. J. Maclair Boraston on "The Birds of Homer." He remarks that "whether in the form of epithet or by special description, Homer's portrayal of birds deals chiefly with essentials. In this lie the advantage and disadvantage of the Homeric method for one whose main purpose is concerned with what in Homer was merely contributory to a fuller one. The advantage of such a method is that it forces essentials to the front, and the disadvantage, that the references to these may be limited by the nature of the matter they serve to illustrate; or that, being references to the characteristics of a class of birds, they may not suffice for the illustration of a particular member of that class."

Dealing first with what Homer calls "carnivorous birds," we find three mentioned, the first represented by the bearded vulture (*Gypaëtus barbatus*), the second and third including the cinereous vulture (*Gyps monachus*), the griffon vulture (*G. fulvus*), and the Egyptian vulture (*Neophron percnopterus*). The poet describes three eagles—"the high-flyer" and the "ruddy," both apparently Bonelli's eagle (*Hieraëtus fasciatus*) in mature and immature plumage, while the "morphnos" or "perknos" eagle, the "black" or "dark," and the "snatcher" are all names for the golden eagle (*Aquila chrysaëtus*). The general terms for the hawk or falcon include several birds—the goshawk (*Astur palumbarius*), the sparrow-hawk (*Accipiter nisus*), the peregrine falcon (*Falco peregrinus*), the lanner (*F. lanarius*), the saker (*F. sacer*), the merlin (*F. aesalon*), and the hobby (*F. subbuteo*). Two varieties of owl are identified with the scops (*Scops giu*) and the long-eared owl (*Asio otus*). Under gulls Homer refers to no fewer than eight varieties, all found at the present day in the Mediterranean. The "diving seabird" includes various kinds of terns, chiefly the common tern (*Sterna fluviatilis*). Under the head of cranes we find the common crane (*Grus communis*), and the demoiselle (*G. virgo*). Swans include the mute swan (*Cygnus olor*) and the whooper (*C. musicus*). Of geese we have the grey lag (*Anser cinereus*), the bean goose (*A. segetum*), and others. Among miscellaneous birds we notice the grey heron (*Ardea cinerea*); the jackdaw (*Corvus monedula*); the starling (*Sturnus unicolor* and *S. vulgaris*); the rock dove (*Columba livia*); three thrushes—the fieldfare (*Turdus pilaris*), the missel thrush (*T. viscivorus*), and the redwing (*T. iliacus*); the common nightingale (*Daulias luscinia*); the great titmouse (*Parus major*); and the ring-dove (*Columba palumbus*).

Mr. Boraston's article records a number of interesting details illustrative of bird-life in the Mediterranean, which will be welcome not only to ornithologists but to classical students, and a survey of the facts which he has collected tends only to increase our admiration for the genius and powers of accurate observation possessed by the greatest of the epic writers.

SIR JOHN DALRYMPLE-HAY, BART., G.C.B., F.R.S.

ADMIRAL THE RIGHT HON. SIR JOHN DALRYMPLE-HAY, Bart., G.C.B., F.R.S., was born in Edinburgh on February 11, 1821, and died in London on January 28. His naval career was commenced in August, 1834, and he was placed on the retired list in 1870, under Mr. Childers's scheme, having attained flag rank as Rear-Admiral about four years earlier, and having occupied various offices on shore after ceasing to command the line-of-battle ship *Indus* in 1859. His active service afloat, therefore, ceased in the year when our first seagoing ironclads were ordered. During the thirty-six years comprised in that service he had witnessed the change from sails to steam propulsion, serving nearly all the time in wood-built sailing ships, and having commanded, as captain, the *Indus*, which was the last sailing line-of-battle ship in seagoing commission. Sir John Hay was present at the capture of Acre by Sir Rupert Stopford, and later (1849) greatly distinguished himself by the destruction of a pirate flotilla in China. The latter service secured for him promotion to the rank of captain; and in 1855–6 he commanded the *Hannibal*, the flagship of Sir Houston Stewart, second in command of the Black Sea Fleet during the Crimean War.

When Kinburn was bombarded by the French ironclad floating batteries, Sir John Hay was present, and then obtained personal knowledge of the value of armour as a protection against the attacks of the most powerful naval guns and shell-fire available at that date. It was natural, therefore, that he should have been appointed chairman of the Iron-plate Committee which was established in 1860 to carry out experiments on armour, and to investigate the innumerable proposals and inventions submitted for adoption in the Royal Navy. In a period of rapid change and transition in naval *matériel* it was a wise step to appoint that committee, and to associate in its membership both distinguished officers and eminent engineers and men of science—including Sir William Fairbairn, Dr. Percy, and Dr. Pole—whose authority on questions of metallurgy and engineering was generally recognised, while their advice and assistance in the conduct of experiments and the analysis of results were of great value.

In his conduct of the affairs of this committee, Sir John Hay displayed great tact and marked ability, often in circumstances of considerable difficulty, inventors being both sensitive and ready to take offence when their proposals were criticised or rejected. Recognition of the value of his work came to Sir John Hay from technical and scientific societies; he was elected a vice-president of the Institution of Naval Architects in 1862, and a Fellow of the Royal Society in 1864. Throughout his long life Sir John Hay continued to take an active interest in both these societies, and in connection with the Naval Architects he played

a prominent part until failing health compelled him to retire. In the conduct of the business, as well as in the discussion of professional subjects, his ripe experience, sound judgment, and charming personal qualities had much to do with the successful development of the institution, the membership of which includes not merely naval architects and marine engineers, but naval officers, shipowners, yachtsmen, officers of the mercantile marine, and many other classes interested in or connected with shipping.

At the Royal United Service Institution also Sir John Hay did good service, and gave proof of his love for and acquaintance with many branches of science, as well as his desire to utilise all departments of knowledge for the improvement of the Royal Navy. In short, for a man born early in the nineteenth century, and employed at sea from a tender age until he had reached the prime of life, Sir John Hay was remarkable; and he may be fairly described as a pioneer in the class of scientific naval officers which has now become both numerous and influential.

Of his political career this is not the place to speak, but allusion may be made to his services as a Sea Lord of the Admiralty in 1866–8. Although the appointment of Sea Lords was then made largely on political as well as professional grounds, and his political future might have been seriously prejudiced by the independent action which he took in November, 1866, he refused to sign the Navy Estimates, and tendered his resignation because he considered the new programme of shipbuilding to be inadequate. This action showed the temper of the man, who, under a most pleasant and conciliatory manner, concealed great strength of character and readiness to act up to his convictions. His business capacity was considerable, he was a capable speaker, and an agreeable writer, as his books dealing with the naval service showed. He died full of years and honours, mourned by many friends; but some years of retirement, accompanied by blindness towards the end, had prevented him from being so much before the public as formerly. His work was done and well done, and many of its results will abide.

DR. A. H. KEANE.

WE regret to announce the death of Dr. A. H. Keane on February 3, after a long illness. He was born in Cork in 1835, was educated in Dublin and elsewhere, and completed his student career in Rome, finally taking his degree with honours in the Roman Catholic College in Dublin. Later he studied in Germany, and thereafter devoted himself to literary work, his first important book being a "History of the English Language" (1878). Shortly afterwards he taught English, German, French, and Hindustani at the Hartley Institute, Southampton, and subsequently a professorship of Hindustani was created for him at University College, London, which he resigned in 1885. After a short visit to the United States, he settled down in Hampstead, where he resided until his death.

Anthropology loses in Dr. Keane one of its most prolific and erudite students. His literary training and great command of languages predisposed him to collation and synthesis, as is proved by several excellent studies in the Journal of the Anthropological Institute; for example, "On the Relations of the Indo-Chinese and Inter-Oceanic Races and Languages" (1880), "The Botocudos" (1883), "The Ethnology of the Egyptian Sudán" (1884), "The Lapps" (1885), and others. He also contributed very numerous articles on ethnology to NATURE, *The Geographical Journal*, *The Academy*, *The Encyclopaedia Britannica* (ninth edition), *Chambers's Encyclopaedia* (1890–1), and *Cassell's Storehouse of General Information* (1890–94). Of more permanent value are his admirable monographs on Asia, Africa, Central America and West Indies, and South America in "Stanford's Compendium of Geography and Travel." Amongst other publications are "The Boer States, Land, and People" (1900), "The Gold of Ophir" (1901), and numerous translations, as, for example, "The Earth and its Inhabitants" (Elisée Reclus), "Peruvian Antiquities" (W. Reiss and A. Stübel), "The Science of Language" (Abel Hovelacque), "Philosophy, Historical and Critical" (A. Lefèvre), "Travels in Africa" (W. Junker), and "The Second Deluge" (J. Rodenberg).

But Dr. Keane's reputation will rest mainly on his "Ethnology" (1896), "Man Past and Present" (1899), and "The World's Peoples" (1908). The first deals with the physical and mental evolution of man, the antiquity of man, criteria of race, and the primary ethnical groups. The second is a masterly summary of the ethnology of all races and peoples, and is an indispensable book to all interested in such subjects. The third, as its subtitle explains, is a popular account of the bodily and mental characters, beliefs, traditions, and political and social institutions of the world's peoples; the numerous photographs add greatly to its value.

Dr. Keane was a typical library student, and being of retiring disposition, was rarely to be seen at scientific meetings. He had strong views and could express them with vigour, but he did not seek controversy. Although lack of opportunity prevented him from making any original investigations, the vast extent of his reading enabled him to marshal in an orderly manner the observations of other people, and often to throw a fresh light upon them.

A. C. HADDON.

NOTES.

WE regret to announce the death, on February 2, in his sixtieth year, of Dr. H. T. Bovey, F.R.S., formerly Rector of the Imperial College of Science and Technology.

M. BIGOURDAN has been elected president of the Paris Bureau des Longitudes for the present year. M. Baillaud becomes vice-president, and M. Andoyer secretary.

THE gold medal of the Royal Astronomical Society has been awarded by the council to Mr. A. R. Hinks, for his determination of the solar parallax from observations of Eros.

THE Canadian correspondent of *The Times* announces the death, at eighty-seven years of age, of Sir James Le Moine, who for many years was an industrious writer on historical and ornithological subjects, and in 1894 was elected president of the Royal Society of Canada.

REUTER'S AGENCY reports that two British officers, one belonging to the Survey of India, have been detached to locate the falls of the Brahmaputra, which are reputed to exist in the hitherto unexplored reach of the river which lies between Assam and the great bend of the river to the northward. Attempts have been made by native surveyors and others to locate these falls and to traverse this part of the river where its valley cuts across the great Himalayan chain, but so far without any success.

FURTHER evidence shows that, of the four reported earthquakes referred to in our last issue (p. 459), that felt in Glenfruin on January 26 was probably not of seismic origin. The shocks at Lennoxtown on January 20 and

Llanhilleth on January 26 were extremely local, and there can be little doubt that they were due in part to artificial causes. The Dunblane shock of January 28 was one of the series of earthquakes which have been so prevalent since 1905 on the south side of the Ochil Hills, possibly with its focus rather farther to the west than usual.

A CELEBRATION of the centenary of the Academy of Natural Sciences of Philadelphia is to be held on March 19–21. The publication of three volumes has been decided upon: a commemorative volume of scientific memoirs; an index to the series of Proceedings and Journal up to and including 1910, now amounting to nearly one hundred volumes; and a detailed history of the academy by Dr. Nolan. Delegates will be received and historical addresses will probably be delivered on the first day; two morning sessions will be devoted to the reading of scientific papers; and there will be a banquet on the evening of March 21, the official birthday of the academy.

WE learn from a communication received from the Decimal Association that the King of Siam, on November 15 last, ordered the adoption of the metric system throughout his kingdom at an early date. The authorities in Siam are in communication with the Bureau International des Poids et Mésures at Sèvres on the subject of the provision of standards and prototypes for furnishing a Central Office of Weights and Measures for the country. The Government stands pledged to the passing of a law introducing the system in about a year from now, which law, after an optional period of one year only, will be enforced throughout the kingdom.

PROF. A. S. HITCHCOCK, systematic agrostologist of the Bureau of Plant Industry, U.S. Department of Agriculture, who represented the Smithsonian Institution in the biological survey of the Canal Zone as a collector of grasses, has just returned to Washington. He estimates that he has secured about 150 species of grasses from the Canal Zone alone, and that, including the collections of Messrs. Pittier and Maxon, the National Herbarium will have as many as 200 species from Panama. This greatly increases the known species, and Prof. Hitchcock believes that he has from four to five times as many from this region as were previously known. Many of the species found in Panama were known previously only from Brazil and other regions of South America.

DR. L. A. BAUER returned to his office at Washington, D.C., at the end of December last, after a nine months' trip of inspection of magnetic work on board the *Carnegie*, and visiting magnetic institutions in the Pacific Islands, New Zealand, Australia, India, Burma, China, and Japan. Three positions as magnetic observer are to be filled in the Carnegie Institution of Washington at salaries ranging from 900 to 1500 dollars per annum and field expenses, according to training and experience, with possibility for further promotions as advancement is made. The duties imply assignment to magnetic survey work (determination of the magnetic elements), according to circumstances, either on land in foreign countries or at sea on board the magnetic survey yacht *Carnegie*. Applications, with full statements as to collegiate training and experience, and accompanied by references, should be forwarded immediately, and addressed to: The Director, Department of Terrestrial Magnetism, The Ontario, Washington, D.C.

IN the notice of Prof. Sollas's "Ancient Hunters" in NATURE of January 25, the reviewer assumed that as no reference was made to Mr. J. Reid Moir or his sub-Crag flints they were "rejected as convincing evidence of man's existence." Mr. Moir writes to suggest that the absence of mention of his implements from below the Crag is probably due to the chapter dealing with "Eoliths" having been written before the facts of his discovery were made public. We understand that the book was in print before Prof. Sollas had the opportunity of examining Mr. Moir's specimens, so that it is scarcely correct to assume that he has rejected them as evidence of man's workmanship.

THE discovery of a human skeleton beneath a stratum of Boulder Clay near Ipswich, and partly embedded in the underlying mid-Glacial sands, is likely to prove an event of considerable importance to those interested in the evolution of the modern type of Man. According to the somewhat sanguine report which appeared in *The Times* of February 1, Mr. J. Reid Moir and those who saw the remains *in situ* are confident that the overlying stratum of Boulder Clay (4½ feet in depth) was undisturbed, and that the remains are older than the deposition of the Chalky Boulder Clay, which marks the most severe of the various Glacial periods. If this proves to be the case, and no doubt Mr. Moir and those associated with him will place all the evidence before experts at an early date, the skeleton thus found will be the earliest remains of the human body yet found in England. The skeleton has been examined by Prof. Keith, who reports that in all its essential features it is of the modern type, with absolutely no trace of the unmistakable characters of Neanderthal man. Yet the period assigned to the Ipswich remains is long anterior to the Mousterian period to which the remains of Neanderthal man belong. To those who regard Neanderthal man as an altogether distinct form of mankind which persisted long after the modern type of man (*Homo sapiens*) was evolved, this discovery at Ipswich will cause no surprise.

THE study of plant diseases is so important from the technical point of view, and presents so many problems of scientific interest, that any suggestions for advancing it deserve serious consideration. The Biology Committee of the Agricultural Education Association is organising a card index that shall form a systematic record of fungus, insect, and other diseases of plants, and invites the co-operation of those able and willing to help in order that the record shall be as complete as possible. The value of the work, of course, will depend entirely on the extent to which this invitation is taken up. The record thus compiled will be available for consultation by any investigator, either by application to the secretary of the committee, Prof. J. H. Priestley, of the University of Leeds, or by application to the Board of Agriculture, which will hold duplicates of all the entries. The committee hopes to receive the cooperation of all investigators of this subject in the British Isles, and to form a record that shall not only be useful to the economic biologist, but also to the mycologist and to other students of plant diseases. Full information about the scheme can be obtained from Prof. Priestley.

IT is stated by *The Times* that the Daylight Saving Bill is to be brought forward again next Session, and its supporters hope that a member who obtains a good place in the ballot will introduce it. From the same source we learn that resolutions in favour of the Bill have now been passed by 408 city corporations and town and district councils, including the Cities of London, Westminster, Glasgow, Liverpool, Belfast, Dublin, Sheffield, and Bradford, and a majority of the London boroughs—that is to say, seventeen out of twenty-eight. It is scarcely to be

expected that the representatives upon these bodies should be familiar with the zone system of standard time reckoning now recognised throughout almost the whole civilised world, for if they were they would understand the practical and international importance of the invariability of the Greenwich meridian upon which the system is based. Surely in a matter of this kind expert knowledge is a safer guide to follow than argument derived from the counting of heads. What is wanted is the opinion of astronomers, navigators, and others, who know the meaning of standards of time and longitude, rather than of city corporations and district councils, which would just as cheerfully pass a resolution in favour of a periodical change of position of the equator as they do that for placing Greenwich in the longitude of Berlin during certain months of the year.

MR. C. G. ABBOT, director of the Smithsonian Astrophysical Observatory, has just returned to Washington from Bassour, Algeria, where he has been making astrophysical observations in regard to the solar constant of radiation. The observing station in Bassour was established in July, 1911, when Mr. Abbot and his field assistant, Prof. F. P. Brackett, of Pomona College, arrived in Algeria, and observations were continued until the end of November. From previous work at Washington, Mount Wilson, and Mount Whitney, it had been determined that the sun was probably a variable star, and that apparently its radiations frequently fluctuated from 2 to 5 per cent. during irregular periods of from five to ten days' duration. Although strongly indicated by the work on Mount Wilson, the result was so important that it seemed necessary to test it further by means of simultaneous independent observations held at Mount Wilson and some other high altitude station remote from there, where an equally cloudless atmosphere existed. Mr. Abbot made complete determinations of the solar constant of radiation for forty-four days in Bassour, while his assistant, Mr. L. B. Aldrich, made similar measurements at Mount Wilson, Cal. The two observing stations were separated by a distance nearly equal to that of one-third the circumference of the earth, thus making the locations ideal in that respect. Unfortunately, some cloudy weather was encountered at each of the stations, but the records of about thirty days will be available for comparison.

THE *Evening News* of February 1 made some interesting remarks on Candlemas, February 2, one of the great festivals of the May or agricultural year which precedes the present solstitial year. The church candle festival followed the lighting of bonfires or blazes in the stone circles, and was dedicated to St. Blazius. The proverbs show that the day has always been considered a critical one from the meteorological point of view—indeed, "The proverbs which cluster round this day are more numerous than those about St. Swithin's, St. Martin's, and St. Michael's Days combined. And they all refer to the weather."

"If Candlemas Day is come and gone,
The snow lies on a hot stone (*i.e.* soon melts)."

"If Candlemas Day be fine and clear,
There'll be two winters in the year."

"A windy Christmas, a calm Candlemas,
Are sure signs of a good crop of grass."

"If Candlemas Day bring clouds and rain,
Winter is gone and won't come again."

"If the lark sings before Candlemas (it did in 1912)
She'll soon cry out and mourn alas!"

These proverbs are followed by a letter from a correspondent, who writes as follows:—"You may sum up this British proverbial wisdom thus: If February 2 (Candlemas Day) is cold, we shall have a cold, late spring and a fine summer. If wet and warm, the chances are we shall get a dismal summer after a fine, open spring. Some of the scores of available proverbs contradict each other on minor points. They all agree that February 2 (Candlemas Day) is a critical point in the year. It sets the barometer and thermometer for us. For years I have verified it, and my advice is, watch the weather on February 2."

THE December (1911) number of *The Journal of Hygiene* (vol. xi., No. 4) contains a paper by Drs. Stokvis and Swellengrebel on the purification of water by an infusorian (*Colpoda cucullus*). Numbers of Colpodæ were added to emulsions of bacteria in water, and as a result the water was clarified, and the bacteria were removed. The purification was effected only in the presence of living Colpodæ.

WE have received the first number of *The Journal of Vaccine Therapy*, which is edited by Dr. R. W. Allen and published by Mr. H. K. Lewis. It contains papers on the vaccine treatment of rheumatic fever and chorea by Dr. Buchanan, of typhoid fever by Dr. Sadler, and of acne by Dr. Allen. Important as vaccine treatment is, we scarcely think that the subject requires a special journal.

The Malaya Medical Journal for last October (vol. ix., part iv.) is devoted to the subject of beri-beri. Recent research, in particular by Braddon, Fraser, and Stanton, strongly suggests that the use of "polished" rice, which seems to be deficient in certain nutritive qualities, is the cause of this disease. The editor, however, points out that there are certain outbreaks which do not seem to be explicable on this hypothesis, and publishes a translation of a paper by Kohlbrugge in which it is suggested that certain acid-forming bacteria present on rice may be the actual cause of beri-beri.

AT the present time, when public interest is directed to the political situation of China, we may direct attention to two valuable papers contributed by Mr. E. W. Capen to the fifth volume of the Publications of the American Sociological Society. In the first this writer, who is familiar with the conditions of inner China, gives a graphic account of his observations. He describes, in order, the struggle for existence, the physical constitution of the people, their mental characteristics, the organisation of family life, the evils resulting from neglect of forest conservation, and the lack of patriotism among the rural population. It is, on the whole, a melancholy picture of social decay as the result of misgovernment. The most interesting portion is that in which he discusses the physical characters of the people and their power of resistance to disease and injuries as compared with Europeans. In the second paper he reviews with ample knowledge the effects of Western influences upon the people of the Orient.

AFTER an exhaustive study of the limb-arteries of the Primates, the details of which are recorded in the January number of *The Journal of Anatomy and Physiology*, Mr. T. Manners-Smith arrives at the conclusion that these arteries—as, indeed, had been previously suggested—are arranged on a definite system. They are, in fact, formed on a segmental plan, and to some extent appear to have constituted portions of the tubules of an arterial plexus with longitudinally arranged meshes. "We must also regard the normal arrangement, which is proper to a par-

ticular family or species, as the result of mechanical conditions affecting the particular family or species in such a way that the departure from the general reticular plan is fixed and definite for the animal in question."

THE American Bison Society, in its fourth annual report, 1910–11, has to deplore the loss of the services of its president, Dr. W. T. Hornaday, who has been compelled by pressure of other work to resign that position. He has been elected the first honorary member of the society, and is succeeded in the presidential chair by Prof. F. W. Hooper. Despite a few mishaps, matters appear to be going well with the survivors of the bison in its native country, the total number of pure-bred animals being 2760, against 2108 in 1910 and 1917 in 1908. Attempts to capture the remnant of the Pablo herd in the Flathead country for the Canadian Government have had to be abandoned on account of the wild state of the animals, which have become completely uncontrollable. The society is anxious to establish a new herd in one of the Dakotas, preferably South Dakota, which formed part of the headquarters of the bison, and the proposal has been favourably received by the secretary to the Federal Government. Efforts are also being made with a view to the establishment of a herd either in the Adirondack Range or in the new Hudson River Park, New York State.

THE horned lizards, or "horned toads," of California and Nevada form the subject of an illustrated monograph by Mr. H. C. Bryant in the Zoological Publications of the University of California (vol. ix., No. 1), which also includes a survey of the whole group. In the second edition of the British Museum "Catalogue of Lizards," twelve species, all included in the genus Phrynosoma, of these strange reptiles were recognised; but Mr. Bryant now admits sixteen, one of which, from the desert tracts of the Gila and Colorado valleys, is made the type of a separate genus, under the name *Anota maccalli*, its claim to this distinction being based on the length, smoothness, and conical forms of the horns, the presence of three (in place of one or two) rows of peripheral spines, the flattened tail, and the existence of supratemporal openings in the skull. Excellent figures show the specific variation of the skull, which in its horn-sheathed spines exhibits a remarkable parallelism to some of the dinosaurs. These horns are considered to be for defensive purposes, serving to frighten certain enemies, although it is scarcely conceivable that they can be efficacious in the case of rattlesnakes, which are some of the worst foes. Some of these lizards are viviparous, but others are oviparous, the eggs being in the case of one species buried in the sand, although in a second they are hatched almost immediately after extrusion. Particulars are given with regard to the remarkable habit possessed by these lizards of spurting jets of blood from the eye, from which it appears that the phenomenon is preceded by congestion of the upper eyelid, from the under-surface of which the jet issues.

LITTLE information has hitherto been accumulated about the composition of cow's milk in India. Messrs. Meggitt and Mann have recently published in the Memoirs of the Department of Agriculture in India a number of analyses which show that the milk contains a high percentage of butter-fat, as much as 5 or 6 per cent., against a general 3 per cent. in England, but there is very great variation even among animals of the same breed. Indeed, the whole investigation emphasises the extremely unselected character of the herds, and suggests possibilities of marked improvement if selection is carried on over a sufficient time.

IN the October (1911) number of *The South African Journal of Science*, the organ of the South African Association for the Advancement of Science, Dr. Juritz describes the results of the chemical investigations he has made in Cape Colony during the last twenty years or more. They deal with waters, poisonous plants, soils, fertilisers, cereals and other agricultural produce, and minerals, and afford an admirable illustration of the way in which the chemist can serve a new country. A short biography is given of the late Dr. Bolus, who played so prominent a part in the development of botany in Cape Colony.

OF the many problems connected with soil fertility, few are more important than those centring round soil erosion. The causes and remedies are dealt with at some length by Mr. M'Gee in Bulletin 71 of the United States Department of Agriculture, Bureau of Soils, where some admirable photographs also are given showing the various types of erosion. Whenever land is brought into cultivation and then neglected, erosion is likely to be serious; only when the surface is covered with vegetation can it resist the disintegrating effect of the rain. Very slight depressions in the surface suffice to form a channel, which rapidly widens and deepens, and before long attains considerable dimensions. The remedies consist, therefore, in planting the land and in terracing.

A USEFUL article dealing with two prevalent diseases of the potato plant is contributed by Mr. R. S. Horne to the Journal of the Royal Horticultural Society (vol. xxxvii., part ii.). The author sifts carefully the conflicting statements ranged round the lowly fungal organism *Chrysophlyctis endobiotica*, producing a disease known under the different names "tumour," "warty disease," and "black scab," and contrasts the swellings induced by it with the more pronounced canker caused by the myxomycete *Spongospora solani*; the latter disease is known as "corky scab," or "potato canker." The author adopts the terms tumour and canker because they indicate the actual nature of the diseases, which are, of course, quite distinct from the potato disease due to *Phytophthora infestans*. Attention is also directed to a note by Mr. F. J. Chittenden in the Journal discussing self-sterility of apple trees, that is, the dependence of fruit formation upon pollination of the flowers with pollen from another variety.

IN the January number of *Petermann's Mitteilungen* Prof. A. Woeikow discusses the salinity of the oceans, and in particular the greater salinity of the Atlantic Ocean as compared with either of the others, and this in spite of the continental area which drains into the Atlantic being far larger than those which feed the Pacific and Indian Oceans. He attributes the higher salinity of the Atlantic to the large amount of water-vapour which is carried on to the continents, which are of comparatively low altitude where they front this ocean. A map of the salinity of the oceans, the drainage areas supplying them, and the altitudes of coast margins is included.

IN *The Geographical Journal* for January, Sir David Gill, F.R.S., describes the 4-metre and 24-metre comparators which have been constructed for the Government of India by the Cambridge Instrument Company under his supervision. The former is for comparing all standards of length up to 4 metres, and enables the determination of their absolute coefficients of expansion by heat; the latter is designed for comparing the lengths of 24-metre invar wires or tapes with a standard 4-metre bar. Unfortunately, only a summary is given of the description of these important pieces of apparatus, and no plans are included.

At the same meeting Mr. J. A. A. Baugh discussed the preparation of invar tapes, and quoted the results of experiments made to determine their variation due to ageing, rolling and unrolling, and tension. The experiments were very instructive, though the number quoted was small. He referred to the difficulty of determining the true temperature of a tape suspended in air, and advocated its determination by means of its electrical resistance. Mr. B. F. E. Keeling directed attention to this difficulty in 1910, and showed that there might be as much as 2° C. between the tape and the surrounding air.

REFERRING to the letter on concentric joints in ice by Mr. H. J. F. Gourley in NATURE of January 25, Julia R. Grugell, of Burleigh Stroud, Gloucestershire, sends some observations on the same phenomenon. The roadside pool studied was 6 feet long, 4 feet broad, and 1 foot deep in the middle and about 3 inches at the side. The rings seen only followed the line of the edge on one side, and halfway round the ends, projecting stones apparently interfering with their formation on the other side. A piece of ice, 16 inches square, cut out and examined showed the bulb formation. The ice was 2 inches thick at the edge, and the first bulb was 3½ inches from the edge and projected 2 inches, being followed by four others of varying shapes. Along the line of the rings the bulbs appeared to be continuous, except the second, which was saucer-shaped in appearance. Looking at the surface of the pool, which was of very smooth ice, the rings were seen alternately clear and opaque, and inspection of the under-surface of the piece removed showed the bulbs were clear through to the surface. The opaque effect seemed to be due to ice crystals on the under-surface of the ice. The ice was the result of several nights' frost, with no thaw by day.

IN connection with the exceptionally warm weather of last summer in Europe and the United States, an article by Mr. R. C. Mossman in *Symons's Meteorological Magazine* for January, on the "Abnormal Weather in South America during 1911," is of considerable interest. For the region north of lat. 40° S. in Argentina and part of Brazil the following mean temperatures below the normal (1898–1907) are given for the four months June-September:—mean max. 2·5° F., mean min. 3·0°, mean temperature 2·7°. From a map showing the departures of the mean temperature for the three months June-August in Argentina it is seen that the greatest depression, viz. 5°, was in a small area in the province of Corrientes. South of latitude 35°, except for a small patch in Buenos Aires, the depression did not exceed 2°, and south of 41° the temperature was above the average, reaching an excess of 3·5° near the Atlantic entrance to the Straits of Magellan. The author observes that there is little doubt that during the year in question a marked displacement of the "centres of action" of both hemispheres took place. In South America the meteorology of the whole year presented a sequence of abnormal features, among the most prominent being excessive rainfall at Rio de Janeiro in March, 1911, and extreme drought in Buenos Aires in the same month.

A COURSE of lectures delivered before the students of the Johns Hopkins University by Dr. Charles Edward Brooks, on "Tables of Mortality and the Theory of Probability," is published in abstract in the Johns Hopkins University Circular, No. 10. The abstract of the six lectures only occupies forty-two pages, and is accompanied by a reprint of the "American Experience" table of mortality. It should enable any student possessing an elementary knowledge of algebra and the mere notation of the calculus to solve ordinary problems on life insurance with a very small amount of preliminary study. It shows that the study of probabilities and statistics is not nearly so difficult as is commonly supposed. It is highly desirable that schoolboys should learn the elementary notions of probability soon after they have learnt to multiply vulgar fractions, and that the elements of statistical mathematics should be taught in schools and colleges in place of much of the present useless algebraical drill.

A REPORT on graduate work in mathematics in the United States universities and colleges is published in the Bulletin of the American Mathematical Society for December, 1911, and forms part of the report of the International Commission on the Teaching of Mathematics. It would appear that forty years ago practically no facilities existed for the study of higher mathematics, the school established at Harvard under Benjamin Peirce being one of a few noteworthy exceptions. At present a much more satisfactory state of affairs has been reached, many institutions, both large and small, possessing well-attended schools of higher study frequented by both graduate and undergraduate students. The report deals, further, on the advantages and disadvantages of study abroad, the former including the acquisition of foreign languages. In regard to the training of teachers in higher mathematics, the report reveals a very different state of affairs from that now prevailing in England, namely, an excess of demand over supply. This, in the opinion of the committee, is likely to have a disastrous effect in encouraging graduates of mediocre ability to undertake some work that they can call "research" in order to qualify as college instructors.

WITH the aid of the Rumford Fund, Mr. P. W. Bridgman, of the Jefferson Physical Laboratory of Harvard University, has continued his experiments on the properties of substances under pressures up to 12,000 atmospheres. His most recent work relates to mercury, and the results are published as Memoir 12 of vol. xlvii. of the Proceedings of the American Academy. He uses a steel piezometer, through the bottom of which a minute hole is made. The piezometer is filled with mercury, and is subjected to pressure in a cylinder of water. As the pressure is applied, water is forced into the piezometer. When the pressure is withdrawn mercury flows out, and the amount which remains in the instrument allows the compression to be determined if those of the water and the steel are known. That of steel was determined independently by the change of length of a rod under pressure. That of water was measured by inverting the piezometer, filling it with water, and subjecting it to pressure in a cylinder of mercury. As the experiments were carried out at temperatures from −39° C. to +22° C., they allow the isothermals for solid and liquid mercury between these limits to be drawn on a pressure-volume diagram.

VOL. vi. of the Journal of the Institute of Metals contains the May lecture of 1911, delivered by Dr. G. T. Beilby. The title, "The Hard and Soft States in Metals," gives a very inadequate idea of the importance of the conclusions which the author has reached by his investigations on metals and other substances. The central fact appears to be that the molecules of any pure substance may be assembled in two different ways, each of which imparts to the substance distinct physical properties. In the first form the substance is crystalline, stable under heat treatment, but yields readily to mechanical forces. In the second the substance is amorphous, becomes crystal-

line under heat treatment, but is much more stable under mechanical forces than the former. Even gentle polishing of a surface is sufficient to break down the first or crystalline form near the surface, and the material flows, ultimately solidifying in the second or amorphous state. Wire-drawing or other mechanical treatment produces the same effect, and the author shows how most of the properties of materials used in construction are due to the presence in them of molecules in the two states of aggregation.

A PAPER by Dr. E. Weiss, of the University of Prague, which appears in the July (1911) number of the *Sitzungsberichte* of the Academy of Vienna, offers a satisfactory explanation of the deviations of the values for the elementary quantity or "atom" of electricity found recently by Dr. Ehrenhaft and by Dr. Przibram from the value found by Prof. Millikan. Like the other observers who have worked in this field, Dr. Weiss uses the speed of motion of electrically charged minute particles of matter either under gravity alone or under gravity and an electric field combined. His particles were of silver of diameters about 10^{-5} cm., obtained by the aid of an electric arc. His arrangement allowed the same particle to be observed during twenty or more falls, and the speeds found differed amongst themselves by 50 per cent. in the case of the smallest particles. When Stokes's law, either in its original form or with Cunningham's correction, is applied to the observations, the values of the electric charges in many cases come less than the atomic charge. Weiss shows that this is due to the particles executing Brownian movements, and when he applies Einstein's theory of these motions to the observations, he finds they give values of the atomic charge between 4 and 5×10^{-10} electrostatic units, in agreement with the number generally accepted.

THE isolation by Willstätter and Esch, recorded in the current number (vol. lxxvi., Heft 2 and 3) of the *Zeitschrift für physiologische Chemie*, of the yellow pigment of yolk of egg in a crystalline state, and the identification of its chemical nature as closely related to the xanthophyll of green leaves, is an important contribution to knowledge. Willstätter's earlier work enabled him to classify the chemically indifferent colouring matters of animal and plant pigments into two classes, the hydrocarbons, $C_{40}H_{56}$, of the carrotene group, soluble in light petroleum, and the related oxygen compounds, $C_{40}H_{56}O_2$, of the xanthophyll series, soluble in alcohol. Nearly two years ago he was able to show that lycopene, the red pigment of tomatoes, was a member of the carrotene group. As the result of the extraction of the yolks of 6000 hens' eggs, about 4 grams of a crude pigment remained. This has been purified by crystallisation from a variety of solvents, from which the pigment, which it is proposed to name luteine, separates in characteristic coloured forms. Analysis shows it to be an isomeride of xanthophyll, and this is confirmed by the study of the absorption spectrum and other properties.

AT a meeting of the Institute of Chemistry, held at University College, London, on January 26, a lecture was delivered by Mr. C. F. Cross on "Cellulose." He pointed out that cellulose, as a basis of manufacture, takes an important position. Primary manufactured products at factory cost represent values approaching 200,000,000*l.* per annum for the United Kingdom. Cellulose derivatives form the basis of smokeless powders, an indispensable auxiliary to photographic art, and the raw material of "celluloid." Taking cellulose as a typical colloid, and enlarging our view to include industries based upon colloids, their preponderance is evident. Industry is chiefly busy in transforming colloidal substances of entirely natural origin. Normal cellulose is still rather a laboratory term and product. The so-called "pure" cellulose in the form of chemical filter papers represented about 90 to 95 per cent. only of "normal" purity. The supposed identity of "rag cellulose" with "normal cellulose" is an illusion. Mr. Cross suggested that the type of combination of lignone with cellulose to form the complex "lignocellulose" may in time modify our views of chemical combination.

WE learn from *The Engineer* for February 2 that in the middle of last month there was put to work a single-deck petrol tramcar on the short tram-line connecting Morecambe and Heysham. This car is the first of three ordered for this service, is capable of carrying thirty-seven passengers, and is driven by a 55 horse-power four-cylinder petrol motor. Now that the petrol tramcar is an accomplished fact, it will be interesting to watch the effect on the fortunes of electric tramway systems. There appears to be no reason why petrol tramcars should not answer their purpose as well as electric cars, and it is evident that success will render them formidable opponents. It is too early as yet to attempt any comparative estimate of costs of running or of upkeep, but it must be remembered that the electric system calls for heavy expenditure in overhead or underground equipment, and also for a generating station in those cases where the tramway authority cannot purchase its electricity.

BULLETIN No. 49 of the University of Illinois contains an account of tests on nickel-steel riveted joints carried out by Messrs. A. N. Talbot and H. F. Moore at the university engineering experiment station. A total of ninety nickel-steel and fifty-four chrome-nickel-steel joints were tested in tension, sixteen nickel-steel and sixteen chrome-nickel-steel joints were tested in tension, compression, and alternate tension and compression. Stretch, slip, and set of riveted joints were observed, as well as the bending of the rivets. There was a noticeable slip of joint generally at loads within ordinary working shearing stress of rivet. The movement of the joint increased fairly regularly to a load averaging about 35,000 lb. per square inch of rivet shear for the nickel-steel joints, when a marked increase of movement was found. This increase was closely coincident with a marked set of the joint and with a marked bending of the rivet. All the riveted joints failed by shear of the rivets, at ultimate shearing stresses, which ran fairly uniform in both the nickel-steel and the chrome-nickel-steel series for all the types of joint tested. In the alternated load tests, the most striking feature was the relatively large slip which took place at comparatively low loads. The amount of this slip was especially large when a joint had been subjected to a single load considerably beyond the ordinary load.

PROF. A. M. WORTHINGTON, C.B., F.R.S., contributes to the February number of *Pearson's Magazine* a well-illustrated article upon his photographic analysis of the splash and jet produced by dropping a rough marble into water from different heights. The same number contains an account of the life-story, with illustrations, of the nightjar, by Mr. E. C. Andrews.

THE annual volume for 1911 of the "Bulletin of Miscellaneous Information" of the Royal Botanic Gardens, Kew, is now available. The volume is published by H.M. Stationery Office at the price of 4*s.* 6*d.*, and may be purchased from Messrs. Wyman and Sons, Ltd., of Fetter Lane, London, E.C. Several of the papers in the ten separate numbers included in the volume have already been noticed from time to time in these columns.

OUR ASTRONOMICAL COLUMN.

DOUBLING OF MARTIAN "CANALS."—Telegraphing to the *Astronomische Nachrichten* (No. 4551) on January 25, Prof. Lowell states that the canals Ganges and Jamuna are doubling, both from the western mouth.

REPORTED FALL OF AN AËROLITE.—A curious accident is reported in a Lloyd's message from the Finisterre (Spain) Signal Station. The message states that at 9 a.m. on January 25 the semaphore and telegraphic apparatus was completely destroyed by the fall of a meteor, thus causing an interruption of both the maritime and land communications. Nothing, more than is implied in the above message, is reported as to the finding of any meteorite or its fragments.

A BRIGHT METEOR.—From Tarnów Prof. Anton Wilk reports the apparition, in a clear, cloudless sky, of a bright meteor on November 15, 1911. The path lay between 20h. 20m., +40°, and 22h. 40m., +30°, and was traversed very rapidly. At the beginning of the flight the meteor was about twice as bright as Venus, whilst during the flight it gave off luminous particles, and was followed by a long luminous trail. At first the colour was bluish, then a glowing yellowish-white, and the duration of the whole phenomenon was about three seconds.

EPHEMERIS FOR SCHAUMASSE'S COMET, 1911*h*.—*Astronomische Nachrichten* No. 4549 contains an ephemeris for comet 1911*h*, computed by M. Schaumasse from the elliptic elements now published by M. Fayet in the same journal.

The present approximate position is 16h. 19m., −3° 57′, and the comet is only about one-sixth as bright as when discovered.

M. Fayet directs attention to the similarity of the orbits of this comet and that of 1894 I. (Denning).

OBSERVATIONS OF COMETS.—Bulletin No. 3 of the Khedivial Observatory, Helwan, contains a further list of positions of Halley's comet determined from photographs taken with the Reynold's reflector by Mr. Knox-Shaw. It has been found desirable to apply a temperature term in the reduction of the measures, the temperature having varied between 6° and 24° C.

Numerous observations of comets are recorded in Nos. 4550–1 of the *Astronomische Nachrichten* from several observatories.

DISTANCES OF SPIRAL NEBULÆ.—Assuming that the spiral nebulæ are external galactic systems, Prof. Max Wolf makes some speculations as to their relative distances in No. 4549 of the *Astronomische Nachrichten*. His deductions are based also on the assumption that such systems are of the same order of actual magnitude, hence the apparent diameters are inverse measures of their distances.

Measures of eight objects have been made, and the relative distances derived, both from the measures of the length and the breadth; the results for each object agree fairly well. Taking the parallax of certain objects in the Milky Way, *e.g.* Nova Persei, as 0·01″, gives a means of calibrating the relative scale, and Prof. Wolf's final speculative numbers are as follow :—

Object	Distance in light years	Apparent diameter, ′	Diameter in light years
M31 ...	33,000 ...	120 ...	1100
M33 ...	94,000 ...	54 ...	1500
M81 ...	172,000 ...	18 ...	900
M101 ...	289,000 ...	18 ..	1500
M51 ...	370,000 ...	10	1100
$H_{8}24$ ...	500,000	15 ...	2200
$H_{4}76$	522,000 ...	7 ...	1100
$H_{1}56$ ...	578,000 ...	8 ...	1300

OBSERVATIONS AT THE MOSCOW OBSERVATORY.—The fifth volume of the *Annales de l'Observatoire astronomique de Moscou* is a handsome volume, in which Prof. Ceraski publishes numerous results derived from various observations made since the new observatory was installed in 1900; the frontispiece is a reproduction of a photograph of the new buildings.

Among other results, Prof. Ceraski gives those obtained for the stellar magnitude of the sun in two separate researches in 1903 and 1905. In the first he compared the sun with Venus, and then, in the evening, Venus was compared with α Leonis. The sun was found to be 242,400,000,000 times brighter than the star, and, taking Müller's magnitude (1·57) for α Leonis, the sun's magnitude is −26·89. In the later research other stars were also employed, and −26·5 was obtained as a more trustworthy value of the sun's magnitude.

Other papers deal with the angular velocities of Perseid meteors, a special eyepiece for solar observations, a method of utilising the sun's heat, the intensity of the luminosity of the atmosphere near the sun's limb, &c. Further, M. Sternberg has a long paper on the application of photography to the measures of double stars, and M. Blažko writes concerning Algol variables, and describes a type of slitless spectroscope. In the appendix a large number of photographs showing the regions around variable stars, discovered by Madame Ceraski, are reproduced.

INTERNAL AND CLOUD VELOCITIES OF GROUPS OF STARS IN RELATION TO SPECTRAL TYPE.—In No. 5, vol. xxxiv., of *The Astrophysical Journal*, Dr. Weersma arrives at some interesting results arising from a mathematical inquiry into the ratio between the linear velocities of the individual members of star groups and the general velocities of the groups as a whole, as it exists in different spectral types. Prof. Kapteyn, in a paper published in 1910, found that the individual linear velocities of stars increase with age, and suggested that this phenomenon probably entails a dissipation of star groups as they grow older. Dr. Weersma now shows, from a study of A-type and K and M-type stars, that this suggestion is probably correct. He finds that the individual velocities do tend to increase with age, while there is apparently a tendency for the group velocities to diminish; the evidence for the latter, however, is by no means conclusive.

SILK-CULTURE IN THE PHILIPPINES.[1]

SILK production is one of the most important industries in most of the warmer parts of the world; but the mulberry silkworm, *Bombyx mori*, still supplies by far the largest proportion of this commodity.

As regards the Philippines, although the Jesuit Father Antonio Sedwo made large plantations of mulberry in 1593, and introduced silkworms, and in 1780 the Augustinian missionary Father Manuel Galiana sent both mulberries and silkworm eggs from China, and the silk industry was carried on for a while with success, yet it seems subsequently to have been neglected until about six years ago, when the Bureau of Science again introduced mulberry silkworms into the Philippines, under the auspices of the American Government, which, at the same time, promulgated an Act forbidding the introduction of silkworms into the Philippines by unauthorised persons.

This was due to the fear of the probable importation of silkworm diseases; but it may also be pointed out that the introduction of that terrible pest the gipsy moth into America was due to an entomologist carrying on experiments with possible silk-producing moths; and great care should always be taken in introducing an animal or plant into a new country, as it sometimes becomes an unexpected pest, even though it may be innocuous in its native home.

The Bureau of Science began by importing the eggs of silkworms from Japan in 1905, but it was found impossible to preserve the eggs of the next brood. Therefore, in 1907, cocoons of four different varieties were obtained from Ceylon, and these proved to be a great success. The pamphlet before us gives a full history of the development and management of the insects in all their stages.

Having succeeded so far, the Bureau of Science attempted in 1909 to introduce the Eri, or castor-oil silkworm, *Attacus ricini*, belonging to another family of silk-producing moths, also from Ceylon. The treatment of the silk produced by this insect is different from that used for the mulberry silkworm, for the moth must not be allowed to emerge from the cocoon, and the cocoons cannot be reeled, but must be spun like wool or cotton, though when thus treated they yield a very fine silk.

1 "A Manual of Philippine Silk Culture." By Charles S. Banks. (From the Entomological Section, Biological Laboratory, Bureau of Science, Manila). Pp. 53+xx plates. (Manila : Bureau of Printing, 1911.)

This moth is closely allied to, if not a form of, *Attacus cynthia*, the Ailanthus silkworm, which Dr. Alexander Wallace attempted to introduce into England some years ago. It is a very handsome species in all its stages, as

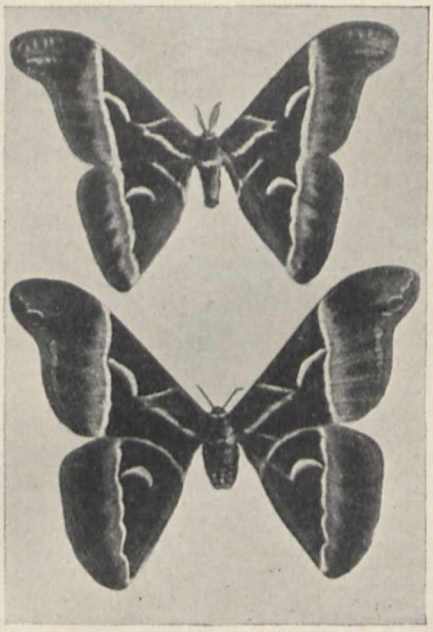

FIG. 1.—Adult male and female of *Attacus ricini*, Boisd., the Eri moth.

may be seen by the accompanying figures of the moths and caterpillars.

The castor-oil plant grows wild in the Philippines, and this silkworm is more easy to rear, and requires less care

FIG. 2.—Eri silkworms ready to spin: half natural size.

than the mulberry silkworm. Several other silkworms are found in the Philippines, some of which may possibly be ultimately utilised as silk-producers.

Enemies and diseases of silkworms are discussed. The most important of the former are ants, rats, and mice; and hitherto it has been possible to keep silkworms in the Philippines almost entirely free from disease, by constant care and supervision.

Other matters treated of in this useful pamphlet are the silk house, the mulberry, shipping eggs, the silk trade of the Philippines, &c. The plates illustrate the mulberry and Eri silkworms in all their stages, cocoons of *Antheraea semperi*, one of the wild silkworms, a mulberry nursery and plantation, plans of a silk house, and various machines used for silk-weaving, &c.

This pamphlet is a good illustration of what may be accomplished by a little energy and foresight in the way of introducing a profitable industry into a comparatively new locality. W. F. K.

THE RECENT FROST.

THE closing days of January and the early days in February witnessed a keen frost over the British Isles, but from the current weather changes it seems probable that the frost has come to an abrupt termination. At Greenwich the temperature fell below the freezing point each night for ten consecutive days, from January 27 to February 5. The lowest shade temperature was 19°, recorded on January 29 and February 3, whilst the lowest maximum day temperature was 27°, on February 4, which day also had the lowest mean of maximum and minimum temperatures—24°. The mean maximum or day temperature at Greenwich for the ten days was 35°, which is 10° below the average of the last fifty years, and the mean of the lowest night temperatures 24°, which is 11° below the average; the mean of the maxima and minima for the whole period was 30°. At the meteorological station at Hampstead the shade temperature on February 3 was 16°, and on the surface of the grass the thermometer registered 6°. In the frost of 1894–5 the average temperature at Greenwich for the whole of February, 1895, was 29°, and in the frost of 1890–1 the mean for December, 1890, was also 29°. Both these frosts were, however, much more prolonged than the spell just experienced. The recent frost was more keen over the country generally than any experienced since the winter of 1894–5, when special trains were run for London skaters to Loch Lomond, which *The Times* of February 6 reports now to be covered for about a mile with good sheet-ice—the first occasion for the last seventeen years. A region of high barometer was centred over the British Isles during the early period of the frost to the close of January, but during the latter period of the frost the barometer was low over England, and the atmospheric conditions were complex in character.

A summary of the weather issued by the Meteorological Office for the week ending February 3, which embraces the severest weather of the recent cold spell, shows that the temperature was much below the average over the entire kingdom, the deficiency amounting to 10° in the south-west of England and the Midland counties, and to about 9° in several other parts of Britain. The lowest temperatures are said to have occurred on February 3 over the kingdom generally. Some of the lowest shade temperatures reported are 4° at Balmoral on February 2, 4° at Nairn on February 5, 9° at Llangammarch Wells, in the south-west of England, on February 3. The lowest readings on the surface of the grass were −0·3° at Norwich at 11 p.m. on February 2, and 0° (zero) at Balmoral and Burnley.

SKULLS AND PHYSIOGNOMY.

AT the present time anatomists are divided as regards the possibility of reconstructing from the skull the appearance of the face and head during life. Those interested in this problem will find a recent pamphlet by Prof. von Eggeling, of Jena ("Physiognomie und Schaedel," Fischer, Jena, 1911, price 1.20 marks), of the greatest assistance, for the author has summarised in a very clear manner the various results obtained by previous investigators, and added his own observations. Such researches were at first employed to ascertain whether the skulls, which were alleged to be those of famous men, really corresponded with their death-masks. In 1867 Prof.

Welcker compared the measurements of a skull said to be that of Dante with the poet's death-mask, and found that the agreement was exact enough to warrant the authenticity of the skull. In 1893 Virchow, after comparing a skull which was found by archæologists in circumstances which led them to believe it to be that of Sophocles with busts of the poet, was unable to give a decided opinion.

The first complete investigation of this kind was made by Welcker in connection with Schiller's skull; the discrepancies between the death-mask, which he accepted as authentic, and the skull were so great—more than he found between modern skulls and faces—that he came to the conclusion that the skull could not be that of Schiller. In 1898 Kollmann and Büchly attempted to reconstruct the physiognomy of a young woman from a skull found in the débris of a lake-dwelling. The bust was criticised by Merkel, who came to the conclusion that the skull gave no clue to the essential parts of the face—the eyes, nose, and mouth. He was led to alter his opinion, however, by handing a skull to a sculptor and asking him to reconstruct the face. The skull was that of an Australian native. The sculptor returned and told him it was impossible to mould a European face on such a skull; the one he ultimately modelled had the features of the race to which the skull belonged.

Prof. von Eggeling has performed a real service to anthropologists and given them the hope of ultimately securing a scientific basis for obtaining trustworthy reconstructions of the face from a study of its skeleton.

In a paper which has appeared in the *Berichte der Naturforschenden Gesellschaft zu Freiburg-im-Br.* (October, 1911) Dr. J. Kalkhof gives the results of a series of measurements of the orbits made on more than 800 human skulls belonging to various races. He found that although the right and left orbits are approximately equal in height, the left, in two-thirds of the skulls examined, was distinctly wider than the right. Some ten years ago Miss Fawcett and Dr. Alice Lee, while examining the crania of prehistoric Egyptians from Naquada (*Biometrika*, vol. i., p. 408), found that the left orbit was not only wider, but also higher, than the right. It may therefore be accepted as proved that in the majority of individuals the left orbit is more capacious than the right. The explanation of the predominance of the left orbit is not easily explained, but it will probably be found that it is due to the greater use of the muscles of mastication of the right side. Dr. Kalkhof has introduced a method of estimating what he has termed the diagonal axis of the orbit, but its utility is not very apparent. He notes the remarkable shape of the orbits of the prehistoric Cro-Magnon race, especially the horizontal direction of the upper orbital margins. We observe that Prof. Elliot Smith, in his recently published book on the ancient Egyptians, uses the shape of the orbits as a criterion for distinguishing an alien people from the real Egyptians.

THE SECOND MENDELÉEFF CONGRESS OF PURE AND APPLIED CHEMISTRY AND PHYSICS.

THE second Mendeléeff congress of Russian chemists and physicists was held at the University of St. Petersburg on January 3–10. The number of members was unexpectedly large, namely, 1700 (that at the first congress was 1008); there were about sixty general, joint, and sectional meetings, at which more than 220 communications were made. Short abstracts of these papers, together with the discussions, were published in the daily "Diary" of the congress.

On January 3, after a funeral service in the University church in memory of Mendeléeff and the honorary president, Beketoff, there was inaugurated the "Mendeléeff Museum"—a suite of three rooms of the University lodging, which Mendeléeff occupied as professor, containing his library and furniture, all fitted up exactly as it was twenty-five years ago. At two o'clock the inaugural meeting was held in the adjoining Great University Hall, where, after election of the president, vice-presidents, and secretaries of the congress, Prof. Osipoff (Kharkoff) spoke on the scientific work of Beketoff, and Umoff (Moscow) on the characteristics and actual problems of the natural sciences.

The evening of that day, and the three following days, were devoted to sectional meetings. On Christmas Day (January 7) there was only one meeting (physical section), and several hundred members made an excursion by special train to the Falls of Imatra (Finland). On the next day, January 8, the congress was invited to the Polytechnic Institute (village Sosnovka, near St. Petersburg), where meetings of the sections of aërodynamics, radio-telegraphy and applied physics, metallurgy and electrochemistry took place, followed by an inspection of all the buildings and laboratories of this vast institute. In the evening a general joint meeting with the Russian Physico-chemical Society was held at the University, the communications made being:—Walden (Riga), electrolytical dissociation in non-aqueous solutions; and Lazareff (Moscow), application of thermodynamics in chemistry. The day was closed by a banquet, attended by some 500 members.

January 9 was devoted to sectional work, and January 10 witnessed the closing meeting of the congress. After addresses by Prof. Walden (Riga) on the development of chemistry in Russia, and Prof. Goldhammer (Kazan) on modern conceptions of time, space, and æther, the reports of the secretaries were read, and several resolutions of sections adopted. Then a vote of thanks to all who contributed to the success of the congress was passed, and the president declared the congress closed. The third Mendeléeff Congress will be held in 1914.

Turning now to the work done in the different sections, we notice that some of the sections proposed did not meet, as no papers were presented; others were very crowded, and held meetings as often as possible. The great number of communications does not allow more than a mention of the titles of those presenting a general interest.

(1) Section of Chemistry.—In the eight sectional meetings about eighty communications were made; of these, the following may be mentioned:—Borodovski (Yurieff), determination of atomic weight of elements by means of absorption of electrons; Speranski (Kieff), adsorption of dissolved substances by ice; Kuznezoff (Kharkoff), catalytic decomposition of aldehydes; Grinakovski (Tomsk), linear velocity of crystallisation in capillary tubes; Bubanovich (Zagreb), criticism of Traube's theory of superficial tension; Fisher (Riga), mechanism of crystallisation in aqueous and alcoholic solutions; Dumanski (Kieff), nature of colloidal solutions; Wurzel (St. Petersburg), latest determination of atomic weight of nitrogen (14,007).

The Chemical Section held three joint meetings with the Section of Physics. Thirteen papers were communicated, of which the following may be noticed:—Tamman (Göttingen, formerly Yurieff), determination of molecular weight of crystalline bodies; Zelinski (Moscow), absorption of ultra-violet oscillations by radio-active substances; Romanoff (Moscow), absorption of electromagnetic waves by alcohols; Kolli (Moscow), photochemical action of electromagnetic waves on a mixture of benzene and toluene; Hollmann (Yurieff), thermodynamics of solutions; Lazareff (Moscow), diffusion and biological processes.

(2) Section of Physics.—Of the twenty-six papers presented at seven meetings, many dealt with advances of physics during recent years and new fundamental conceptions. Among the papers were:—Weinberg (Tomsk), slow deformations of solids; Goldhammer (Kazan), theory of dispersion and absorption of light in isotropic immobile bodies; Arkadieff (Moscow), magnetic properties of iron and nickel under the influence of swift electrical oscillations; Ehrenfest (St. Petersburg), on the existence of æther; Roshdestvenski (St. Petersburg), anomalous dispersion in sodium vapours; Timiriazeff (Moscow), viscosity of rarefied gases; Kravetz (Moscow), constitution of absorption bands in transparent media.

(3) In the Section of Radio-telegraphy six papers, mostly of a technical nature, were communicated in three meetings. A joint meeting with the Section of Applied Physics was held in the Polytechnic Institute, where three communications were made:—Chernysheff (St. Petersburg), absolute measurements of high voltage; Müller (St. Petersburg), production of electromagnetic waves in a system of three communicating conductors.

(4) The Section of Geophysics met on seven occasions,

when sixteen communications were made and discussed. Many are of general interest:—Voeikoff (St. Petersburg), the influence of water on the heat balance of the earth; Vernadski (St. Petersburg), gaseous interchange in the earth's crust; Tochidlovski (Odessa), formation of the elements of fog; Aganin (Odessa), new hypothesis of formation of thunderstorms; Dubecki, actinometric observations at the glacier of Berel. In the joint meeting of this section and the Section of Physics four communications were presented. Prince Golitzin (St. Petersburg) gave an account of the actual state of seismology, and Rosenthal (Warsaw) spoke about the determination of the depth of the origin of earthquakes.

(5) Considerable interest was taken in the Section of Astrophysics; in three meetings eleven papers were read. Of these we mention:—Amaftunski (Vilna), theory of sunspots as resulting from the activity of prominences; Tikhoff (Pulkovo), on the scintillation of stars; light-filters applied to the study of physical properties of Mars and Saturn; optical properties of solar prominences; Donich (St. Petersburg), astrophysical investigation of complete solar eclipses; Neuimin, advances of selenium-astrophotometry; Arzikhovski (Novocherkassk), spectra of planets obtained by Slipher, and the spectrum of chlorophyll.

Many papers were also read at meetings of the sections of metallography and technical electrochemistry; aërodynamics; biochemistry and biophysics; agricultural chemistry; hygiene; and didactics, the last-named being devoted to methods of teaching physics and chemistry in colleges (gymnasiums), and kindred matters.

The exhibitions of physical and chemical apparatus were very successful, and many foreign firms took part in them (viz. A. Hilger, C. Zeiss, Heraeus, Füss, and others). In spite of the cold (on some days a temperature of −25° was registered), more than sixty excursions were made to different works and institutions of St. Petersburg and its environs. Almost all museums were open to the members of the congress, and the provincial members made the most of this occasion to acquaint themselves with the capital. After the end of our congress many members took part in the Congresses of Applied Geology and Mathematics, which were inaugurated in St. Petersburg on January 9.

RELATION BETWEEN HEIGHT AND LENGTH OF THE WAVES FINALLY PRODUCED AT SEA BY WINDS OF ANY GIVEN SPEED.[1]

OBSERVATIONS made by the author, and those of Scoresby, Paris, Abercromby, and others, show that when the waves in a storm are fully developed they travel with the same speed as the wind which produces them. If there be any excess velocity of wind, such as might be supposed necessary to prevent the waves from flattening out through the effect of friction, it is a quantity so small that it falls within the errors of observation. Similarly for the breakers which reach our coasts after storms in the Atlantic, the author has recorded periods which show a deep-water velocity equal to the maximum recorded velocity of the wind during the same spell of weather, the latter being in one case Beaufort's force 11, or 64 statute miles per hour, and in another case Beaufort's 12, or 77 statute miles per hour. He has never recorded breakers with a speed equal, or nearly equal, to the speed which the wind momentarily attains in gusts, the speed of the waves not exceeding the average speed of the wind. The observations indicate that if there be any waves which travel faster than the wind, they do not attain sufficient amplitude to form breakers.

Since the highest waves finally produced travel with the same speed as the wind, their period and length can be at once precisely calculated for any given speed of wind. The recorded heights of fully developed waves for all weathers, from "strong breeze" to "strong gale," 25 to 44 statute miles per hour, are proportional to the speed of the wind, the multiplier being 0·7. Thus the height of the waves finally produced in a strong breeze, such as that of the trade winds, is $25 \times 0{\cdot}7 = 17{\cdot}5$ feet, and in the ordinary "strong gale" of the North Atlantic $44 \times 0{\cdot}7 = 30{\cdot}8$ feet. The length of the waves being precisely calculable from the speed of the wind, their flatness can be calculated by dividing by the empiric number for height. The ratio of length to height is thus proportional to the velocity of the wind, the multiplier being 0·6.

Description of wind.	Beaufort's number for wind-force.	Velocity of wind (V) in statute miles per hour = Velocity of wave.	Period in seconds = V ÷ 3·493.	Length in feet = V² ÷ 2·382.	Height in feet = V × 0·7	Length ÷ Height = V × 0·600.
Strong breeze ...	6	25	7·2	262	17·5	15·0
Moderate gale ...	7	31	8·9	404	21·7	18·6
Fresh gale ...	8	37	10·6	575	25·9	22·2
Strong gale ...	9	44	12·6	813	30·8	26·4
Whole gale ...	10	53	15·2	1180	37·1	31·8
Storm	11	64	18·3	1720	44·8	38·4
Hurricane ...	12	77	22·0	2489	—	—

The author recently obtained measurements of large waves in unusually favourable circumstances, the ship, P. and O. ss. *Egypt*, being hove-to for nine hours in the Bay of Biscay during the storm of December 21, 1911. The following velocities of wind are the means of two sets of estimates of the Beaufort's number. At 4 a.m., velocity of wind, 48·5 statute miles per hour; 8 a.m., 46·5; noon, 35·5. The velocities of the waves were:—8 a.m., 47 statute miles per hour; 10 a.m., 43·5; noon, 39·5. At 10 a.m. the prevailing height of wave was 31 feet, very few being lower. There was no "swell," *i.e.* no waves longer and flatter than these, neither were there any noticeable short waves. This remarkable "sea" was the effect of a very strong wind upon a heavy swell already running in precisely the same direction. The speed of this swell, as observed in the positions occupied by the ship on the preceding day, was 40 statute miles per hour. Its height was usually about 15 feet, individual crests rising occasionally to a little more than 20 feet.

[1] Summary of a Cantor lecture delivered before the Royal Society of Arts on January 22 by Dr. Vaughan Cornish.

QUANTITATIVE STUDIES IN EPIDEMIOLOGY.

THE publication of a paper on this subject by Sir Ronald Ross in a recent issue of NATURE[1] prompts me to present a note which I had been holding over for a longer article, and have also incorporated in a paper read before the Washington Philosophical Society.[2] At the same time, I wish to offer a solution for a certain system of differential equations obtained by Sir Ronald Ross—a solution which presents certain points of interest.

I.

We may set ourselves the problem of investigating the relation between the number of the infected population (the focus of infection), the total population, the "infectiousness" of the disease, and its mean duration. We shall here restrict our considerations to the case of a disease such as pulmonary phthisis, which is more or less constantly present (*i.e.* not epidemic in its occurrence). Brief reflection shows that we can apply to this case a mathematical treatment precisely analogous to that of the growth of a population; for we may think of the diseased portion of the population as a separate aggregate, into which new individuals are recruited by fresh infections, just as new individuals enter an ordinary population by procreation. On the other hand, members are continually eliminated from the aggregate, first by deaths, secondly by recoveries. On the basis of these considerations, formulæ can without difficulty be established between the

[1] October 5, 1911, p. 466.

[2] November 11, 1911: "Evolution in Discontinuous Systems." Published in the Journal of the Washington Academy of Sciences, January and February, 1912.

factors enumerated above. Such general formulæ, however, involve certain functions which are unknown, and the determination of which by statistical methods would at best present great difficulties. The matter assumes a somewhat more favourable aspect if we are satisfied with the discussion of the simple special case of a stationary population in which the disease also is supposed to have reached equilibrium.

We may then proceed as follows :—

Let N be the total number of the population, and N_1 the number afflicted with the disease.

Let $S=Ns$ be the total number of deaths per unit of time, and let $S_1=N_1s_1$ be the number of deaths per unit of time due to the disease considered.

Let $N_1\sigma_1=N_1\frac{s_1}{\tau}$ be the total number of individuals eliminated from the aggregate of diseased persons per unit of time from all causes, including deaths by the disease under consideration, by other diseases, and also recoveries.

When a stationary condition is reached, σ_1 must be equal to the reciprocal of the mean duration L of the disease.

In this case we have, then,

$$N_1s_1=N_1\frac{\tau}{L} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

Furthermore, if γ is a factor indicating that fraction of the total deaths which is due to the disease considered, then

$$N_1s_1=N_1\frac{\tau}{L}=\gamma Ns \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

Hence

$$\frac{N_1}{N}=\frac{\gamma Ls}{\tau} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

or, solving for L,

$$L=\frac{N_1}{N}\frac{\tau}{\gamma s} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (4)$$

By the way of a numerical example, I will substitute in the formula thus obtained some data gathered from the statistics of New York City. The supposition of a stationary population and equilibrium condition of the disease is quite unwarranted here, but in the absence of more suitable material, and in view of the great uncertainty of the figures obtainable, we shall have to rest content with this very crude illustration.

In 1909 the population of New York numbered about 4·5 millions. The total number of consumptives at the time has been estimated at about 45,000. Hence $\frac{N_1}{N}=0{\cdot}01$. The death-rate per head per annum from all causes was 0·016; that from tuberculosis alone, 0·002. Hence

$$s=0{\cdot}016$$
$$\gamma s=0{\cdot}002$$
$$\gamma=0{\cdot}125.$$

The coefficient τ represents a measure of the "deadliness" of the disease—*i.e.* it expresses what fraction of the persons once struck with the disease ultimately die therefrom. It is difficult to obtain any kind of estimate of the value of τ. We will assume that $\tau=0{\cdot}8$.

We then have by (4)

$$L=\frac{0{\cdot}01\times 0{\cdot}8}{0{\cdot}002}=4.$$

In view of the crudity of the data on which it is based, this calculation must be regarded purely as an illustration of the principles involved, and not in any sense as an attempt to determine L, although the endeavour has been made to preserve at least the right order of magnitude in the example given.

II.

In dealing with metaxenous diseases, Sir Ronald Ross obtains the equations

$$\frac{dz}{dt}=k'z'(p-z)+qz \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (5)$$

$$\frac{dz'}{dt}=kz(p'-z')+q'z' \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (6)$$

He points out that

$$\frac{az}{dt}=\frac{dz'}{dt}=0$$

when

$$z=\frac{kk'pp'-qq'}{kk'p'-kq}=A \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (7)$$

$$z'=\frac{kk'pp'-qq'}{kk'p-k'q'}=A' \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (8)$$

Let us introduce new variables

$$Z=z-A \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (9)$$
$$Z'=z'-A' \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (10)$$

Equations (5), (6) then appear in the form

$$\frac{dZ}{dt}=aZ+bZ'+cZZ' \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (11)$$

$$\frac{aZ'}{dt}=a'Z+b'Z'+c'ZZ' \quad . \quad . \quad . \quad . \quad . \quad . \quad (12)$$

where the coefficients a, a', b, b', c, c' are functions of k, k', p, p', q, q'. If these latter are constant, the solution of (11), (12) can immediately be written down in series form, namely,

$$Z=A_1e^{-ht}+B_1e^{-Ht}+A_2e^{-2ht}+B_2e^{-(h+H)t}+C_2e^{-2Ht}$$
$$+A_3e^{-3ht}+B_3e^{-(2h+H)t}+C_3e^{-(h+2H)t}+D_3e^{-3Ht}+\ldots \quad . \quad (13)$$

and a similar series for Z'. The constants of these series can be evaluated by substituting the solution in the original equations and equating the coefficients of homologous terms of the right-hand and left-hand member. In particular, we thus obtain

$$h=-\tfrac{1}{2}\{(a+b')+\sqrt{(a-b')^2+4a'b'}\} \quad . \quad . \quad . \quad . \quad (14)$$
$$H=-\tfrac{1}{2}\{(a+b')-\sqrt{(a-b')^2+4a'b'}\} \quad . \quad . \quad . \quad . \quad (15)$$

This result throws an interesting light on the character of the path by which the final "static" condition is reached; the process is oscillatory so soon as

$$(a-b')^2+4a'b'<0$$

The solution (13) is then preferably written in trigonometric form,

$$Z=e^{-mt}(P_1\cos nt+Q_1\sin nt)+e^{-2mt}(P_2\cos 2nt+Q_2\sin 2nt+R_2)+$$
$$e^{-3mt}(P_3\cos 3nt+Q_3\sin 3nt+R_3\cos nt+S_3\sin nt)+\ldots \quad (16)$$

with a similar series for Z'. It will be observed that for large values of t both Z and Z' follow the law of damped harmonic oscillation, with a common period, and a phase difference depending on the value of the constants a, a', b, b'.

In conclusion it may be remarked that Sir Ronald Ross's equations (5) and (6) can still be solved by the method here set forth if the coefficients k, k', p, p', q, q' of those equations are not constants, but functions of z and z'. The right-hand members of equations (11) and (12) are then obtained as Taylor's series for two variables, and thus extend to an infinite number of terms. This does not in any way affect the form of the solutions (13), (16), which remain valid also in these circumstances.

ALFRED J. LOTKA.

NATIONAL SYSTEMS OF EDUCATION.[1]

THE International Council of Women has issued a special pamphlet entitled "National Systems of Education," which ought to prove useful to educationists and to the large body of voluntary workers who interest themselves in educational progress. The pamphlet comprises short accounts of the leading features of education in the various countries or States represented within the International Council of Women—United States, Canada, Germany, Sweden, Great Britain and Ireland, Denmark, Netherlands, New South Wales, Victoria and Queensland in Australia, Tasmania, New Zealand, France, Switzerland, Austria, Hungary, Norway, Belgium, Greece, Russia, Finland, Italy, Servia, and Bulgaria.

These accounts have been contributed by the members of

[1] First Report of the Education Committee of the International Council of Women, compiled by Mrs. Ogilvie Gordon, Convener. Pp. 94. (Aberdeen, Rosemount Press.) Price 6*d*.

the education committee in response to a series of questions framed by the convener, Mrs. Ogilvie Gordon. Among the writers are such well-known experts as Mme. Pauline Kergomard, Government inspectress in France; Miss Florence Keys, of Bryn Mawr College, in the United States; Miss Ellen Terserus in Sweden; Miss L. Sandholt in Denmark; Miss Augusta Rosenberg in Hungary; Dr. E. Graf in Switzerland; Dr. I. Grassi in Italy; Frau Marianne Hainisch in Austria.

The lines of the inquiry have been adhered to by all the contributors, and this has secured a directness and simplicity in the method of treatment that will specially commend the pamphlet to the non-professional reader. It also facilitates a comparison of the different stages of advancement reached by one country and another, in any particular department of education.

We find, for example, that primary education is obligatory in all these countries, with the exception of Russia, Finland, and some parts of Canada. In Russia, elementary education is not compulsory. The number of schools is at present restricted, and can by no means accommodate all the children. In European Russia, 43 per cent. of the men and 21 per cent. of the women can read and write. The numbers attending the elementary schools are 3,882,883 boys and 1,517,260 girls. The towns are much better provided with schools than the rural districts. Primary education is free. The schools are chiefly under the control of the local government bodies, but there are several thousand church schools. The pupils of the primary schools are taught reading and writing, arithmetic, and religion. In Finland, the question of compulsory education is the question of the moment. However, most people can read, as there is a law (1686) which enacts that all Lutherans who desire to marry must be able to read. The Canadian report says:—"There is a movement in Montreal to secure a compulsory school law there. In Nova Scotia each municipality decides for itself whether attendance of children at schools shall be compulsory or not. . . . In poor, thinly settled districts, where the inhabitants make their living by fishing, lumbering, &c., there is still much illiteracy, and very little interest is taken in securing educational advantages for children."

Religious instruction in accordance with the established church of the country is compulsory in the primary schools of Germany, Austria, Hungary, Sweden, Denmark, Russia, Finland, and Greece. In Belgium and Switzerland, if the parents wish, the children are allowed to absent themselves from religious teaching. In Norway "religious instruction is compulsory except for dissenters' children." In the Netherlands the "public elementary schools do not undertake religious instruction, but, by arrangement, instruction may be given in the schools by all denominations." In the United States "no specific religious instruction of any kind is admitted in the public schools, elementary or secondary."

When we compare the period during which attendance at the primary schools is obligatory, we find that it is longest in Great Britain, where, normally regarded, the school age is from five to fourteen years. Next come Austria, Hungary, Switzerland, Germany (except Bavaria and Würtemberg, where the age is six to thirteen), with eight years' attendance, from six to fourteen, certain exemptions being permitted, especially in rural areas. On the other hand, these are the four countries where all boys are compelled to attend continuation classes after leaving the primary school, up to fifteen years of age in Switzerland and Hungary, and sixteen years in Munich and a number of industrial centres in Germany and Austria. In France, attendance is compulsory from six to thirteen years of age; in Norway and Denmark, from seven to fourteen years; in Belgium and the Netherlands, from six to twelve years.

In Sweden, the usual period of attendance is from seven to fourteen years of age, but exemptions at twelve years are freely allowed among the poorer children for wage-earning purposes, delicacy of health, or entry on skilled trades. If they remain until fourteen or fifteen years of age, the boys and girls are given more advanced and specialised work, much in the same way as in the supplementary schools or classes in Scotland.

The public elementary schools of Sweden are described as co-educational, but it has to be remembered that in the larger public schools the boys and girls are taught separately in several of the branches, after ten years of age. For example, cardboard sloyd and elementary needlework are taught as a three years' course to mixed classes of boys and girls between seven and ten years of age. Afterwards the boys and girls are taken separately; both continue cardboard sloyd until about eleven and a half years of age, but the girls are also taught from ten years onward more advanced needlework and household subjects, while the boys in these years pass through stages of woodcarpentry and metalwork.

The system of trade schools and day continuation classes is only beginning in Sweden. There are "compensation" evening schools, compulsory for the children of twelve or thirteen years of age, who are exempted from the primary schools, and there are voluntary evening schools for older pupils. Almost every Swedish town supplies a good business training in the evening schools.

One striking inequality in Sweden is that the State provides for boys a complete secondary- or high-school education at public schools which are practically free, whereas girls have to depend upon private enterprise, and pay fees accordingly. Also in Denmark "all the secondary schools for girls alone are private schools, but recently in Copenhagen a few secondary classes for girls have been established in the public schools (municipal or State grammar schools)."

Frau Steinmann writes of the provision of secondary schools for girls in Germany:—"The higher schools for girls are those towards which the women of our country are chiefly directing their attention at present. Until lately they were 'higher' schools mostly in the sense that they were attended by the higher classes, the instruction being no other than in a 'middle school.' Recently they have been much improved, an advancement due to the influence of women's associations; but still (with the exception of Saxony) they are not preparatory for any public examination, and cannot be regarded as on the same level as the higher schools for boys. . . . The majority of these schools, probably 75 per cent., are private schools; only a small proportion are public schools."

The note of progress in girls' education is clearly sounded by Mme. Kergomard for France:—"Secondary education for girls is proving a remarkable success in our country. Scarcely begun, it can already count its institutions in almost all the chief towns in the 'departments' (there called lyceums), and in almost all the chief places in the 'districts' (there called colleges and secondary courses). These courses, which were started with a view to the general culture and higher education of girls, are being naturally and irresistibly directed towards the diplomas, and no longer towards diplomas of a limited kind, known as 'women's diplomas,' which are looked down upon in the universities, but towards the full licentiate and fellowship degrees as for men.

"The study of dead languages has gradually been organised in the secondary schools; we declare that we no longer wish for 'equivalents,' any more than we are willing to accept an inferior place in the university. . . . The universities are open to women, thanks to the system of recognising some branches of study in lieu of the men's programme; but we wish to discard all 'equivalents,' as they deprive us of the right to teach in these universities."

Among other European countries, Switzerland has already gone a long way in adapting the higher education of girls to the needs of the universities, and assimilating, with certain reservations, the gymnasial courses for girls to the courses in boys' gymnasia. Servia has lately been making very rapid strides in her educational system, and every advancement is shared alike by boys and girls:—"Most girls whose parents can afford it, and especially in recent years, attend the girls' gymnasia, which are founded on exactly the same system as those for boys. The cost of education in the gymnasium for boys is 20 francs in the lower classes and 40 francs in the higher classes; for girls the cost is 25 francs per annum in the lower and 45 francs in the higher classes.

"*Commercial academies* have lately been opened for boys and girls; some are co-educational, others are special schools for boys or for girls. Pupils are only admitted to these academies after having passed through four classes of a gymnasium and obtained the corresponding certificate.

The academy then provides a three years' course in commercial subjects, and grants a diploma which enables the outgoing scholars to enter upon banking, accounting, and other mercantile and commercial careers."

Of secondary education in Russia, her Excellency Mme. Philosophoff writes:—"In the Russian Empire there are 689 ordinary secondary schools for boys and 605 for girls; the numbers in attendance are 149,438 boys and 194,506 girls. There are, moreover, special secondary schools, technical, commercial, artistic, &c., which are attended by 163,053 boys and 46,911 girls. . . . The schools usually have the right to give the pupils who pass the final examination a diploma. In the boys' high schools for classics this diploma opens the way to the university. Pupils of 'Realschulen' must pass an additional examination in Latin. Girls who have passed through a girls' high school may be admitted to the private university colleges or medical colleges for women, but not to the universities. Women were admitted to the universities in 1905, 1906, and 1907, but the right was then withdrawn. The syllabus of work in the high schools for girls is much the same as in the classical high schools for boys, except that it does not include Latin."

For complete equality of opportunity in an education that shall be preparatory either to the university or to various forms of professional careers not demanding a university diploma, one turns to the United States:—"Both the elementary and the high schools are absolutely free to residents. To non-residents a small fee is charged, averaging according to locality. Practically all institutions above the secondary schools offer scholarships and fellowships, awarded on various grounds, to students in undergraduate and in graduate work.

"The majority of the high schools are co-educational, though in large centres segregated high schools are also maintained by the public-school system. . . .

"A phenomenal expansion has recently been witnessed in agricultural, technical, and vocational training. Great progress in agriculture has been attained by the universities, notably that of Wisconsin, and agricultural high schools have been opened in many localities. The first vocational public school was opened in New York City, September, 1909. Technical and trade schools have been opened in many cities, and technical instruction is also offered by cooperation between manufacturers and local school boards. Business colleges are numerous throughout the country, and the university curriculum at certain institutions has been extended to include courses in railroad administration, consular service, business methods, &c."

Miss Keys comments upon the promise of usefulness given by the Carnegie foundation for the advancement of teaching:—"During the five years of its existence (organised 1905), in its function as a pensioning body for the faculties of colleges and universities, it has investigated the curricula and teaching equipment of such institutions with a view to determining their eligibility to benefit by the pension fund. The result of such investigations and the subsequent publication and free circulation of findings have thus far been of indubitable advantage to sound educational methods. Notably has this been the case in connection with the report on the medical schools of the United States and Canada: the facts there published have been instrumental in closing some of the least defensible of these schools and in profoundly modifying for the better schools well-meaning but ill-equipped. Thus far, then, the foundation, by the ideals and methods of those conducting it, has happily contradicted the apprehensions of those educators who saw in it a possible agent for formalising the higher institutions of learning, and thus retarding progressive development."

The question that deals with universities, university colleges, and polytechnic institutions has elicited an interesting series of responses. In the United States these number 606, and only 89 of them are under the control of the State or of municipalities, 517 being under private corporations. The autonomous government of the private colleges has given rise to the notorious want of uniformity in the degree standards throughout the States, and to certain of the inadequacies which have been exposed by means of the Carnegie foundation.

In Canada the larger universities, such as the Toronto University, the McGill University at Montreal, and Dalhousie University at Halifax, are co-educational. "Several new universities are being started in the West (one at Saskatoon, another in British Columbia), and they will probably have an important educational influence on that part of the Dominion. . . . The fees payable at Canadian colleges are usually small, and the cost of living is moderate, except in the larger cities, such as Montreal and Toronto."

Germany has now thrown its universities and polytechnic institutions entirely open to women, with the exception of the Roman Catholic theological faculties. "Women may take the same degrees as men in medicine, philosophy, and science. In law they may take the degree of a Doctor in Law, but most States do not allow them to pass the examination demanded for a lawyer, and none to enter the Civil Service. In theology, some Protestant faculties allow women to take their university degree (Lic. Theol.), but none to pass the examination leading to church service. . . . Literary, professional, and scientific societies generally admit women of university rank, yet not all do so. The cost of university education is very different. It may be fixed between 400 marks and 1000 marks (ca. 20*l.* and 50*l.*) a year, residence and board not included."

Sweden also excludes women from the licentiate in theology, but permits them to attend the lectures. All other degrees are the same for men and women. "According to an Act of Parliament passed last year, *all careers are open to women graduates*, except in the faculty of theology and the army and navy medical posts in the faculty of medicine. Women of university rank are eligible for all societies upon the same terms as men of university rank. All university instruction in Sweden is *free*. There are *a great many bursaries* offered to students of small means. Students who are under training as teachers are offered no special facilities."

Norway, Denmark, and Servia are other States in which university instruction is given without any payment of class fees. In the Netherlands the cost of university teaching is 16*l.* 3*s.* 4*d.* per annum during the first four years; in Switzerland it is about 300–400 fr. annually; in Austria the minimum is 40 kr. a semester, or half-session, and the maximum is 100 kr. a semester for the ordinary student in the faculty of philosophy; in medicine, the ordinary fees are 100 kr. a semester in the first and second years, and 200 kr. a semester in the third, fourth, and fifth years. In Russia the cost is 10*l.* to 12*l.* annually. In New South Wales the cost is as much as 25*l.* to 30*l.* annually. Thus there are great differences in the expenses of a university education, but in every country there are scholarships and bursaries for deserving students.

The educational conditions in Great Britain and Ireland have been ably described by the Hon. Mrs. Franklin, who represents the National Union of Women Workers (or British National Council) upon the International Council of Women.

The information gathered together in this very inexpensive pamphlet is full of suggestion, and if the pamphlet succeeds in making for itself a circulation, there is little doubt but that the various contributors will be encouraged to amplify their statements at a future date, and to reissue this trustworthy record of educational conditions and advances from time to time. The International Council of Women is undoubtedly fulfilling its high ideals in placing its world-organisation, at present presided over by the Countess of Aberdeen, at the service of the public in such ways, and it is sincerely to be hoped that every encouragement will be given to the disinterested work of the council in the cause of education.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Dr. J. B. Hurry, of Reading, has offered to present to the University securities adequate for the endowment of a research studentship in physiology of the value of 100*l.*, tenable for one year, and available every two years. He suggests that the holder of the studentship should bear the title of "Michael Foster Research Student," in memory of one who did much for the

establishment of the biological and medical schools at Cambridge.

The General Board of Studies has reported in favour of establishing a lectureship in experimental morphology, and should the report be adopted it asks for powers to appoint C. Shearer, of Clare College, subject to the confirmation of the Special Board for Biology, as the lecturer for a period of five years.

Applications for the John Lucas Walker studentship, the holder of which shall devote himself (or herself) to original research in pathology, are invited, and should be sent, before February 19, to Prof. G. Sims Woodhead, Pathological Laboratory, New Museums, Cambridge, to whom also applications for further information regarding the studentship may be addressed. The studentship is of the annual value of 200*l.* (grants may also be made for assistance and apparatus), and is tenable for three years from April 18.

The Special Board for Biology and Geology reports that the Gordon Wigan income for 1911 has been applied as follows:—(*a*) 50*l.* to Prof. Hughes, being 40*l.* for a motor for driving a rock-slicing machine and 10*l.* for the forwarding of Pleistocene research; (*b*) 50*l.* to Prof. Punnett in order that the Botanic Garden Syndicate may continue to offer special facilities for plant-breeding experiments; (*c*) 50*l.* to Prof. Gardiner for the care and development of the collections of insects.

OXFORD.—The Weldon memorial prize has been awarded to Prof. Karl Pearson, F.R.S. This prize was founded in memory of the late Prof. Weldon, and is awarded to the person who, in the judgment of the electors, has during the last six years published the most noteworthy contribution to biometric science.

Dr. Merry, Rector of Lincoln College, has addressed a letter to the Vice-Chancellor in which he says that the college is now in a position to respond to the appeal made some time ago for help to the University in the way of contribution to the endowment of some of the professorships. A fellowship in the college has been offered to and accepted by the professor of pathology (Prof. G. Dreyer).

Sir E. Ray Lankester, K.C.B., F.R.S., Mr. M. E. Sadler, Vice-Chancellor of Leeds University, and the Duke of Northumberland, K.G., F.R.S., have been elected honorary students of Christ Church.

A REUTER message reports that Sir Charles N. E. Eliot, K.C.M.G., formerly Commissioner and Commander-in-Chief for the British East Africa Protectorate, and Vice-Chancellor of the University of Sheffield, has been nominated principal of Hong Kong University.

A SERIES of nine free popular lectures is being given in the new lecture hall of the Horniman Museum, Forest Hill, S.E., at 3.30 o'clock on Saturday afternoons. The lectures commenced on Saturday last, when Dr. H. S. Harrison, curator of the museum, lectured on "A Museum of Evolution."

WE learn from *Science* that the will of the late Mrs. E. H. Hitchcock provides that the Hitchcock mansion and the estate of forty-five acres, valued at 10,000*l.*, shall go to Dartmouth College. To the Howe Library of Hanover, occupying the ancestral home of Mrs. Hitchcock, an endowment of 10,000*l.* is left. To the Pine Park Association, a society formed to preserve the natural beauties of the town, is bequeathed a large tract of woodland adjoining the Vale of Tempe.

THE fellowship of the City and Guilds of London Institute has been conferred upon Mr. Noel Deerr and Mr. Leonard P. Wilson. This distinction is conferred upon students who, having obtained the associateship and spent at least five years in actual practice, produce evidence of having done valuable research work or of having otherwise contributed to the advancement of the industry in which they are engaged. Since Mr. Noel Deerr gained his associateship at the City and Guilds (Engineering) College he has been occupied as chemist to cane-sugar factories, and has rendered signal services to the cane-sugar industry. Since Mr. Leonard P. Wilson gained his diploma he has held the Leathersellers' Company's research fellowship. He is now a chemist at one of the artificial silkworks at Coventry. His work in connection with the artificial silk industry has been of special value.

A COPY of the report of the Librarian of Congress and the report of the superintendent of the library building and grounds for the year ending June 30, 1911, has been received from Washington. In the internal affairs of the library the record of the year shows rather a steady progress along lines now well established than any novelty of importance, except the more systematic and extended distribution of copyright duplicates to other Federal libraries. The library has recently been the beneficiary of two bequests from Europe. One, in 1910, was by the late Mr. Henry Harrisse, an American long resident in Paris, the cartographer and historian of the period of Columbian discovery; the other, in May, 1911, by the late Dr. A. B. Meyer, director of the Dresden Museum of Zoology, of the letters of Prof. F. Blumentritt, of Leitmeritz, on account of the many items of information relating to the Philippines. We notice that the grants to the library in 1911 amounted to 133,400*l.*, and that the expenditure during the same period reached 131,000*l.*

THE future of the London Institution has been under the consideration of the board of the institution for some time. The Government has been approached on the question of the inauguration of a scheme to utilise the institution as a school of Oriental languages. At a meeting of the board, held on February 1, it was decided to issue a circular to the proprietors of the institution reviewing the situation and enumerating proposals for founding the London Institution for Oriental Languages. The circular was published in *The Times* of February 2, and we notice that it is proposed to provide, say, 20,000*l.* to 25,000*l.* by grants from Government, and an annual income, towards which the Government has agreed to contribute 4000*l.* a year. It is also proposed to transfer to the new governing body, or to the Government for the use of the new governing body, the freehold property of the institution and all other property of the institution, except its funds at present invested in Consols. It should be pointed out that in order to carry the proposals into effect an Act of Parliament will be required, but as the proposals meet with the approval of the Government, it is not anticipated that this would be a matter of difficulty.

A FEW months ago reference was made in these columns to a movement to ensure that a girl's education should include some knowledge of the science which affects home problems and some practice in the domestic arts. To give practical effect to the views then expressed, it was necessary for a university to open its doors to special courses for training women in the study of the science of the household, and thus ensure for schools a continual supply of teachers trained to impart the knowledge on which the necessary reforms must be based. King's College for Women had made a most successful start in educating women on these lines, but the movement could not be carried on successfully without adequate endowment. The sum of 100,000*l.* was needed—20,000*l.* to provide a hostel for the practical training in domestic arts and as a residence for women students, 20,000*l.* for building and equipping laboratories, and 60,000*l.* for the endowment of salaries for professors and lecturers. A trust fund committee was formed to receive moneys given for this purpose, and the announcement is now made that the whole of the 100,000*l.* required has been subscribed privately in the course of a few months. The Marquis of Anglesey gave 20,000*l.* to build and equip the laboratories, and another 20,000*l.* was given anonymously to found the hostel, which her Majesty has allowed to be called Queen Mary's Hostel. Mrs. Wharrie gave a sum of 20,000*l.* to provide for the teaching of chemistry, in memory of her father, the late Sir Henry Harben, and when it was known that yet 30,000*l.* was required, another donor, who had already by his influence rendered splendid service to the movement, at once came forward and gave this amount to complete the endowment. The fund will be administered in accordance with the terms of the trust deed by an executive committee composed of representatives of the subscribers and of King's College for Women, including Lady Meyer and Lady Rücker, who were the pioneers of the scheme. Negotiations are now proceeding respecting a site for the hostel and for the new buildings of King's College for Women, in which will be incorporated the laboratories of the home science department.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, February 1.—Sir Archibald Geikie, K.C.B., president, in the chair.—Dr. A. **Harden** and Dorothy **Norris**: The bacterial production of acetylmethylcarbinol and 2 : 3-butylene glycol from various substances. *B. lactis aërogenes* and *B. cloacae*, when grown in a peptone solution containing either glucose, lævulose, mannose, galactose, arabinose, isodulcite, or adonitol, produce both acetylmethylcarbinol and 2 : 3-butylene glycol. Glycerol, ethylene glycol, and acetaldehyde under similar conditions also give rise to butylene glycol in presence of *B. lactis aërogenes*, but no acetylmethylcarbinol is produced. In these three cases a carbon synthesis is involved analogous to that which occurs in the butyric fermentation of glycerol and lactic acid. The fermentation of citric and malic acids, of dihydroxyacetone, and of peptone water gives rise to neither carbinol nor glycol.—J. **Thompson**: The chemical action of *Bacillus cloacae* (Jordan) on glucose and mannitol. The *B. cloacae*, like *B. lactis aërogenes*, produces a considerable proportion of 2 : 3-butylene glycol from glucose and mannitol, as well as a small amount of acetylmethylcarbinol. The other products are alcohol, acetic, lactic, formic and succinic acids, carbon dioxide, and hydrogen. As in the cases of *B. lactis aërogenes* and *B. coli communis*, the percentage of alcohol produced from mannitol is about double that formed from glucose.—J. H. **Mummery**: The distribution of the nerves of the dental pulp. The object of the paper is to demonstrate, with the author's preparations, that the nerve fibres of the dental pulp do not terminate, as considered by most histologists, at the pulp margin, but that, although they here form a narrow plexus, fine neurofibrils pass out from it in great abundance and enter the dentinal tubes, traversing the dentine in intimate association with the dentinal fibrils to the inner margin of the enamel and cementum. The bundles of medullated nerve fibres which enter the tooth at the apical foramen traverse the pulp in more or less parallel lines, running in most cases in company with the blood vessels. They send off numerous side branches, which at the periphery of the pulp lose their medullary sheath, the axis cylinders spreading out into a mass of neurofibrils which enter into a more or less dense plexus beneath the odontoblast layer. These neurofibrils are more abundant towards the crown of the tooth, and are scattered and nearly absent in the lower part of the root. Fine fibrils are met with in the substance of the pulp, but in much greater abundance at the margins, in the neighbourhood of the odontoblast layer. At the periphery of the pulp these fibres break up into a plexus, known as the plexus of Raschkow, immediately beneath the layer of odontoblast cells. From this plexus fine neurofibrils pass between and around the odontoblasts, enclosing them in a meshwork and entering into a narrow plexus at the inner margin of the dentine, from which fine fibres are given off to the dentinal tubules. In the substance of the dentine in well-impregnated preparations fine dotted lines can be traced in the tubules. In the majority of cases there appear to be two fibres in each tubule. These dotted lines can be traced in many preparations to the inner margins of the enamel and cementum.—F. W. **Twort** and G. L. Y. **Ingram**: A method for isolating and cultivating the *Mycobacterium enteritidis chronicae pseudotuberculosae bovis* (Jöhne), and some experiments on the preparation of a diagnostic vaccine for pseudo-tuberculosis of bovines. In 1910 the authors demonstrated the possibility of obtaining a pure growth of Jöhne's bacillus on a medium containing the powdered substance of the dead human tubercle bacillus. This medium was suggested by the possibility that previous failures in attempts to cultivate the micro-organism of Jöhne's disease had resulted from an inability on the part of the bacillus to build up some necessary part of its food material, and that this part might be supplied ready formed in the bodies of the dead tubercle bacilli. During the past year the authors have tested the growth of Jöhne's bacillus on media modified by substituting 1 per cent. of other dead acid-fast bacilli in place of human tubercle bacilli. They have experimented with seventeen varieties, and have obtained positive results with a large number, but negative results with others, including the bovine tubercle bacillus. These experiments demonstrate a hitherto unrecognised difference between the human and bovine types of tubercle bacilli. The authors have also succeeded in extracting, by means of hot ethyl alcohol and other solvents, the essential substance (existing in the various acid-fast bacilli) which is needed by Jöhne's bacillus for its vitality and growth. The strains of Jöhne's bacillus which they have isolated have been inoculated into a number of animals, with negative results in the case of rabbits, hens, pigeons, guinea-pigs, rats, and mice, thus furnishing further proof that Jöhne's bacillus is not a variety of the human, bovine, or avian tubercle bacillus. The inoculation of calves and a cow with strains of bacilli isolated from cases of pseudo-tuberculous enteritis has reproduced the disease with its typical characteristics, and the bacilli have been again isolated from the artificially infected areas, and show the characters of the bacilli originally inoculated. Avian tuberculin, originally recommended by Bang, of Copenhagen, for the diagnosis of Jöhne's disease, has in the authors' hands given negative results. They have prepared diagnostic and other vaccines from their pure cultures of Jöhne's bacillus, but so far have been unable to obtain a diagnostic vaccine of sufficient strength. As the bacillus is now growing more vigorously, the authors hope to overcome this difficulty in the near future.—E. A. N. **Arber**: The fossil flora of the Forest of Dean Coalfield (Gloucestershire) and the relationship of the coalfields of the west of England and South Wales.—Dr. F. W. **Edridge-Green**: Simultaneous colour contrast. (1) The colours and changes of colour which are seen on simultaneous contrast appear to be due to the exaggerated perception of objective relative difference of the contrasted lights. Whilst all the known contrast phenomena are easily explicable on this view, there are many facts which are opposed to the older theories. For instance, spectral yellow or pigment yellow contrasted with green do not appear red when seen through a blue-green glass, which is impervious to the red rays. (2) A certain difference of wave-length is necessary before simultaneous contrast produces any effect. This varies with different colours. (3) A change of intensity of one colour may make evident a difference which is not perceptible when both colours are of the same luminosity. (4) Simultaneous contrast may cause the appearance of a colour which is not perceptible without comparison. (5) Both colours may be affected by simultaneous contrast, each colour appearing as if moved further from the other in the spectral range. (6) Only one colour may be affected by simultaneous contrast, as when a colour of low saturation is compared with white. (7) When a false estimation of the saturation or hue of a colour has been made, the contrast colour is considered in relation to this false estimation. That is to say, the missing (or added) colour is deducted from (or added to) both. (8) A complementary contrast colour sensation does not appear in the absence of objective light of that colour.—Prof. H. E. **Armstrong** and E. **Horton**: Studies on enzyme action. XIV.—Urease, a selective enzyme.

Linnean Society, January 18.—Dr. D. H. Scott, F.R.S., president, in the chair.—Dr. A. Anstruther **Lawson**: Some features of the marine flora at St. Andrews.—Miss E. L. **Turner**: Discovery of a nestling bittern in Norfolk on July 8, 1911. Slides were shown from photographs taken by the author, and they showed the young bird in its protective attitude simulating a bundle of reeds, and the nest itself.

Mineralogical Society, January 23.—Prof. W. J. Lewis, F.R.S., president, in the chair.—Miss M. W. **Porter** and Dr. A. E. H. **Tutton**: The relationship between crystalline form and chemical constitution; the double chromates of the alkalies and magnesium. The investigation of the crystals of ammonium-magnesium chromate containing $6H_2O$, and of those of the analogous salts containing rubidium and cæsium (the formation of the corresponding potassium salt being impossible), shows not only that the double chromates belong to the same monoclinic series as the double sulphates and selenates previously investigated by Dr. Tutton, but that their mutual relationships are precisely parallel to those afforded by the other groups of the series. The rubidium and cæsium salts exhibit the

same progressive changes of morphological and physical properties in the same direction as the rubidium and cæsium salts of all the other groups investigated, so that if the potassium salt could be prepared the three salts would undoubtedly form a eutropic group progressive in properties in accordance with the atomic weights of the three alkali metals, and it is even possible to predict the properties of the missing potassium salt. As in all the other cases, the ammonium salt is isomorphous, and not eutropic. Moreover, the double chromates are isomorphous and not eutropic with the eutropic sulphates and selenates.—Prof. W. J. **Lewis**: A lead-grey sulpharsenite from Binn, probably liveingite. The crystals have two prominent zones mutually inclined at 90°, the one markedly oblique and the other prismatic in symmetry. Assuming oblique symmetry, the face-symbols are very high numbers; assuming anorthic symmetry, they are simple, but the crystals possess several relations characteristic of oblique symmetry, and twinning, though undoubtedly occurring, is not a satisfactory explanation.—R. H. **Solly** and Dr. G. F. H. **Smith**: A new anorthic mineral from the Binnenthal. Since no further crystals have come to light similar to the five minute ones found in 1902 by Mr. Solly on a crystal of, probably, rathite, they have recently been remeasured. They are lead-grey, and their streak is chocolate in colour, and they are therefore probably a sulpharsenite of lead. No axes or plane of symmetry were observed, and the symmetry is therefore anorthic. The fundamental constants are $a:b:c=0{\cdot}9787:1:1{\cdot}1575$; $\alpha=116°\ 53\frac{1}{2}'$, $\beta=85°\ 12'$, $\gamma=113°\ 44\frac{1}{2}'$; 010 : 001 = 62° 41′, 001 : 100 = 83° 4½′, 100 : 010 = 65° 46′; and about twenty-one forms were observed, of which the most prominent are 100, 010, 001, $\bar{1}10$, $1\bar{1}1$, $11\bar{1}$.—Dr. A. **Hutchinson**: Colemanite and neocolemanite. By a slight change in the orientation adopted for the crystals of the latter mineral, its crystallographic and optical properties can be brought into harmony with those of the former. This can be effected by a rotation of the crystal through 180° about the normal to the face 001, 100 of neocolemanite then coinciding with $\bar{2}01$ of colemanite.—Dr. A. **Hutchinson** and Dr. A. E. H. **Tutton**: Further observations on the optical characters of gypsum. With the aid of new apparatus, by which the section-plate of gypsum perpendicular to the first median line can be surrounded during observations of the interference-figure by flowing hot water, of which the temperature is accurately recorded both immediately before and after passing the crystal, the authors have been able to prove definitely that the temperature at which gypsum becomes uniaxial is for sodium light 91°, for red C and greenish-blue F hydrogen light 89°, and for the violet hydrogen line near G 87°. These temperatures agree precisely with those observed for the exact superposition of the pair of images of the spectrometer slide, afforded by a 60° prism cut to give the α and β refractive indices. Owing to the large correction necessary for conduction of the crystal holder, when the ordinary Fuess air-bath heating apparatus was employed, and to the difficulty in determining it, former determinations of the temperature at which a section-plate of gypsum becomes uniaxial were too high, and did not agree with the prism observations.—Dr. G. F. H. **Smith**: Note on a large crystal of anatase from the Binnenthal. The crystal exhibits a combination of the forms $a(100)$, $\tau(313)$, and $z(113)$, and the others not prominent, and it is remarkable for the fact that the faces τ have been entirely replaced by numberless tiny crystals with the forms $z(113)$, $k(112)$, $p(111)$, and $e(101)$, and the same orientation as the large crystal.

Geological Society, January 24.—Prof. W. W. Watts, F.R.S., president, in the chair.—Dr. C. A. **Matley**: The Upper Keuper (or Arden) Sandstone group and associated rocks of Warwickshire. The stratigraphy of a sandstone zone in the Keuper Marls of Warwickshire, well exposed in the area formerly occupied by the Forest of Arden, is described. This zone varies in lithological composition and thickness. It is never wholly a sandstone, but always contains beds of light grey and pale green shale, marl, and mudstone. The sandstone usually forms thin, flaggy, white or light grey beds, and exhibits ripple-marks, current-bedding, and surfaces with footprints and sun-cracks. The zone contains *Estheria minuta*; plants; teeth, spines, and scales of fishes; tracks and remains of labyrinthodonts and reptiles; and occasional casts of molluscan shells. The zone was first described by Murchison and Strickland in 1837, but has not hitherto been completely mapped. The author traces it from the type-locality at Shrewley over an area of 108 square miles, and finds that it forms a continuous deposit at an horizon between 120 and 160 feet below the base of the Rhætic. He accepts the view of Murchison and Strickland, and he also correlates with it the similar deposit at Leicester described by Plant. The formation was probably formed, as an episode in the history of the Keuper Marls, by an irruption of the sea into the Keuper Marl area. It represents a phase corresponding to that of the Rhætic bone-bed and the tea-green Marls, but of somewhat earlier date. The author is inclined to the view of the older observers that the Marls are aqueous deposits, though possibly containing much wind-borne material, deposited in a shallow lake undergoing strong evaporation and subjected to occasional irruptions of the sea. They represent the closing phase of Triassic "continental" conditions in the English Midlands, when the slow subsidence which was soon to bring in marine Rhætic and Liassic deposits was in progress, and produced that overlapping of the Keuper rocks on to the higher grounds of the Triassic land-surface which is observable in the neighbouring districts of the Lickey Hills, Nuneaton, and Charnwood Forest. The paper also records three well-borings through the Marls into the Lower Keuper Sandstone.

Physical Society, January 26.—Prof. H. L. Calnelard, F.R.S., president, in the chair.—R. **Appleyard**: A direct reading instrument for submarine cable and other calculations. The logarithmic spiral has frequently been used for determining by a graphic method the logarithm of the ratio of two quantities. If an attempt is made to apply the spiral to the solution of engineering problems, such as arise in the design of submarine cables, there is difficulty in obtaining sufficient accuracy, especially for readings near the pole of the spiral. This defect has been removed by introducing a secondary spiral, similar in all respects to the primary spiral, and having the same pole, but displaced round the pole through a certain constant angle. A pair of radial scales, each having its zero at the pole, and each divided into the same number of equal divisions, can be rotated about the pole. At all angular positions a scale of this kind will be cut by the two spirals if they are sufficiently extended. For all angular positions of such a radial scale the distance between the pole and the point where that radial scale is cut by the secondary spiral is always the same multiple of the distance between the pole and the point where the radial scale is cut by the primary spiral. In effect, the secondary spiral magnifies the radial scale readings of the primary spiral to any desired extent, depending only upon the angle through which the template of the primary spiral is rotated to form the secondary spiral. The spirals are drawn in a manner that avoids ambiguous readings, and give maximum precision within the range of diameters of conductors and dielectric coverings required for submarine cable work. The instrument is provided with two similarly divided radial scales, one corresponding to d, the diameter of the conductor, and the other corresponding to D, the diameter of the dielectric. The angle between the two scales, corresponding to any pair of values of d and D, is then a measure of $\log D/d$. The scales can be marked to indicate weights of conductor and dielectric, and the circle of degrees to which the spiral is drawn can be marked to indicate $\log D/d$, capacity, dielectric resistance, and other functions of D and d, if required, for any definite dielectric, the specific constants of which are known. The general equation to the spiral may be written $\theta=A\log d+B$, where A and B are constants. To draw the secondary spiral, the primary spiral is rotated backwards about its pole through an angle ϕ. This is equivalent to rotating both the radial scales through ϕ. The intercepts are now d_1 and D_1—*i.e.* the radial scale readings are now greater in the ratio $n=\frac{d_1}{d}=\frac{D_1}{D}$.—S. **Butterworth**: The vibration galvanometer and its applications to inductance bridges. Vibration galvanometers are divided into two types, according as their moving parts possess only one or an infinite

number of degrees of freedom. A theory of the former type of galvanometer when used in circuits containing inductance and capacity is worked out, and the conditions of maximum sensibility are determined. The same theory is applicable to the string type of galvanometer provided that the damping is small. The results are applied in the case of a general inductance bridge: (*a*) Anderson's bridge, (*b*) a modified Rimington's bridge, (*c*) Heydweiller's modification of the Carey-Foster bridge, and (*d*) a bridge for measuring frequency. The best conditions for working Anderson's bridge with the vibration galvanometer as detector are obtained. Experimental results for methods (*b*) and (*d*) are quoted.—Dr. P. E. **Shaw**: Sealing-metals. The established method of fixing quartz fibres for accurate torsion experiments is due to Prof. C. V. Boys. It involves considerable trouble, which can be avoided by the means given, while the resulting joint is in some cases stronger. Prof. Threlfall used Margot's solder to fasten glass, aluminium, or quartz surfaces to any other. This material acts perfectly, and is simple, the bit being of aluminium, and there being no flux. Investigation shows that there is no special merit in Margot's formula. In place of Margot's solder the following act very well:—(*a*) tin; (*b*) zinc; (*c*) alloys of tin and zinc; (*d*) tinman's solder; (*e*) aluminium. Lead does not stick well. Then there is a variety of materials with melting point ranging from 180° to 660°. For all materials which act in the same manner as sealing-wax the term sealing-metals is suggested. They have the advantages over any wax in (*a*) high melting point, (*b*) non-emission of vapour when temperature is raised. There are applications other than for tension fibres where joints to withstand temperature are required.—Dr. J. H. **Vincent** and A. **Bursill**: A negative result connected with radio-activity. Specimens of iron, antimony, and bismuth were subjected to a high-frequency alternating magnetic field. The air in the neighbourhood was tested for any ionisation that might have been thus produced. The results were negative.—Prof. A. **Anderson**: A copper-zinc uranium oxide cell and the theory of contact electromotive forces. A uranium oxide cell with copper and zinc plates is described, and reference is made to the temperature coefficient of its E.M.F. A difficulty connected with the energetics of the cell is pointed out, and a possible explanation put forward tentatively.

Royal Anthropological Institute, February 6.—D. **MacRitchie**: The kayak in north-western Europe. The kayak, or skin canoe of the Eskimos, was in use on the coast of northern Russia two or three centuries ago. Evidence of this is obtained from statements made by Burrough in 1556, and from the chronicles of a Danish expedition to Vaigatz in 1653. It appears that the natives of that coast not only used the ordinary kayak, constructed to hold one person, but also built kayaks capable of holding two occupants, a variety of this canoe which is nowadays specially associated with western Alaska and the Aleutian Isles. It was further shown that three kayaks were captured off the northern shores of Scotland about the end of the seventeenth century. One of these is still preserved in the museum of Marischal College, Aberdeen. An important fact is the occasional presence of a kayak-using race of "Finns" or "Finnmen" in the Orkney Islands during the last twenty years of the seventeenth century, as testified to by three writers of that period. The Orkney people being of Norse stock, the word "Finn" would bear to them the meaning of the Swedish "Lapp." It is consequently worthy of note that the mountain Lapps have a tradition that their ancestors crossed into Sweden from Denmark in small skin boats, and that the only Lapp name for a boat denotes a skin canoe, propelled by paddles, and devoid of rowers' seats and steering place. The comparatively recent survival of Lapp communities in southern Norway was also referred to. After considering the theories of castaways from Greenland, and of Eskimos brought captive to Europe who had subsequently regained their freedom, the lecturer expressed himself in favour of the hypothesis that the Orkney "Finnmen" of the seventeenth century, like their kayak-using contemporaries on the north Russian coast, were the unassimilated remnants in Europe of people of Eskimo type, whose range in earlier times had been wholly circumpolar.

MANCHESTER.

Literary and Philosophical Society, January 23.—Prof. F. E. Weiss, president, in the chair.—Thomas **Thorp**: A crossed transparent grating. The secondary spectra produced by the crossing of the gratings are quite pure and free from all "scatter."—J. R. **Gwyther**: The modes of rupture of an open hemispherical concrete shell under axial pressure. The author gave an account of tests carried out with nine specimens he had prepared, made of concrete in the proportion of 1 : 1½ : 2, the aggregate being ¼-inch chippings, and the results obtained by subjecting these shells in the ordinary way to compression in a horizontal testing machine. "Longitudinal" cracks in meridional planes first appeared, spreading gradually, and the shells ultimately broke by an irregular crack roughly along a parallel of "latitude," the mean height being approximately 0·6 the height of the shell. The vertex of the cone of fracture roughly coincided with the centre of the base. In the plain specimens the "longitudinal" cracks began at the base; in the specimens reinforced at the base they commenced at the top; and in the specimens reinforced both at the base and the top they commenced around the middle of the shell. Mr. Gwyther concluded that the "ring tension" was comparatively small, that the fracture depended on the load and not the stress, and that the final rupture was due to an excessive "bending moment." He gave a table he had prepared showing the vertical breaking loads in tons and breaking stresses in pounds per square inch.—R. F. **Gwyther** read a note on the mechanical conditions involved in the foregoing question

DUBLIN.

Royal Irish Academy, January 23.—Rev. Dr. Mahaffy, president, in the chair.—H. **Ryan** and T. **Dillon**: Higher tertiary alcohols derived from palmitic and stearic esters. Some discrepancies between theory and experiment in the analysis of beeswax suggested an examination of the properties of higher tertiary alcohols, but as substances of this class have been, with one exception, hitherto unknown, it was necessary to attempt their synthetical preparation. Good yields of higher tertiary alcohols were obtained by the action of alphyl and aryl magnesium halides on the esters of palmitic and stearic acids. By dropping concentrated sulphuric acid into a hot solution of a higher fatty acid in alcohol a second liquid phase, consisting of the nearly pure esters, forms, and hence, rapidly and quantitatively, the fatty acid is converted into its ester. The method is an extremely convenient one for the preparation of such esters. The tertiary alcohols formed esters with acetyl chloride, but with acetic anhydride and sodium acetate mixtures of esters and unsaturated hydrocarbons were obtained. Phenyl isocyanate did not form urethanes with them, and when they were heated with potash-lime to 230° C., unlike the corresponding primary alcohols, they underwent no change.—A. **McHenry**: Report on the Dingle Bed rocks. It is suggested by the author that the seeming conformable succession on the south is due to inversion and overthrusting of the rocks, and that the true position of the "Dingle Beds" in the geological succession is at the bottom of the Upper Silurians, and that they are probably of Llandovery age; while on the north and north-east sides of the fossiliferous Silurian inlier, the rocks there, called "Smerwick Beds" on the Survey map, are the equivalents in age to the "Dingle Beds," and come in their true and regular order below the Wenlock division of the Silurians. The exact similarity of the "Dingle Beds" and "Smerwick Beds" in all their characters is very apparent in the field, and was even noticed by Du Noyer when surveying the district more than fifty years ago. The author has no doubt of their being the one set of strata, and probably of Llandovery age.—Rev. Canon **Lett**: Mosses and hepatics (Clare Island Survey). A total of 272 mosses and 140 hepatics were found in the district, of which 27 mosses and 22 hepatics occurred on the island only, and 95 mosses and 42 hepatics on the mainland only. Eight hepatics were hitherto unknown in Ireland, while *Scapania nimbosa* and *Riccia serocarpa* had previously only one station in the country (South Kerry).—Miss G. **Lister**: Mycetozoa (Clare Island Survey). In the Clare Island district 31 species were found during a visit last November.

Advantage is taken of this report to summarise our knowledge of this group in Ireland. Some 65 species in all are on record from the country, but about six of these are regarded as probably erroneously recorded.—Carleton **Rea** and Sir H. C. **Hawley**: Fungi (Clare Island Survey). Previous to the present survey only two species of fungi were on record for the county of Mayo. Some 750 species are now recorded, of which nearly 300 are new to the Irish flora. One new genus of Hyphomycetæ—Candelospora, Hawley—and one new Agaric—*Hygrophorus squamulosus*, Rea—are described. On Clare Island itself a list of 284 species of fungi was compiled.—A. W. **Stelfox**: Land and fresh-water Mollusca (Clare Island Survey). This group was closely studied not only on Clare Island, but along the whole coast of Mayo, and on the adjoining islands of Inishtusk, Caher, and Inishbofin, and analyses of the faunas of the different parts of the area are made. In the whole district 90 species of Mollusca were found. Of these, 58 occur on Clare Island, two of which are looked on as owing their introduction to man.

EDINBURGH.

Royal Society, January 8.—Dr. John Horne, F.R.S., vice-president, in the chair.—Dr. **Kidston** and Prof. Gwynne **Vaughan**: The Carboniferous flora of Berwickshire. Part i. *Stenomyelon tuedianum*, Kidst. The description was founded on a specimen found by the late Mr. Matheson, Jedburgh, in 1859, and additional material found in the original locality in 1901. Briefly put, it is as follows:—stem monostelic, primary xylem without xylene parenchyma, divided more or less distinctly into three lobes by as many radiating and interrupted bands of parenchyma; primary tracheæ porose on all walls, the protoxylems of the leaf traces decurrent as exarch strands on the extremities of the lobes; secondary thickening occurs, secondary tracheæ with porous pith on radial walls only; medullary rays numerous; stele closely invested by a zone of sclerotic periderm; leaf traces depart successively from the extremities of the lobes and repeatedly divide in the cortex; leaf-trace protoxylems become immersed; the outer cortex of the "Spargonum" type. The stem possesses so many features peculiar to itself that in the present state of our knowledge it is unsafe to speculate as to its relationship to the other members of the Cycadofilices. It is perhaps best to let it remain among that nebulous group in which it has already provisionally been placed by Dr. Scott. At the same time, it should be noted that the absence of independent meristeles in the cortex of the stem separates it widely from *Sutcliffia insignis*, Scott, with which one might be tempted to compare it.—Dr. F. J. **Cole**: A monograph on the general morphology of the myxinoid fishes, based on a study of Myxine. Part iv. On some peculiarities of the afferent and efferent branchial arteries of Myxine. These peculiar structures are called vascular papillæ, and have been found in some cases to be the means by which blood is passed direct from the arteries into the surrounding "lymphatic" peribranchial sinuses. Such blood re-enters the blood stream *via* the superior jugular veins. The so-called lymphatic spaces of Myxine contain normally red blood, and therefore must be excluded from the lymphatic system *sensu stricto*. They are, however, not situated directly in the course of the blood stream, but partake of the nature of both systems. The Myxinoids are in the act of acquiring a definite lymphatic system.—Prof. Sutherland **Simpson**: The effect of changing the daily routine on the diurnal rhythm in body temperature. Experiments were made on the daily variation in body temperature during travel across the American continent and across the Atlantic Ocean. It was found that the body quickly adjusted itself to the new conditions, so that the diurnal rhythm depended entirely on the daily routine.—Prof. David **Hepburn**: The Scottish National Antarctic Expedition. Observations on the Weddell seal. Part ii. The paper gave an account of the genito-urinary organs of a young *Lèptonychotes weddelli*, captured and embalmed by the naturalist of the Scottish Antarctic Expedition. A detailed account was given of the following special points:—the adaptation of the pelvic organs to the great obliquity of the osseous pelvis; the allantoidal shape of the urinary bladder, which extended as far forwards as the umbilicus; the presence of prostatic glandular tissue, as revealed by the microscope; the presence of a cylindrical piece of developing bone common to both corpora cavernosa penis; the absence of a scrotum, and the lodgment of each testis in a subcutaneous recess showing no surface bulging; the absence of vesiculæ seminales; the presence of a bilateral retractor penis muscle composed of unstriped muscle fibres, probably representing the tunios dartos of the absent scrotum.

GÖTTINGEN.

Royal Society of Sciences.—The *Nachrichten* (physico-mathematical section), parts iv. and v. for 1911, contain the following memoirs communicated to the society:—

June 17.—K. **Wegener**: The *rôle* of direct radiation in the temperature-period of the air at low and middle altitudes of the troposphere.—A. **Bestelmeyer**: The path of the kathode rays proceeding from a Wehnelt kathode in a homogeneous magnetic field.

July 1.—E. **Landau**: The partition of numbers compounded of ν prime factors.—K. **Försterling**: Formulæ for the computation of the optical constants of a metallic film of given thickness from the polarisation conditions of the reflected and transmitted light.

July 29.—H. **Bohr**: The behaviour of the zeta function $\zeta(s)$ in the half-plane $\sigma > 1$.—C. **Runge**: Graphical solution of the boundary conditions of the equation

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0.$$

—P. **Bachmann**: Materials for a scientific biography of Gauss: (i) on Gauss's work in the theory of numbers.

September 14.—Th. v. **Kármán**: The mechanism of the resistance experienced by a moving body in a liquid.

October 13.—R. **Fricke**: The transformations of automorphic functions (dedicated to Richard Dedekind on his eightieth birthday).

October 28.—G. **Tammann**: Equations of condition in a region of small volume.—R. **Wedekind**: Contributions to the knowledge of the Upper Devonian series at the northern margin of the slate ridge (Schiefergebirge) on the right bank of the Rhine.

The Business Communications (part ii.) include a discourse on "Metamorphic Processes in the Crystalline Slates," by O. **Mügge**, and congratulatory addresses to Prof. Waldeyer, and to the Universities of Breslau, Christiania, and St. Andrews.

BOOKS RECEIVED.

The Practical Science of Billiards and its "Pointer." By Colonel C. M. Western. Pp. iv+153. (London: Simpkin and Co., Ltd.) 3*s*. 6*d*. net.

The University of Missouri Studies. Vol. ii. Science Series:—The Flora of Boulder, Colorado, and Vicinity. By Prof. F. P. Daniels. Pp. xiii+311. (University of Missouri.) 1.50 dollars.

A Shorter Geometry. By C. Godfrey, M.V.O., and A. W. Siddons. Pp. xxii+301. (Cambridge University Press.) 2*s*. 6*d*.

South African Zoology. By Prof. J. D. F. Gilchrist. Pp. xi+323. (Cape Town: T. Maskew Miller.) 10*s*. 6*d*. net.

Fortschritte der Naturwissenschaftlichen Forschung. Edited by Prof. E. Abderhalden. Vierter Band. Pp. 299. (Berlin & Wien: Urban & Schwarzenberg.) 15 marks.

The Arctic Prairies. A Canoe-journey of 2000 Miles in Search of the Caribou; being the Account of a Voyage to the Region North of Aylmer Lake. By E. Thompson Seton. Pp. xvi+415. (London: Constable and Co., Ltd.) 12*s*. 6*d*. net.

Practical Anthropology. By T. E. Smurthwaite. Pp. 40+2 charts. (London: Watts and Co.) 2*s*. 6*d*. net.

A School Chemistry. By F. R. L. Wilson and G. W. Hedley. Pp. xxii+572+diagram. (Oxford: Clarendon Press.) 4*s*. 6*d*.

Social Life in the Insect World. By J. H. Fabre. Translated by B. Miall. Pp. viii+327. (London: T. Fisher Unwin.) 10*s*. 6*d*. net.

How Other People Live. By H. Clive Barnard. Pp. 64. (London: A. and C. Black.) 1*s*. 6*d*.

An Elementary Text-book of Coal Mining. By R. Peel. Sixteenth edition. Pp. 386. (London: Blackie and Son, Ltd.) 3*s*.

A New Geometry. By W. M. Baker and A. A. Bourne. Books i.–iii. Pp. xxii+122+iii. (London: G. Bell and Sons, Ltd.) 1*s*. 6*d*.

Heat and the Principles of Thermodynamics. By Dr. C. H. Draper. New and revised edition. Pp. xv+428. (London: Blackie and Son, Ltd.) 5*s*. net.

The Prescribing of Spectacles. By A. S. Percival. Second edition. Pp. v+168. (Bristol: J. Wright and Sons, Ltd.) 5*s*. 6*d*. net.

The Problems of Philosophy. By the Hon. B. Russell, F.R.S. Pp. 255. (London: Williams and Norgate.) 1*s*. net.

Anthropology. By R. R. Marett. Pp. 256. (London: Williams and Norgate.) 1*s*. net.

Our Weather. By J. S. Fowler and W. Marriott. Pp. xi+131. (London: J. M. Dent and Sons, Ltd.) 1*s*. net.

Modern Theories of Diet and their bearing upon Practical Dietetics. By Dr. A. Bryce. Pp. xv+368. (London: E. Arnold.) 7*s*. 6*d*. net.

Tables of Logarithms and Anti-logarithms (Four Figures), 1 to 10,000. Arranged by Major-General J. C. Hannyngton. Pp. iv+41. (London: C. and E. Layton.) 1*s*. 6*d*. net.

Tables of Logarithms and Anti-logarithms to Five Places. By E. Erskine Scott. Students' edition. Pp. iii+383. (London: C. and E. Layton.) 5*s*. net.

A Nature Calendar. By Gilbert White. Edited, and with an Introduction, by W. M. Webb. Pp. xii+62+xiii–xx. (London: The Selborne Society.) 25*s*. net.

DIARY OF SOCIETIES.

THURSDAY, FEBRUARY 8.

ROYAL SOCIETY, at 4.30.—The Spectrum of Comet Brooks (1911*c*): Sir Norman Lockyer, K.C.B., F.R.S.—A Chemically-active Modification of Nitrogen produced by the Electric Discharge. III.: Hon. R. J. Strutt, F.R.S.—The Atomic Weight of Radium: R. Whytlaw-Gray and Sir W. Ramsay, K.C.B., F.R.S.—The Emission of Electricity from Carbon at High Temperatures: Dr. J. A. Harker, F.R.S., and Dr. G. W. C. Kaye.—The So-called Thermoid Effect and the Question of Superheating of a Platinum-silver Resistance used in Continuous-flow Calorimetry: Prof. H. T. Barnes, F.R.S.—An Optical Determination of the Variation of Stress in a Thin Rectangular Plate subjected to Shear: Prof. E. G. Coker.—Spectroscopic Observations. Lithium and Cæsium: Dr. P. V. Bevan.—A Metrical Analysis of Chromosome Complexes, showing Correlation between Evolutionary Development and Chromatin Thread-widths throughout the Animal Kingdom: Capt. C. F. U. Meek.

ROYAL INSTITUTION, at 3.—The Phenomena of Splashes: Prof. A. M. Worthington, C.B., F.R.S.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—High Voltage Tests and Energy Losses in Insulating Materials: E. H. Rayner.

ROYAL SOCIETY OF ARTS, at 4.30.—The North-East Frontier of India: Sir Thomas H. Holdich, K.C.M.G., F.R.S.

CONCRETE INSTITUTE, at 8.—Discussion on Prof. B. Pite's paper: The Æsthetic Treatment of Concrete.

MATHEMATICAL SOCIETY, at 5.30.—On Exceptions to a Generalisation of a Theorem of Jacobi's: A. C. Dixon.—On some Properties of Groups whose orders are Primes: Prof. W. Burnside.—Some results concerning Diophantine approximations: G. H. Hardy and J. E. Littlewood.

FRIDAY, FEBRUARY 9.

ROYAL INSTITUTION, at 9.—Very High Temperatures: Dr. J. A. Harker, F.R.S.

PHYSICAL SOCIETY, at 8.—Annual General Meeting.

ROYAL ASTRONOMICAL SOCIETY, at 5.—Anniversary Meeting.

ROYAL GEOGRAPHICAL SOCIETY, at 5.30.—Desert of North Africa: Captain H. G. Lyons, F.R.S.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Steam-turbines: Some Practical Applications of Theory: Captain H. Riall Sankey, R.E.

PHYSICAL SOCIETY, at 8.—Annual General Meeting.—Presidential Address: Prof. A. Schuster, F.R.S.

MALACOLOGICAL SOCIETY, at 8.—Annual Meeting. Presidential Address: On the Lower Tertiary Mollusca of the Fayum province of Egypt: R. Bullen Newton.

ASSOCIATION OF CHEMICAL TECHNOLOGISTS (at Battersea Polytechnic), at 8.—The Structure of Metals: Dr. J. C. Humfrey.

MONDAY, FEBRUARY 12.

ROYAL SOCIETY OF ARTS, at 8.—The Meat Industry. The Sheep and its Products: Loudon M. Douglas.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Explorations in Papua: Hon. Miles S. Smith.

TUESDAY, FEBRUARY 13.

ROYAL INSTITUTION, at 3.—The Study of Genetics: Prof. W. Bateson, F.R.S.

ROYAL GEOGRAPHICAL SOCIETY, at 5.—Desert of North Africa: Captain H. G. Lyons, F.R.S.

SOCIETY OF DYERS AND COLOURISTS, at 8.—New Apparatus for the Control of Water Purification and like purposes: Hon. R. C. Parsons.—Water Treatment by means of the Permutit Process: Dr. L. H. Harrison.

INSTITUTION OF CIVIL ENGINEERS, at 8.—*Further discussion:* The Water-supply of the Witwatersrand: D. C. Leitch.—Investigations Relating to the Yield of a Catchment-area in Cape Colony: E. C. Bartlett.

WEDNESDAY, FEBRUARY 14.

ROYAL SOCIETY OF ARTS, at 8.—Gem Engraving: Cecil Thomas.

ROYAL GEOGRAPHICAL SOCIETY, at 5.—Research Meeting.—Distribution of Early Bronze Age Settlements in Britain: O. G. S. Crawford.

THURSDAY, FEBRUARY 15.

ROYAL SOCIETY, at 4.30.—*Probable Papers:* A Specific Instance of the Transmission of acquired Characters—Investigation and Criticism: Dr. T. G. Brown.—Further Experiments on the Cross-breeding of two Races of the Moth *Acidalia virgularia*: W. B. Alexander.—On the Effects of Castration and Ovariotomy upon Sheep: F. H. A. Marshall.—The Causes and Prevention of Miners' Nystagmus: Dr. T. L. Llewellyn.—The Stomatograph: W. L. Balls.—Composition of the Blood Gases during the Respiration of Oxygen: G. A. Buckmaster and J. A. Gardner.

ROYAL GEOGRAPHICAL SOCIETY, at 5.30.—Desert of North Africa: Captain H. G. Lyons, F.R.S.

INSTITUTION OF MINING AND METALLURGY, at 8.

FRIDAY, FEBRUARY 16.

ROYAL INSTITUTION, at 9.—The Road: Past, Present and Future: Sir John H. A. Macdonald, K.C.B., F.R.S.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Annual General Meeting.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Works for the Prevention of Coast-erosion: W. T. Douglass.

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