THURSDAY, MAY 18, 1911.

THE NORTH POLE.

The North Pole. By Robert E. Peary. With an introduction by Theodore Roosevelt. Pp. xii+326. (London: Hodder and Stoughton, 1910.) Price 25*s.* net.

PEARY'S narrative of the journey by which he reached the North Pole and satisfied his life's ambition cannot fail to command the respect of all who appreciate indomitable perseverance, high courage, and unfaltering devotion to an ideal. Peary cheerfully accepted months of drudgery, for although he describes life on the march in the Arctic as a dog's life, he regards the work as a man's work; and although he met with repeated disappointment—for beating the northern record without reaching the pole he despises as an empty bauble—his devotion was at length rewarded by well-earned success. Peary's last journey will probably always be his most famous, for it accomplished one of the greatest geographical quests; but its results are probably of less real geographical value than his exploration of northern Greenland, one of the most important of Arctic achievements.

Peary's book on the whole is disappointing. Its form at once arouses the prejudice of those who do not buy books by bulk. It is unnecessarily large, its size is increased by some illustrations which are neither instructive nor ornamental, and by the use of vast margins to the pages. The book is issued regardless of the congested conditions of most people's bookshelves, and is apparently intended for those who can find space for works with a large proportion of blank paper. The book has obviously been prepared in haste; the illustrations are in no particular order, and their titles cannot have been corrected by the author. Thus the view of the stone cairn, entitled "Camp Morris K. Jessup," that is, the camp at the North Pole, should be "Cape Morris K. Jessup," a mistake which might give rise to a serious misunderstanding. There is a map, inconveniently large, from which Crocker Land, one of Peary's most suggestive discoveries, has been omitted.

The book has no particular literary charm, although it is occasionally enlivened by touches of American humour, such as the statement that the atmosphere in Eskimo huts can be handled with a shovel.

The most interesting part of the book is the description of the Eskimo whose Mongolian affinities Admiral Peary clearly recognises. The account shows the author's tendency to judge everything by Arctic standards. Thus because the fair-skinned Eskimo were not as much impressed by white men as were some dark races, Peary dismisses with scorn the idea that any aborigines regarded the first Europeans they saw as superhuman. "Much nonsense," he says (p. 53), "has been told by travellers in remote lands about the aborigines regarding as gods the white men who come to them, but I have never placed much credence in these stories."

The book tells in detail the story of the expedition and its equipment; but in spite of the space available there are many omissions of the very things one would most like to know. Thus Peary claims that the success of his dash to the pole was only possible owing to the new sledges and portable stove that he designed for the expedition. He does not give future travellers the benefit of any descriptions of these instruments and their novel features. There is also little in this book to answer the criticism of those who have questioned Peary's actual attainment of the pole. There is an appendix by Mr. Henry Gannett, Admiral Chester, and Mr. O. H. Tittman, who state that they have examined Peary's journal and records, and they are unanimously of the opinion that he reached the pole. Some adequate statement of the evidence that was laid before these distinguished authorities might have been given as one of the appendices, of which there are three. There is no reason to distrust the fact that Peary reached the pole, or sufficiently near it for any practical purpose. The great increase in his pace after he parted from Captain Bartlett is not explained in the text, but the photographs of the area round the pole show wide stretches of smooth ice, hence exceptionally easy ice conditions may account for the speed of the final marches.

It is not easy to follow the story of the last few days of the approach to the pole, especially as the continuous daylight renders his references to morning and evening less helpful than they would be in following an ordinary itinerary. A tabular statement of his marches would have been very useful. The numerous references to the observations taken and the facsimiles of some of the calculations are not convincing, especially as a curious statement on p. 241 suggests that Peary has only a rule of thumb acquaintance with astronomical methods. He remarks that he had to strain every nerve to arrive at the pole by noon, so that he could at once take an observation for latitude; but at the pole the sun would be moving round at nearly a constant altitude, so that any time would have served for the observations, and time would not enter into the computation.

The author gives an interesting description of the arduous voyage up and down Kennedy Channel. He tells us that only four ships have made this dangerous passage, and of these one was lost and two were badly damaged. Peary's experiences show that Sir George Nares's successful navigation of this channel in the *Alert* is a feat which has not received the credit it deserves.

The most interesting geographical contribution in the book is the discussion by Mr. R. A. Harris, of the United States Coast Survey, of the bathymetric and tidal observations. The soundings taken show that a continental shelf covered by 100 fathoms of water extends for forty-six miles north of Grant Land. From the edge of this shelf, the sea deepens rapidly to 825 fathoms, but it then becomes shallower again to the north, and the depth lessens to 310

fathoms; the sea deepens again, and Peary's soundings found no bottom at 1500 fathoms. The existence of this shallow ridge has an important bearing on the possible existence of land further to the west. This question is discussed by Mr. Harris, and he concludes from the tidal evidence, and the fact that the flood at Point Barrow comes from the west and not from the north, that there must be a wide area of land or of island strewn sea to the west of the Arctic Archipelago. He estimates that there is an area of nearly half a million square miles either of land, of islands, or of shoals still undiscovered in the Arctic Ocean to the north of the western part of North America and of eastern Asia. Mr. Harris suggests that this land must extend from north of Bennett Land, which is to the north of Siberia, eastward to Crocker Land, and with Peary's attainment of the pole the settlement of this problem is the most interesting geographical question left in the Arctic Ocean.

ENERGY AND THE ORGANISM.

Vicious Circles in Disease. By Dr. J. B. Hurry. Pp. xiv+186. (London: J. and A. Churchill, 1911.) Price 6*s.* net.

A FEW days before this volume was placed in the hands of the reviewer he had been watching for a few minutes the race of a small brook into a larger but more sluggish stream. Curiously near the inrush a wisp of straws lay almost at rest, circling slowly round and round, but not swept with other wisps and leaves into the main current. This arrest was due to a still but deep whirlpool formed by the different velocities of the waters at the angle of meeting. Light objects which skirted this eddy swiftly vanished on their way to the sea; those caught in it were imprisoned. However, by placing a walking stick tangentially to the eddy, now one straw, now another, would dart aside, and, catching a streak of the main current, would speed off into liberty.

This humble little parable may serve to illustrate Dr. Hurry's interesting volume on vicious circles of disease. The author's message may be summed up thus: In health the confluent or congruent streams of energy should work in reciprocal harmony for the several ends of the organism as a whole; but in disorder this agent or that, alien or home-grown, may strike tangentially upon one or more of such streams and form a vortex, twisting the lines of function and setting up, in one or more situations, a focus of wasting energy, and, it may be, a trap for alien or degraded products which should be run out of the system. Now at some point in this circle the gyrating lines may be cut, the eddy may be diverted, and the lines of energy released to their normal directions. The hound which had turned to hunting its own tail may be put again on the track.

Among the absurd axioms which we are apt to repeat without thought is that which unconditionally impugns the practical impulse to "treat symptoms"; but in the majority of cases—in all for which we have no specific antidote—no other course is open to the practitioner. Moreover, even where we have such a specific, to refrain from treating symptoms, if the physician's, is not the patient's point of view. He asks for cure; but also for relief. Now these observations and maxims of Dr. Hurry emphasise a further truth—that in so doing we may be cutting across—at any point, it matters not where—a "vicious circle." To disperse a vortex, expending energy in mere friction, may serve even to disperse the malady; at least it may moderate its intensity, or dispel vexatious symptoms. But often the whole trouble consists in such a vortex, and in a single one; in these cases, therefore, of which the author gives many an instructive instance, to treat a symptom is to cure a disease; for the conception of disease as an "entity" ought to be banished even from the language of the modern physician. Sometimes it is the knife which must take the place of the walking stick of the parable; but happily milder means often suffice to divert the currents into the normal channels, but not, as Dr. Hurry inadvertently says (p. 167), to "reverse" the circular movement. This cannot happen—or, more accurately, never does. Evolution never returns by the way it came.

There is one more demur. Dr. Hurry seems scarcely to realise, or fully to impress upon us, the factor of "organic memory" in these phases of function, the bent of biological matter to repeat what it has done before; a faculty on which development and purpose depend. In vicious circles every gyration deepens the groove, an abnormal habit is formed, so that arrest of such a local waste of energy and such a distress becomes more and more difficult; herein enters the problem of "faith healing," of the stronger tangential force which is to dissipate the vortex and redistribute the currents of energy. The longer the "habit"—the fixture of organic memory—the harder the impulse needed to "break the circle," for the habit has become independent of the original cause, which indeed had often vanished.

Dr. Hurry does not pretend for a moment to have discovered this notion of vicious circles, but he has made it his own; it is one often remarked upon by medical practitioners, but no one has presented the subject systematically to us before in a printed book. But both in lectures and practice I remember that the Teales, of Leeds—especially Mr. Pridgin Teale—taught the principle emphatically, and, if they did not publish the experience, put it variously into practice. And so it has been, no doubt, with many another physician; but of this the author is well aware, while he has himself the merit of perceiving the need of a systematic study of the problem, of adapting the principle with much ingenuity to explain many morbid conditions, and of illustrating the practice by interesting examples. Out of his careful clinical studies and large experience Dr. Hurry is justified in pointing to the great array of evidence which he has brought forward in his chapters on the systems of the body, and formulated in diagram, and in declaring that this aspect of medicine "is one which no practitioner of the *ars medendi* can afford to neglect."

C. ALLBUTT.

ALCHEMY, ANCIENT AND MODERN.

Alchemy: Ancient and Modern: Being a Brief Account of the Alchemistic Doctrines, and their Relations, to Mysticism on the One Hand, and to Recent Discoveries in Physical Science on the Other Hand, together with some particulars regarding the Lives and Teachings of the most noted Alchemists. By H. Stanley Redgrove. Pp. xiv+141. (London: W. Rider and Son, Ltd., 1911.) Price 4*s.* 6*d.* net.

THE author of this book thinks he perceives in the trend of modern chemical doctrine an approximation to the fundamental dogmas of philosophical alchemy, as these were understood and taught by its greatest exponents. The application of the principles of evolution to the genesis of the chemical elements has, in his opinion, brought us back to the "basic idea" permeating all alchemistic theory, and that, in his judgment, the time is gone when it may be regarded as legitimate to point to alchemy as an instance of the aberrations of the human mind. How far the general proposition is, or can be, substantiated by the facts of experiment at present known to us, may be seriously questioned. It is practically certain that no proof of transmutation has ever been given. Allegations of such an occurrence have been made, of course, times without number. But whenever any instance of the kind has been properly scrutinised, the allegation has been wholly disproved, and the evidence that it has been made in bad faith and as the result of conscious fraud, and not merely of honest self-deception, is, in a large number of instances, complete and irrefutable.

Does the evidence to be obtained from modern experimental inquiry place the "basic idea" on any surer foundation? Mr. Redgrove evidently thinks it does. Otherwise the *raison d'être* of his book is gone. He is, he tells us, not only a student of chemistry, but also of "what may be generalised under the terms Mysticism and Transcendentalism"; and he hopes that this unusual combination of studies has enabled him to take what he calls a broad-minded view of the theories of the alchemists, and to adopt a sympathetic attitude towards them. No one can possibly object to Mr. Redgrove taking a broad-minded view of anything—certainly not of chemical theory, whether ancient or modern. But theories in chemistry stand or fall by facts. The ancient alchemists certainly never proved their theories. Have the modern alchemists done any better?

That there is such a thing as the philosophy of alchemy is undoubted. Some of the earlier followers of the art were men whose names are not merely hallowed by a hoary antiquity, but who are known from their writings and by the testimony of their contemporaries to be earnest, thoughtful philosophers, actuated by the true spirit of science. It is difficult to believe that such men were not influenced by some guiding principle, and that they followed their calling simply as empirics. That many of them were churchmen, and some of them mystics, has lent colour to the supposition that they regarded alchemy as a form of transcendentalism, and the general character of certain of their writings may be pointed to in proof of such a view. But although at various periods in the history of alchemy there were men—John Dee was such a man—whose conduct and mode of study were largely influenced by their predilection towards occultism, it is quite certain that by far the greater number of adepts were swayed by the most mundane and even the most sordid of considerations. However desirous we may be to share Mr. Redgrove's sympathy and broad-mindedness, we fail to perceive that he has done anything towards the elucidation of the philosophy of alchemy. He has advanced no view that has not already been presented and examined, and he has given no facts that are not to be found in other works, such as those of Kopp, Hoefer, Figuier, Gerding, or the more recent publications of Mr. Waite. Davy once said that analogy was the fruitful parent of error. The author has been actuated by an analogy which is fundamentally unsound and treacherous.

There is really no evidence that modern science is permeated by the spirit of alchemy, and, therefore, strictly speaking, there is no meaning in the phrase "modern alchemy." The fact is, Mr. Redgrove has been led away by an inconstant and wandering affection. He will learn in time, if he does not already know it, that he cannot serve two mistresses, and that he had better be off with the old love before he is on with the new. At the moment his true love for chemistry has been somewhat obscured by an illicit, but we trust transient, affection for that Delilah named Mysticism, and the present book is apparently the product of his mixed emotions. He had better return to chemistry, and give her his undivided allegiance. As he knows her more thoroughly he will learn to appreciate her whole-heartedly. There is not much romantic fascination about her; she has nothing of the glamour of mysticism; indeed, she tends to be rather matter-of-fact, but then that is one of her strongest points.

There is a certain type of mind from which the facts slip off like the proverbial water from the duck's back, but which nevertheless prides itself on its receptivity for "broad views." The views are frequently made so very broad that they have actually no depth. It is only to this type of mind that Mr. Redgrove's book can appeal.

THEORIES OF THE AETHER.

A History of the Theories of Aether and Electricity from the Age of Descartes to the Close of the Nineteenth Century. By Dr. E. T. Whittaker, F.R.S. Pp. xiv+475. (London: Longmans, Green and Co.; Dublin: Hodges, Figgis and Co., Ltd., 1910.) Price 12*s.* 6*d.* net.

WHEN we turn to an historical survey of electrical theory we are usually entertained by reprints showing scenes like the Abbé Nollet demonstrating the properties of an electrified boy, but the present work contains more satisfactory evidences of first-hand knowledge of the authorities. It traces carefully the growth, during three centuries, of optical and electrical science, more especially in rela-

tion to the theory of the æther. As regards mathematical calculations, space is saved by expressing results in vector notation, as well as by numerous references to the original memoirs; the treatment of the more important advances, without being exhaustive, is sufficiently adequate to define them clearly in their historical setting, that being the proper function of a work of this type.

Two-thirds of the book are devoted to the period ranging from Descartes to Maxwell. For most students this will probably be the more valuable portion, epitomising work which is not easily accessible.

Dr. Whittaker makes an interesting addition to the history of the law of electrostatic attraction between two charged particles. The law of inverse square of the distance is commonly ascribed to Coulomb, on account of his direct verification by means of the torsion balance (1785). When the researches of the Hon. Henry Cavendish were edited by Maxwell in 1879, it was seen that the same law had been established by a different method as early as 1773; on referring to early literature, such as Young's "Lectures," it appeared that the unpublished work of Cavendish was quite unknown to his contemporaries. Dr. Whittaker directs attention to a still earlier statement in Priestley's "History of Electricity," published in 1767. It appears that Priestley, following Franklin, had made experiments which showed that, when a hollow metallic vessel is electrified, there is no charge on the inner surface, and no electric force in the air inside. Priestley then continues:

"May we not infer from this experiment that the attraction of electricity is subject to the same laws with that of gravitation, and is therefore according to the squares of the distances; since it is easily demonstrated that were the earth in the form of a shell, a body in the inside of it would not be attracted to one side more than another?"

The chapter on elastic solid theories covers an important period. Cauchy, who was first in the field, obtains full credit for his various theories; although one sees how his work failed to stimulate later writers, especially of the English school. Dr. Whittaker remarks that his point of view in the earlier theories appears to have been: Given the equations of vibration of an elastic solid, what boundary conditions must be used in order to obtain Fresnel's results? It was Green who first showed that with a properly localised energy function, the Lagrangian method gave not only the equations of motion, but also the correct boundary conditions.

Some attention is paid to the æther of Cauchy's third theory of reflection, better known as the contractile æther of Lord Kelvin. The form of energy function used by Lord Kelvin might have been noticed; after beginning with the ordinary form for an elastic solid, he transformed it, by integrating by parts, into a form similar to that of MacCullagh's theory. One would consider this form as properly localised, not for the contractile æther, but for a medium specified to be rotationally elastic.

In the later portion of the book mechanical theories are treated further under the more modest description of models of the æther; there are also chapters on the followers of Maxwell, on conduction in solutions and gases, and on more recent theories of æther and electrons. These give a general account of various lines of advance since the time of Maxwell; in particular one notices the problem of relative motion of the earth and the æther, leading to a consideration of the nature of systems of measurement of space and time. The period of the book closes with the æther still endowed with a certain degree of substantiality, however different it may be from ordinary matter. In view of more recent developments based on the theory of relativity, Dr. Whittaker's treatise appears at an opportune time; it forms an important and valuable aid to a comparative study of theories of the æther. T. H. H.

DISEASES OF ECONOMIC PLANTS.

Diseases of Economic Plants. By Prof. F. L. Stevens and J. G. Hall. Pp. x+513. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1910.) Price 8*s.* 6*d.* net.

THIS book is primarily intended for those who wish to recognise—without having recourse to the microscope—and then to combat fungous diseases of cultivated plants. Descriptions are given of the prominent characteristics of the most destructive diseases of fruit and vegetables cultivated in the United States, as well as information regarding the latest methods of prevention or cure. All the best bulletins of the numerous State agricultural experimental stations and of the U.S. Department of Agriculture have been examined for facts; the authors have had the help also of various specialists in reading over the proofs of certain parts, *e.g.* Dr. Erwin F. Smith has thus assisted with the bacterial diseases, Dr. L. R. Jones with potato diseases, and so forth. Short, clear, scientific descriptions are given of the various life-stages of the species of fungi causing plant diseases; these are accompanied by practical advice as to the methods to be employed against each stage by the grower. In many cases, *e.g.* in that of the onion "smut" and of the "common scab" of the potato, and of the various diseases of the apple, the account given is a model of what should be provided by the man of science for the practical man. Clear directions are given for the making and application of fungicides, and also useful information on the subject of spraying machinery. It would have been well, however, to have supplied fuller information on the subject of "Bordeaux injury," and how it may be avoided. Practical details are given of the disinfection of seeds by the use of formaldehyde gas, and the various methods of soil disinfection are discussed. It is pointed out that the presence in land of such ineradicable soil diseases as the melon, cowpea, cotton, or tobacco "wilt," onion "smut," cabbage "black rot," &c., may result in a depreciation of 50 per cent. or more in the market value of the land. In dealing with many of the diseases of cereals, pea, bean, lettuce, celery, potato, carnation, violet, asparagus, grape, strawberry, and other fruits the authors are not content with merely

stating that "resistant" varieties or "strains" should be grown but in all cases mention the names of such "resistant" varieties obtainable on the market. Such practical information is likely to be of great value to the market grower or gardener; it must be admitted that such assistance as this is not yet able to be given in this country, except in a few cases, by the man of science to the grower.

Throughout the book we find instances given of fungous diseases of different crops which have become epidemic in various districts in the States and caused serious money losses; on the other hand, we have detailed evidence given showing that such losses may often be avoided by careful and thorough spraying with the right fungicide at the right time. The annual loss caused by potato "blight" in the United States is estimated at 36,000,000 dollars; that caused by wheat "rust," 67,000,000 dollars. Turning to horticultural crops, we are told that the violet "leaf-spot" caused, in 1900, a loss of 200,000 dollars; the celery "leaf-spot"—which for the past three seasons has been causing havoc in several counties in this country—is stated to have caused a loss, in California, in 1908, of 1950 car-loads, and a money loss of 550,000 dollars. An interesting account is given of the gradual invasion of the States since 1896 by the asparagus "rust"; it is now known in every State where asparagus is grown—

"In some States the invasion of this disease has almost, if not quite, prohibited commercial asparagus growing. . . . The Palmetto varieties are quite resistant, and offer a solution of the rust problem in some localities."

Of the American gooseberry mildew (which we may remember has, since its introduction into Europe, about 1900, now spread over the whole of Ireland and England) it is said:—

"This disease has quite prohibited the cultivation of the finer sorts of English gooseberries in America, and is a grave menace to the culture of gooseberries in Europe."

One or two points of purely scientific interest may be noted. The statement is made that the pea mildew (*Erysiphe polygoni*) hibernates in seed derived from affected pods, and that the celery "leaf-spot" (*Septoria petroselini*, var. *Apii*) is probably carried by the seed of celery. The mistake is made of identifying the mildew on cucumber, cantaloupes, and muskmelons with *Erysiphe polygoni*, although Reed's interesting work on the specialisation of parasitism shown by this mildew—which this mycologist correctly referred to *E. Cichoracearum*—was recently published in the States. In place of *Podosphaera* the misprint *Podosphaeria* (with the "popular" (!) name "podosphæriose") appears three times; also the erroneous name of *Sphaerotheca mali* is continued for the apple mildew, and the mistake made of supposing that *Podosphaera leucotricha*—of which *S. mali* is a synonym—is a distinct species.

The book is very well illustrated, and the writing remarkably clear and to the point. There is one touch of pedantry—quite out of place in such a practical book as this—against which a strong protest must be raised—the attempt to create "popular" names derived from the generic name of the fungus causing the disease. Thus we have "Sphæropsose" proposed for "black rot," caused by *Sphaeropsis*, and such verbal monstrosities as "pseudomonose," "lasiodiplose," "meruliose," &c.

A chapter on the legislative regulations—Federal and inter-State—in force in America might have been added to make the admirable thoroughness of this book quite complete. As it is, this book should be in the hands of all the officials—both the Board of Agriculture's inspectors and the inspectors of the various county councils—who are now engaged in England in the work of combating fungous diseases under the provisions of the "Destructive Insects and Pests Act." The importance of the need to create a more enlightened public opinion on matters connected with plant protection and plant sanitation is rightly insisted upon in this book; as its authors say:—"To create a much-needed, enlightened, aggressive public opinion is part of the duty of plant pathology."

E. S. S.

ELEMENTARY MATHEMATICS.

(1) *A Class Book of Trigonometry.* By Dr. C. Davison. Pp. viii+200. (London: Cambridge University Press, 1910.) Price 3*s.*

(2) *The Student's Arithmetic.* By W. M. Baker and A. A. Bourne. Pp. viii+328+1. (London: G. Bell and Sons, Ltd., 1910.) Price 2*s.* 6*d.*

(3) *First-Year Mathematics for Secondary Schools.* By Prof. G. W. Myers and others. Third edition. Pp. xii+365. (Chicago, U.S.A.: University of Chicago Press; London: Cambridge University Press, 1909.) Price 4*s.* net.

(4) *Second-Year Mathematics for Secondary Schools.* By Prof. G. W. Myers and others. Pp. xiv+282. (Chicago, U.S.A.: University of Chicago Press; London: Cambridge University Press, 1910.) Price 6*s.* net.

(5) *Geometric Exercises for Algebraic Solution. Second-Year Mathematics for Secondary Schools.* By Prof. G. W. Myers and others. Second impression. Pp. ix+71. (Chicago, U.S.A.: University of Chicago Press; London: Cambridge University Press, 1909.) Price 3*s.* 6*d.* net.

(1) THE introductory course provided by this textbook includes the solution of triangles, omitting the ambiguous case, applications to the geometry of the triangle and quadrilateral, and easy problems in surveying. Complicated identities are excluded on the ground that they belong to the programme of the specialist rather than the amateur for whose use this is primarily intended. The general character of the book will probably be considered unduly conservative. It fails to take cognisance of the recent movement affecting the teaching of trigonometry. There is scarcely as much numerical work as many teachers will require, and the quality of the problems, which profess to be practical, is distinctly poor. The best feature of the book is the material provided for oral work, which will be found invaluable for class purposes.

(2) This is an abbreviated edition of the "Public School Arithmetic," by the same authors. The number of examples worked out in detail has been materially diminished on the ground that the average boy is apt to rely too much on this form of assistance and so avoids the necessity of thinking for himself. This is, of course, a matter of opinion. It is not at all an easy thing to train students to read for themselves; in general they are far too prone to rely on oral help. In more advanced work, it is unquestionable that there is a real educational value in forcing a boy to find out for himself the meaning of what the text-book is explaining, provided only that the book itself is a good one. Of course, progress is made more slowly in these circumstances, but the substance of what is read is more likely to be digested owing to the increase of mental effort. It is, however, hard to decide at what stage this recourse to books should be encouraged. The present volume gives a very thorough account of all branches of the subject. Indeed, in our opinion it contains far more than it is desirable for the average boy to know. The time required for mastering its contents is so considerable that it will leave small opportunity for proceeding to more fruitful work. But so long as an exhaustive study of the subject is required by examining bodies, it will be necessary for writers to meet this demand. In this the present volume is eminently successful.

(3) and (4) In the opinion of the authors of this treatise, which is issued in two volumes, the subjects of algebra and geometry should be fused together as far as possible. It is suggested that students are more likely to realise the relations which subsist between these two portions of elementary mathematics, if a single text-book is placed in their hands. An examination of the contents of the separate volumes shows that algebra predominates in the first and geometry in the second; but in each case it is true to say that the correlation of the two subjects is kept consistently in view. The first course includes the elements of algebra up to simultaneous linear equations, factors, and fractions, and the fundamental ideas of geometry, viz., congruence, parallelism, and similarity, with numerical illustrations and straightforward constructions. The principle of moments is used to provide some interesting algebraic problems. The advanced course contains a more systematic account of formal geometry, the properties of the circle, theorems on areas and similar figures, the investigation of regular polygons, and more difficult constructions. With this is combined the general solution of the quadratic, the algebraic theory of proportion, graphical algebra, and simple numerical trigonometry restricted mainly to right-angled triangles. The manipulation which is expected from the student is of a simple character. This is probably the best plan for students of the age for which this book is designed. But we doubt whether it is equally desirable to exclude at the same time anything which can be properly called a rider. Numerical work in geometry provides the most certain means of elucidating new ideas, but unless this is combined with a certain amount of theoretical work, the intrinsic value of the subject is sacrificed. The ability to solve a simple rider is the best index of the intellectual growth of the student.

(5) The title of this book is an adequate description of its contents. It consists of about eight hundred examples, illustrating the theorems of elementary plane and solid geometry, and it yields a collection of questions which many will find a useful supplement to formal treatises.

OUR BOOK SHELF.

Ornitologia Argentina. Catálogo sistemático y descriptivo de las Aves de la República Argentina. By Dr. R. Dabbene. Tome Primers. Pp. xiv+513. (Buenos Aires: Museo Nacional, 1910.)

THE object of the present work, of which the volume before us is only the first, is to provide, as we learn from the preface, a systematic list of all the genera and species of birds inhabiting Argentina, mainly from the point of view of their geographical distribution, for the use, chiefly, of students of ornithology in the Republic. Most of the species common to the neighbouring countries of Brazil, Bolivia, Paraguay, and of the frontiers of Chili and Uruguay are included, since it is highly probable that the birds of these regions will be discovered in the Argentine when it is more fully explored. Included also are all the species inhabiting the archipelagoes and islands lying off the shores, as well as the lands extending southward to the Antarctic circle.

The work is to contain three parts. The first deals with those anatomical characters of birds which are of classificatory value. The second discusses the geographical distribution of the birds of the Republic, with a list in systematic order of all its recent and fossil species, and their assignation to the different zones—shown on a coloured map—into which the author divides the region. The final section, to be dealt with in future volumes, will contain brief diagnoses of the orders and families, &c., of birds represented in the Argentine, with keys for differentiating the species, which number 469, referable to 71 families. An extensive bibliography is appended to each section.

Although Dr. Dabbene is largely indebted, with due acknowledgment, for his morphological facts to European investigators, and among English workers especially to Huxley, Garrod, Forbes, Beddard, Chalmers Mitchell, Garrod, and Newton—from whose works most of his figures are derived, the volume will be of very great value to students so disadvantageously remote from the great European libraries and books of reference, as are those domiciled in Argentina. The section devoted to geographical distribution brings concisely together the data under this head, and will be appreciated by those elsewhere interested in South American ornithology. The volume is provided with very full indices.

Die Samenpflanzen (Blütenpflanzen, Phanerogamen). By Prof. K. Wilhelm. Pp. xvi+151. (Wien and Leipzig: F. Deuticke, 1910.)

THERE can be no disagreement with the author's opinion that the only satisfactory method of acquiring a knowledge of plant classification is to practise the determination of unknown species with the aid of a flora or other systematic compilation. It has been Dr. Wilhelm's object to supply a compilation suitable for the use of foresters, agricultural, pharmaceutical, and other technical students. The chief essentials for such a work appear to be a differentiation,

if possible analytically disposed into orders—better known as "cohorts"—a good description of the families, and an indication of important characters for leading genera. This requires a work of some magnitude, but not more extensive than Warming's "Systematic Botany," which follows these lines. Wilhelm's "Samenpflanzen" defines orders and families, and in the case of large families supplies discriminating characters for subfamilies, but only in occasional instances provides the necessary information for identifying genera.

The arrangement adopted is a modified Eichler-Engler system, prepared by Prof. R. Wettstein for his "Handbuch der systematischen Botanik," but the diagnostic characters have been redrafted by Dr. Wilhelm. A very valuable feature in the former book is the series of notes pointing out the probable relationships and affinities between various families, thus furnishing an important key to the system; a similar phylogenetic guide would be useful for the book under notice. The plants enumerated include European species, those yielding economic products, and timber trees; by the adoption of different printing types it is intended to give an idea of the comparative importance of the various genera. The lists are, so far as observed, both full and accurate.

The Past at Our Doors, or the Old in the New Around Us. By W. W. Skeat. Pp. xi+198. (London: Macmillan and Co., Ltd., 1911.) Price 1*s.* 6*d.*

In this interesting little book Mr. Skeat shows how the past is not only at our doors, but upon our lips. Confining himself in the main to the subjects of food, dress, and the home, he brings together a multitude of facts bearing upon the history of the common objects and events of our domestic environment. The etymological bias is marked, but excusable—perhaps even inherited—and Mr. Skeat does not fail to emphasise the influence of our ancestors upon our deeds, as well as upon our words.

In the "Story of Our Food" the range is from meal times and their names, through the apparatus of the table, to hunting, ploughing, and the preparation of food, with other matters taken by the way. The section on "Dress" follows the general lines of recent works on the subject, and is more fully illustrated than the rest of the volume. The "Story of Our Homes" is chiefly an account of the evolution of the modern dwelling-house, including such furniture as cupboards, dressers, wall-hangings, carpets, and beds.

In view of the great variety of subjects discussed in a small space, some degree of discontinuity was unavoidable, and the book has the character of a work of reference on a small scale. If it is pemmican, it is good pemmican, and full value for the money.

H. S. H.

Serum and Vaccine Therapy. Bacterial Therapeutics and Prophylaxis Bacterial Diagnostic Agents. By Prof. R. T. Hewlett. Second edition. Pp. x+406. (London: J. and A. Churchill, 1910.) Price 7*s.* 6*d.* net.

The second edition of Prof. Hewlett's book on serum-therapy, which has just appeared, does not claim to give more than an outline of the mode of preparation and employment of the therapeutic sera and vaccines. As such it ought to prove of service to the student or busy practitioner, who may not have the opportunity or the time to consult the larger works on this subject. It is doubtful, however, if the author has been entirely successful in his effort to condense the subject, for the requirements of the interested medical reader. The authorities quoted, though few, are not always the most authoritative, and their opinions are too frequently referred to without criticism or comment. A good account is given of the preparation of the antitoxins for diphtheria and tetanus and antivenin. Referring to the employment of antitoxin as a prophylactic against diphtheria, the author is apparently impressed with the objections raised against it on the ground that an anaphylactic state may be induced, and he thinks that a diphtheria-endotoxin, which he is at present elaborating, may prove an efficient substitute for antitoxic serum in prophylaxis. The appearance of this preparation will be awaited with interest by the medical profession. The intracerebral injection of tetanus antitoxin is recommended as the method which gives most hope of success in cases which have lasted any length of time, but it does not seem that trustworthy data on this question are available.

More space might have been devoted to the use of tetanus antitoxin as a prophylactic and to the anti-meningococcal and antidysentery sera, both of which have proved of the highest value in practice, and in point of efficiency should follow closely after diphtheria antitoxin.

Other sera, such as antipneumococcic and anti-typhoid, have more space devoted to them than their importance at present warrants.

Vaccine-therapy receives adequate treatment at the author's hands, but it is somewhat curious that the account should be prefaced by a dissertation on opsonins. These substances should surely take their place in the general scheme of antibodies called forth in response to immunisation.

The closing chapters of the book deal with the preparation of calf lymph, typhoid vaccine, mallein, tuberculin, and sour milk.

We observe at the close of the book certain trade advertisements, the majority of which deal with soured milk or cheese. These appear somewhat out of place in a scientific treatise.

Handbook of American Indians north of Mexico. Edited by F. W. Hodge. In two parts; part ii., N—Z. Pp. iv+1221. (Smithsonian Institution, Bureau of American Ethnology, Bulletin 30.) (Washington: Government Printing Office, 1910.)

The second and concluding volume of the "Handbook of American Indians north of Mexico" has followed three years after the publication of the first volume. It consists of more than a thousand pages of closely printed matter in double columns; there is in addition a synonymy of 158 pages and an extensive bibliography; unfortunately, the latter is not quite complete. For example, Mr. C. Hill-Tout's papers on the Salish in the *Journal* of the Royal Anthropological Institute and Reports of the British Association, and his book on "British North America—I., the Far West" (1907), are totally ignored, both here and in the article "Salish." It is impossible to review a book of this kind as it is composed of an enormous number of notes and short articles written by experts, of whom fifty-four were employed on this volume alone. The information is given succinctly, and in most cases an adequate bibliography is added at the end of each article. There is as large a number of illustrations as space permitted. All those interested in North American ethnology and archæology will appreciate the value of authoritative statements on disputed points, and the references for further information thereon. It is also a great convenience to be able to discover the synonymy of a tribe and to be informed as to what may be regarded as its official designation. As a book of reference it is simply invaluable, and it should find a place in every public library; every ethnologist will procure a copy as a matter of course.

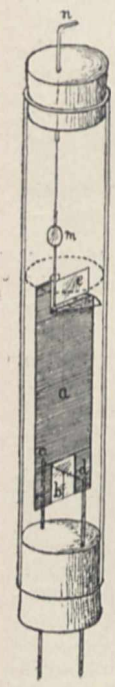
LETTERS TO THE EDITOR.

[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.]*

The Thomson and Peltier Effects.

A MODIFIED Joule radiometer has been applied successfully to show the existence of the Thomson effect in copper and the Peltier effect at the junction of two dissimilar metals.

The lower part of a vertical glass tube 3 cm. in diameter was divided into two compartments by a cardboard diaphragm *a*, 12 cm. long. A rectangular strip was cut away from the upper part of the partition, and a mica plate, *b*, was substituted for a similar strip from the lower part. A thin copper wire *cd*, No. 36, was soldered to two thick copper leads, No. 16, fixed into a cork. The wire *cd* was passed through a slit in the mica plate *b*, and the cork was pushed to within 1 cm. of the lower edge of the partition. The wire *cd* was arranged so that it was nearly bisected by the mica plate. A mica vane *e* attached to an aluminium wire was suspended by a quartz fibre within the aperture in the upper part of the partition. A horizontal disc of cardboard, shown dotted in the figure, was fixed to the upper cork by a pair of rods, and fitted inside the tube just above the vane. A horizontal sector-shaped plate of mica was fastened to the partition just below the vane to complete a channel for the current of air from the warm to the cool side of the partition. The clearance between the edges of the vane and the opening was about 1·5 mm., and the angular movement of vane was restricted by stops to about 30°. The motion of the vane was observed by reflecting a beam of light from the mirror *m* on to a scale at a distance of 80 cm.



The partitioned tube, together with the suspended vane, constitutes a Joule radiometer in which unequal heating of the columns of air in the two compartments will cause a deflection of the vane. The radiant heat from a candle flame at a distance of 2·5 metres falling on one side of the partition produced a deflection of 5 cm. of the spot of light on the scale. Owing to its high sensibility, it was found necessary to shield the columns of air from draughts and radiant heat from external sources.

A current of 6 amperes was passed through the thin copper wire *cd*, and a temperature gradient was thus established from the centre towards each end of the wire. The vane was deflected owing to the Thomson effects and the inequality of the Joule effects in the two halves of the wire. The position of the vane was fairly steady after an interval of five minutes, and the spot of light was brought to the centre of the scale by turning the bent wire *n* attached to the fibre. The current was rapidly reversed, and the spot of light moved quickly through 8 cm. on the scale. The wire *cd* was adjusted to slightly different positions in order to vary the inequality of the Joule effects, and practically the same result was found in every case. It was concluded from the direction of motion of the vane that in copper heat was absorbed when the current flowed up the temperature gradient.

To show the Peltier effect, an iron wire 4 cm. long and 1 mm. diameter was soldered to another pair of copper leads and bent just under the partition. The passage of a current of 1 ampere through the junctions was sufficient to move the spot of light off the scale. There is no need to reverse the current in this case, and it can be shown quite easily that heat is absorbed when the current flows from copper to iron. F. W. JORDAN.

South-Western Polytechnic, Chelsea, S.W., May 8.

Compulsory Latin Diagnoses for Fossil Plants.

THE question whether descriptions of new species, genera, &c., of *fossil* plants should be accompanied in future by a diagnosis or diagnoses *in Latin* has been recently discussed among those who are working on fossil botany. It is not proposed here to enter into the arguments which have been advanced either for or against this proposition. It appears, however, that, so far as palæobotany is concerned, the arguments against the use of diagnoses in Latin are held far to outweigh those in favour of such diagnoses. In order to test current opinion on this point, a memorandum has been recently circulated by the writer among those who are engaged in the study of fossil plants in this country and in the United States, and by Prof. Nathorst in Sweden and Denmark. The object of the memorandum was to ascertain the present intentions of those working at fossil plants as regards this much disputed question. The result of this exchange of opinion has been very remarkable. Every palæobotanist in this country, in the United States, and in Scandinavia to whom a copy of the memorandum has been sent has expressed his intention of avoiding the general use of diagnoses in Latin, and, further, of recognising as valid diagnoses instituted in the future which are not published in Latin.

The memorandum in question contained two statements of intention, which were as follows:—

(1) "I do *not* propose to include a diagnosis in Latin in the description of any new species, genus or family that I may institute in the future, unless there appear to me, in particular cases, to be special reasons for so doing."

(2) "I will *not* refuse to accept new species, genera or families of fossil plants instituted by other workers in the future, solely on the ground that their description is not accompanied by a diagnosis in Latin."

The following is a list of those who have subscribed to both these statements. In the case of those names indicated by a *, some slight modification of the wording of one or other statement was made. These reservations follow the list of signatures:—

Mr. C. T. Bartholin, Copenhagen, Denmark.
Dr. M. J. Benson, Royal Holloway College, Englefield Green, Surrey.
Prof. E. W. Berry, Johns Hopkins University, Baltimore, U.S.A.
Prof. T. D. A. Cockerell, University of Colorado, Boulder, U.S.A.
Mr. W. T. Gordon, The University, Edinburgh.
Dr. Th. G. Halle, Stockholm, Sweden.
Dr. N. Hartz, Copenhagen, Denmark.
Dr. G. Hickling, The University, Manchester.
Mr. H. S. Holden, University College, Nottingham.
Mr. A. Hollick, New York Botanic Garden, New York, U.S.A.
Prof. E. C. Jeffrey, Harvard University, Cambridge, U.S.A.
Dr. R. Kidston, F.R.S., Stirling.
Dr. F. H. Knowlton, U.S. Geological Survey, Washington, U.S.A.
Mr. F. J. Lewis, The University, Liverpool.
Mr. A. J. Maslen, London.
Dr. H. Möller, Falun, Sweden.
Prof. A. G. Nathorst, Stockholm, Sweden.
Prof. F. W. Oliver, F.R.S., University College, London.
* Mr. Clement Reid, F.R.S., The Geological Survey, London.
* Mrs. Clement Reid, Milford-on-Sea, Hants.
Dr. D. H. Scott, F.R.S., Oakley, Hants.
Mrs. D. H. Scott, Oakley, Hants.
Dr. M. C. Stopes, The University, Manchester.
Mr. H. H. Thomas, The Botany School, Cambridge.
Mr. D. M. S. Watson, The University, Manchester.
Prof. F. E. Weiss, The University, Manchester.
Dr. D. White, U.S. Geological Survey, Washington, U.S.A.
Dr. G. R. Wieland, Yale Museum, New Haven, U.S.A.

Mr. and Mrs. Clement Reid have signed both statements with the addition of the words "if it is accompanied by a recognisable figure" at the close of the second statement after the words "diagnosis in Latin." They add,

"we consider that the international character of the diagnosis will better be maintained if the Vienna rule be altered so as to read 'either a diagnosis in Latin *or a recognisable figure*.' This alternative would do away with the difficulty as to language, and would allow botanists to use their own language, provided they give a characteristic figure."

Prof. Seward has signed the second statement, and has added the following remarks:—"In view of the nature of much of the material available for investigation, I consider that it is undesirable to insist on a Latin diagnosis for all species described by palæobotanists. In cases where a formal diagnosis is possible, such diagnosis and a figure of the specimen ought to be given, but for the present at least I am not disposed to bind myself to the publication of a diagnosis in Latin. It is, I believe, in the interests of the subject to avoid pledging oneself to any fixed rule as regards either a diagnosis or the language in which the diagnosis is to be written.—A. C. Seward."

Prof. Zeiller, of Paris, to whom a copy of the memorandum was forwarded, has signed the second statement mentioned above, and has kindly expressed his reasons for being unable to subscribe to the first. These are as follows:—

"M'étant, au Congrès de Bruxelles, rallié, dans un esprit de conciliation, à la disposition générale qui fait de la diagnose latine une obligation, je n'en persiste pas moins à penser que cette obligation ne devrait pas être étendue à la paléobotanique, l'application s'en heurtant souvent, avec l'état fragmentaire et incomplet des fossiles végétaux, à des difficultés presque insurmontables, notamment lorsqu'il s'agit d'échantillons à structure conservée ne montrant que des caractères anatomiques internes.

"J'émets le vœu que tous les paléobotanistes s'unissent pour demander au prochain Congrès de leur laisser à cet égard la liberté dont ils avaient joui jusqu'ici, et à l'encontre de laquelle on n'a relevé aucun inconvénient.—R. Zeiller."

In conclusion, while, as we have seen, the British, American, and Scandinavian palæobotanists have agreed to avoid the *general* use of Latin diagnoses for the present, it should be pointed out that the object of the memorandum mentioned above has been solely to ascertain the opinions and *present* intentions of workers on fossil plants in this respect. It is, of course, understood that those who have subscribed to the two statements quoted above are not in any way bound as to the future, and they are at perfect liberty if, in altered circumstances in the future, they should wish to depart from their present opinions and intentions to do so. The view is widely held that perfect liberty in regard to matters of nomenclature, as in other directions, is essential to the progress of our knowledge of fossil plants.

E. A. NEWELL ARBER.

The Sedgwick Museum, Cambridge.

Spitting Cobras.

THE following note may be of interest, the more so as the existence of cobras in Borneo is denied in a recent work on Borneo ("Seventeen Years among the Sea Dyaks"). In your "Notes" in NATURE of May 4 (p. 320) you refer to the "spitting cobras" of East Africa. The cobra of East Borneo also has the power of projecting its poison to a distance of at least 1 metre. In January of last year I was walking along a narrow jungle track about twenty miles from the coast, in lat. 1° 10′ S., when I saw a cobra erect preparing to strike at me. I struck it about 30 cm. from the head and broke its back (as I thought). It then projected two streams of liquid at me as I stood over it. A Bugis close beside me exclaimed, "dia menumpit!" (menumpit=to shoot with the blow-pipe). One stream struck the lapel of my coat, but I did not notice where the other struck. I placed the dead (?) cobra on a tree, intending on my return to carry it to my camp and bottle it, but when I returned it was gone.

About two hours after the incident I felt an irritation on my skin, which lasted for some hours, and then gradually disappeared. There was a newly healed leech wound at the place, but I could hardly believe that the cobra venom could have penetrated thick puttees, trousers, and socks all wet through. But I sent for the Bugis who had accompanied me, and without telling him anything, asked him to point out where the cobra poison had struck me. He immediately placed one finger on the lapel of my coat and another on my shin exactly where the irritation was.

He added that about ten miles away his brother had lost the use of his arm for three months because of a cobra which had projected its poison at him.

The cobra was black with a bluish sheen, but the throat was yellow. Estimated length, 1600 mm.

Boscombe, May 8. T. R. H. GARRETT.

The Reform of the Calendar.

THE article in this week's NATURE on "Daylight and Darkness" leaves little to be said with regard to the so-called Daylight Saving Bill. Its adoption would indeed render us "the laughing-stock of the enlightened people of the world." No object, however good in itself, can be attained by a deceitful and underhand process, which must lead to many inconsistencies and misunderstandings. There is no reason why 12 o'clock should be the exact time of noon; in point of fact, it seldom is, as clocks must be regulated to keep *mean* time. But there is a very good reason, and it is of great importance, that the interval between two consecutive hours by the clock should be always exactly one hour. To regulate it otherwise would be deceitful and confusing.

My purpose, however, in this letter is rather with reference to Mr. Philip's letter on the "Reform of the Calendar." He denies that the week has had an unbroken continuance, because the paschal full moon on A.D. 31 (which he thinks was the year of the Crucifixion) fell on March 27, which was a Tuesday. Now the Jewish Passover had nothing to do with the day of the week, and might fall on any day, being regulated by the moon. That it fell in A.D. 31 on a Tuesday proves that that could not have been the year of the Crucifixion, which was probably A.D. 30, or possibly (as Prof. Sanday now thinks) A.D. 29. The seventh day of the week (the Jewish Sabbath) was the day after the Crucifixion, and the day after that, the first day of the week, the day of the Resurrection. Christians observed that day as their sacred day every week, and the Church decided (after the early Quartodeciman controversy, settled by the Council of Nicæa) to keep the Christian Passover (which we call Easter) always on that day of the week. There has, then, never been any break in the continuity of the week.

Blackheath, May 13. W. T. LYNN.

The Rusting of Iron.

IN view of the correspondence which has taken place recently in NATURE on this subject, I should like to refer to the results of some further investigations which I have made in conjunction with Mr. J. R. Hill in continuation of those published in the Journal of the Chemical Society in 1905. In that paper, and in other previous publications, experimental evidence was brought forward to show that the rusting of iron can take place in the absence of carbon dioxide, contrary to the generally accepted view. Several chemists have addressed themselves to the task of defending the old opinion that carbon dioxide is necessary. Their arguments were summarised recently in an article in NATURE initialled "T. M. L." No exception can be taken to this article if its limitations are clearly recognised. It omits all reference to the large body of experimental work which has been published by Whitney, Tilden and others, in addition to myself, to show that the old view must be abandoned. The most recent work of Lambert and Thomson confirms this conclusion, whilst making an important addition to our knowledge of the conditions of reaction between iron, oxygen, and water when brought together in the most highly purified forms.

My object in writing this note is to state that I have now ascertained the cause of the inhibiting effect which certain substances, including alkalis and potassium bichromate, exert in preventing the rusting of iron, and it therefore becomes possible to explain a number of facts, including certain results which have been held to prove that carbon dioxide is a necessary factor in rusting.

It is now clear that all those agents which inhibit the rusting of iron (see Journ. Chem. Soc., 1905) also render the iron "passive" to a greater or less extent, and that this passivity of iron persists after the metal has been removed from the effective solution. Iron which has been immersed in alkalis or in a solution of potassium bichromate is found still to be passive after careful washing with water, that is, after removal of all trace of the solution which produced the effect. The iron is no longer attacked by nitric acid of a certain strength or by the appropriate solution of copper sulphate, nor does it "rust" in presence of oxygen and water. Contact with certain substances, especially dilute acids, including carbonic acid, at once destroys the passivity, and the iron becomes active again in all respects. A full account of this work and of its bearings will shortly be given.

The fact alluded to in recent correspondence, that an iron cylinder which has been immersed in potash solution and afterwards washed with water will not rust in air until carbon dioxide is admitted, does not prove that carbon dioxide is necessary for rusting. The observed facts are due, first, to the passivity of the iron induced by the alkali, and, secondly, to the destruction of this passivity by the carbon dioxide. The same piece of iron will rust freely in air deprived of carbon dioxide, provided that it has not been in contact with alkali of such a strength as will induce passivity.

May 9. WYNDHAM R. DUNSTAN.

SCIENCE AND THE IMPERIAL CONFERENCE.

SUCH words as Empire and Imperial, like many others, suffer some disadvantage from their historical antecedents. Looked at in the past they recall something Roman, something Napoleonic; the rule of dependent peoples, conquered by the sword, and governed, not wholly inefficiently, but without much say in the matter, by military power. Looked at in the present and with a scientific eye, the British Empire reveals itself as something fundamentally different. It is simply the last term of social aggregation. Free peoples, starting from the family, aggregate themselves into larger and larger groups, and the common freedom is maintained by the naval supremacy of the mother-country. The Crown consecrates the unity of the whole.

Every stage of aggregation in such a system has its common interests which require concerted action. The recognition of this inevitably leads to some sort of what Herbert Spencer would have called physiological integration in which the whole is greater, or at any rate more efficient, than the sum of its parts. The Imperial Conference, which is about to meet, has come into existence just as naturally as a municipality or a county council. The essential principle is the same: the scope of its deliberation will only extend to larger problems.

Such problems will be matters of high policy, and though it may be hoped that they will be dealt with in a scientific spirit, it is improbable that the direct interests of knowledge will for the moment find a place amongst them. But the principle of Imperial Conference, which happily there is every reason to regard as permanently established, has already received a development in a more detailed direction. The Imperial Education Conference, which held its last public sitting on April 28, has now received Government recognition, though its first meeting in 1907 was the result of unofficial initiative. It is not improbable that its example may be followed on behalf of other interests of no less importance.

Knowledge in a logical order would come before education. But the machinery of an Imperial Conference would probably not be very helpful to the progress of science in the abstract, as that cannot be earmarked to any nationality. The scientific study of the Empire itself is a field in which that machinery could find employment with results of the most profound scientific interest and the greatest practical utility.

Looking at the magnitude of the Empire, nothing is more remarkable than the feeble interest it excites in the mind of the average citizen. His horizon is rarely more than parochial, and the only imperial problem on which he probably has a distinct conviction is the necessity of maintaining our naval supremacy. It is something that in a vague way he should wish it to be maintained. But what the Empire is, or what are its future possibilities, he neither knows nor cares. In this he is hardly to be blamed. He was taught in his youth, as we may learn from the "Reminiscences of Goldwin Smith," that Colonies were a source of weakness, and we may learn from the same authority that half a century ago even the Colonial Office was animated with the idea of getting rid of them decently. If, since that day, opinion has changed to acquiescence in the existence of Empire, it is due to the influence and advantages of a peaceful commerce. Perhaps in generations to come it may excite a livelier enthusiasm.

A common attack, such as a conference might stimulate, on scientific problems, might do something to bring this about. There is no suggestion that science should be centred in the home-country. The dominions have their own scientific activity, and the ranks of the Royal Society are open to their workers. The problems that demand cooperation are not local but far extending, even cosmical.

Our Admiralty has charted the shores frequented by our shipping, and the world's navigation has the benefit. The international recognition of the meridian of Greenwich is our reward. But though the *Challenger* expedition made a noble beginning, a thorough exploration of ocean depths still remains to be accomplished, and is a task which naturally falls to a maritime race. But the land cries out to be accurately mapped. Both Africa and Australia have suffered from using imperfectly determined meridians of longitude as boundaries. The accurate determination of the position of salient points throughout the Empire would alone be a sufficient subject for a conference. Were this accomplished local surveys would start from a sound basis in filling up the details. As it is, even the survey of the United Kingdom is not absolutely coordinated with that of the continent. Such an enterprise as that of Sir David Gill in measuring an arc of the meridian from the Cape to the northern hemisphere would not be left to private initiative.

If the topography of vast territories is still imperfectly known, their geology is practically untouched. Africa differs from neighbouring continents in being all but an island. It seems to be the part of the earth's surface which has been least disturbed by volcanic action. It has preserved a structure of great antiquity. Thoroughly understood, it would throw light on an early chapter of the history of the earth.

In the southern hemisphere British maritime activity is dominant. A knowledge of the meteorology of its oceans is a necessary condition of their secure navigation. Sir Charles Bruce, in his "Broad Stone of Empire," has given a striking account of what has been accomplished towards it by the Mauritius Meteorological Observatory. Such a measure of undoubted success should stimulate further endeavour and the provision of other stations. It ought to be possible to predict the disastrous droughts of India

and Australia. This will never be accomplished until we thoroughly understand the influence of the Antarctic Continent. Its investigation would alone be a fit subject for an imperial conference. It is a problem which should no longer be nibbled at, but made the object of systematic attack.

If we turn from the physical to the biological field the need of cooperative endeavour is no less insistent. The problems of geographical distribution are hampered for want of material from large, uninvestigated areas. In anthropology our knowledge is still fragmentary, even of the subject races of the Empire. Commerce affords a wide area for the distribution of their local diseases. Cases of sleeping sickness are to be seen in our hospitals, and beri-beri has sometimes produced a panic in our ports. Yet the campaign against tropical disease has only begun.

If it is objected that such schemes are visionary, it may be replied that half a century ago they were actually within the field of practical politics, and that, too, at a time when anything like Imperialism was certainly not in fashion. In 1859 the Duke of Newcastle, the Secretary of State for the Colonies, wrote officially that "her Majesty's Government have under their consideration a project for collecting the materials of a National Work on the Astronomical features, the terrestrial physics, the botany, zoology, and geology of the Colonial Possessions of the British Empire." All this remained a project except as regards botany, which was imposed on Kew. The task, with various fortunes, sometimes of neglect and discouragement, has occupied it steadily ever since. With the completion, now in sight, of the two great Floras of Africa, under the editorship of Sir W. Thiselton-Dyer, the vast undertaking will have been practically accomplished. It is to be noted that except in the case of tropical Africa, the expense has been borne by the Dominions and Colonies concerned. And to the Flora of South Africa a spontaneous and not the least liberal contributor has been the Transvaal Government.

The inference that may be drawn from such facts is that while the Imperial Government could probably be induced to aid well-considered scientific work in the Crown Colonies and Protectorates, funds would be forthcoming for the share of that of the Dominions. Cooperation would give them a voice in the scope and character of any scheme, and a guarantee of its efficient and economical execution.

Such a sketch of what imperial cooperation might do for knowledge of the globe on which we live has at any rate the charm of a pleasant dream. Will it ever be realised? Not as long, certainly, as a Prime Minister can describe our Government as "the organised power of Philistines." The Philistine has the Government he deserves, and Philistine he will remain until the schoolmaster is touched with idealism and the aim of life ceases to be purely materialistic. Men may learn that though the pursuit of wealth may be exciting its attainment is dull in its results and usually mischievous in its effects. Ambition may prompt the rich to leave a worthier monument behind them than the mere record of their death duties. The value of wealth consists not in its possession but in its power, whether for good or evil. Perhaps the sporting instinct will come to the rescue of knowledge. Wealth may effect the performance of what a man may not be able to achieve himself, and yet feel some pleasure in seeing done. Money has been found to explore the ornithology of New Guinea, and men have been ready to risk their lives in the enterprise. Such sporadic efforts will never be wanting; what is needed is the coordination which will unite them in a considered campaign.

NATURAL HISTORY OF THE BIBLE.

THE celebration of the tercentenary of the English authorised version of the Bible is an event of national importance, when everything connected with Holy Writ commands, if possible, more than ordinary interest, not only from Biblical scholars, but also from a large section of the general public. Among the numerous sections of the subject, that which most commends itself to students of natural science is, of course, the natural history of the Bible in the wider sense of that term—that is to say, inclusive of zoology, botany, and mineralogy; and the present celebration affords a fit opportunity of reviewing and revising our knowledge of Bible animals, plants, and minerals, and also of considering whether any emendations of the names by which some of them are referred to in the authorised version ought not to be amended. This has been recognised by the authorities of the British Museum, who are now arranging in the hall of the Natural History Branch at South Kensington an exhibition of Bible animals, plants, and minerals, which will be opened in due course, and will doubtless attract a large amount of attention and interest on the part of the public.

Although comparatively little interest and importance attaches to the list of species regarded by the ancient Jews as unclean, the correct identification of the animals and plants referred to in other parts of the Bible is in many cases essential to a proper appreciation of the context, more especially when they are introduced to illustrate a simile, or to accentuate some striking or picturesque feature in local conditions. At the time when the authorised version was written natural history had scarcely attained the position of a science, even the birth of Linnæus not having taken place until nearly a century after the translators had finished their labours. But this lack of knowledge of natural history common to all educated persons of that day was by no means the only difficulty with which the translators had to contend. For, in the first place, the animals and plants of Syria and Palestine were probably even less known than those of several other parts of the world; while, secondly, the dispersal of the Jews had led to the proper meaning of many of the old Hebrew names of animals and plants being more or less completely forgotten.

Consequently the translators were plunged into a very sea of difficulties, from which, considering all things, it is little short of a marvel that, despite many egregious blunders, they emerged as creditably as they did. In regard to names of which the true signification was not apparent the translators followed two distinct courses. In some cases, as, for instance, with *shâphân* ("the hider"), they made a "shot" at the meaning of the name, rendering the one quoted by coney, the then current designation of the rodent we now term (except in legal phraseology) rabbit. On the other hand, some Hebrew names, like *shittim* and *almug*, among the designations of timber and trees, were transferred directly to the English version without any attempt at translation or identification. And there is little doubt that this latter was the preferable course. Indeed, in the case of almug trees it is almost the only legitimate one, as the species is not yet identified with absolute certainty, although it may be the red sandal-wood of India. Shittim-wood might, of course, be now translated as acacia, but even this would be unsatisfactory, as the tree popularly known in this country by the latter name is really a Robinia.

In a few instances, as in the case of "pygarg" for *dishon*, the translators used terms of which they could not possibly have known the proper meaning;

the African antelope termed πύγαργος by Herodotus being still unidentified, and therefore having no claim to be regarded as the equivalent of the Hebrew *dishon*.

The real misfortune is, however, when well-known English names of plants and animals are given as the equivalents of Hebrew words of totally different signification. Examples of this are apple for apricot, chestnut for plane, sycomore or sycamore (etymologically justifiable) for a fig of the banyan group, ferret for an animal which may have been a gecko, the aforesaid coney for the Syrian hyrax, and, above all, badger (in the shape of badgers' skins) for the Red Sea dugong. The last is indeed a particularly bad case, as it should have been obvious that badgers' skins, even in a comparatively dry climate, do not form suitable material for a church-roof. The case of "coney" has been complicated by the word having fallen practically into disuse, in the original sense, in consequence of which many persons, and especially Americans, appear to regard it as the proper English name of the hyrax.

In nearly all the cases where the real meaning of the original cannot be ascertained, or where, as in the instance of sycomore, we have no vernacular name for the species referred to, it appears to me that it would be much better if the Hebrew word were retained, with a brief marginal explanation.

In modern times much light has been thrown on Bible natural history by identifying the old Hebrew names of animals and plants with their apparent equivalents in Arabic and Coptic, and likewise by the study of the animals represented in the Assyrian and other ancient sculptures, as well as in the Egyptian frescoes. The mummified animals of Egypt have also contributed their quota of information. There is, however, little doubt that if further attention were devoted to the correct identification of the animals in the magnificent series of Assyrian and Babylonian sculptures in the British Museum still more information might be obtained.

In our own country the great pioneer in this line of research was the late Canon Tristram, whose "Natural History of the Bible" and "Fauna and Flora of Palestine" still remain standard authorities. To Tristram we owe the identification of the Hebrew *reem*, mistranslated unicorn in the authorised version, with the extinct wild ox, or aurochs, the name apparently still surviving in the Arabic *rim*, now applied in North Africa to certain large gazelles. And in his works will be found mention of the identity of the Hebrew *nesher* (translated eagle) with the Arabic name, *nisr*, of the griffon vulture; of the Hebrew *cabh* (rendered tortoise) with *dab*, the Arabic term for the lizards of the genus Uromastix, and many other analogous instances. Unfortunately, Tristram was led to believe that several kinds of large North African antelopes, such as the bubal hartebeest, the addax, and the white or sabre-horned oryx, were natives of Palestine and the adjacent regions, whereas it is now ascertained that none of these ranges to the east of the Lower Nile, although the white oryx was brought down from the interior by the ancient Egyptians. Consequently his identifications of Bible ruminants are to a great extent erroneous, but an attempt has been made to correct them in the new edition of "Murray's Dictionary of the Bible." Important information, especially in regard to insects, will also be found in the "Oxford Bible." On the Continent, Dr. Duerst, in various publications, has contributed largely to our knowledge of the cattle—wild and tame—of Biblical times, while Dr. Lortet and his associates, whose studies of their mummified remains are published in the Archives of the Lyons Museum, have done the same for the sheep, goats, dogs, &c.

To attempt anything like a complete survey of Biblical natural history in the space at my disposal is obviously impossible, and references can only be made to a few points of general interest. Whatever may have been the origin of the story of Jonah, it is curious to note that in the Ethiopic Bible the whale is referred to as *anber*, the Arabic equivalent of ambergris, and was thus evidently regarded as the sperm-whale, by which alone that perfume is produced. Here my readers may be reminded that ambergris was the original amber, the latter word having been subsequently transferred to the substance now known by that name. Although leviathan in one passage seems undoubtedly to indicate a whale, it generally refers to the Egyptian crocodile, the range of which, until recently at any rate, extended to Syria, and formerly, as attested by the story of St. George and the dragon, included Asia Minor.

The above usage of one and the same Hebrew word in two senses is not unparalleled in the Bible, and must have been another sore difficulty in the path of the translators. *Tinshemeth*, for instance, which is translated in one passage as mole and in others as swan, is considered to indicate the chamæleon in Leviticus xi. 30, while in another part of the same book it is believed to stand for some kind of aquatic bird, which may perhaps have been the purple water-hen. Before leaving *tinshemeth*, it may be added that not only were the translators wrong when they rendered it mole, but that they were also in error when they identified another Hebrew word, *hephor-perôth*, with that animal; for, as a matter of fact, there are no moles in Palestine and Syria, and the burrowing animal indicated would seem to be one of the rodent mole-rats of the genus Spalax.

In the rendering of the names of birds, the translators were in several instances either exactly or approximately correct, pelican, crane, stork, quail, and partridge being exact translations, while glede (an old name of the kite) and hawk are near enough approximations for the smaller birds of prey, as is also swallow for swift. It is curious, however, that in two passages where swallow and crane are mentioned together, the latter name is employed as the translation of the Hebrew word meaning swallow (or rather swift), and *vice versâ*. Sparrow, the translation of *tzippor*="the chirper," is doubtless used in a general sense, although, as Tristram pointed out, the solitary sparrow on the housetop is in all probability the blue rock-thrush. Possibly such names as "gier-eagle" (from the German *gier*, a vulture, and familiar in the form of lammergier) and "ossifrage" may have been in use in this country in the seventeenth century, but nowadays neither conveys any definite meaning to the reader, the former really indicating the Egyptian scavenger-vulture, or "Pharaoh's hen," and the latter the lammergier. Lapwing is distinctly an unfortunate translation, the bird indicated being probably the hoopoe.

In regard to invertebrates, it may be noted that the rendering of *sās* in Isaiah as worm is not far out, as the word indicates the larva of a clothes-moth, and it has been suggested to me that the "booth that the keeper maketh" (Job xxvii. 18) refers to the rough larval case of a psychid moth. "Canker-worm" is now generally admitted to refer to one of the immature stages of the locust, and in the Oxford Bible it is suggested that "palmer-worm" may include not only caterpillars, but likewise a second immature phase of the locust, which would accord well with the context. Locust, grasshopper, ant, hornet, bee, fly, flea, and scorpion are correct, or

nearly correct, renderings of the Hebrew names for which they stand; and the same is doubtless the case with coral, which is found in the Red Sea and the Persian Gulf. Pearls in the Old Testament is, however, the rendering of the Hebrew *gābhîsh*, signifying ice and thus rock-crystal, whereas in the New Testament μαργαρίται is rightly translated pearls. Manna, it is perhaps needless to add, was certainly not the product of a Coccus, as the natives of Palestine now tell travellers, but apparently a mountain lichen, of which quantities were at times blown down to the plains.

A few allusions to botany have been already made, and it may be added that in the case of cultivated plants many of the translations are more or less nearly true to nature. A "garden of cucumbers," for instance, conveys an excellent idea of the abundance of melons, gourds, cucumbers, &c., characteristic of so many Eastern countries; but a local touch of colour is unfortunately lost in the reference to "white, green, and blue hangings," in which the word rendered "green" should have been translated "cotton," so that the passage should run "where were hangings of white and violet-coloured cotton." Lack of space prevents me, I regret to say, saying more on this part of my theme, and the same limitation prevents a discussion on minerals. This, however, is not a matter for regret, as Dr. Fletcher informs me that the whole subject is in great confusion, and it will therefore be advisable to await his contribution to the forthcoming exhibit at the Natural History Museum. It may be mentioned, however, that in many cases at any rate the precious stones referred to in the Bible are rightly identified only so far as the matter of colour is concerned, sapphire being apparently lapis lazuli, ruby an unknown red stone, chrysolite probably a topax, and chrysoprasus a green chalcedony akin to the "prase" from which Egyptian scarabs were cut.

I should have liked to say something with regard to the animals of the New Testament, but can only refer to Prof. Ridgeway's identification of the "pale horse" (ἵππος χλωρός) of Revelation with the dun breed, or the one of the colour of dry grass. Naturally one would have expected to find the black horse associated with Death; but, according to Prof. Ridgeway, the dun was regarded as the worst breed, and accordingly despised, a fact which, it may be suggested, perhaps affords another argument in favour of the antiquity of this type. R. L.

MEDITERRANEAN CIVILISATION AND THE PHAESTOS RIDDLE.[1]

JUDGED by the declared aims of the author, who before his lamented death, was one of the brightest of Italian men of science, this is an eminently successful work. He is "convinced that it is worth while to excite the curiosity of those who are not archæologists," and he never forgets the average reader. He is equally convinced of the independence of Mediterranean civilisation, and he has undoubtedly made out a very strong case. The author's enthusiasm sometimes makes the reader unnecessarily suspicious, but added to the popularising and argumentative motives of the author is a sincere respect for facts, and the wants of the specialist are also provided for in numberless references and footnotes. The author was himself an experienced explorer, and he has some interesting theories of his own to put forth, such as that Cyprus is not "the land of copper" and that the word *bronze* is a form of Brindisi (p. 208). On Minoan matters he writes from first-hand knowledge. In Italy he did excellent work in completing a survey of the known dolmens of that country. The dolmens illustrated are remarkably similar to our British cromlechs. The book is

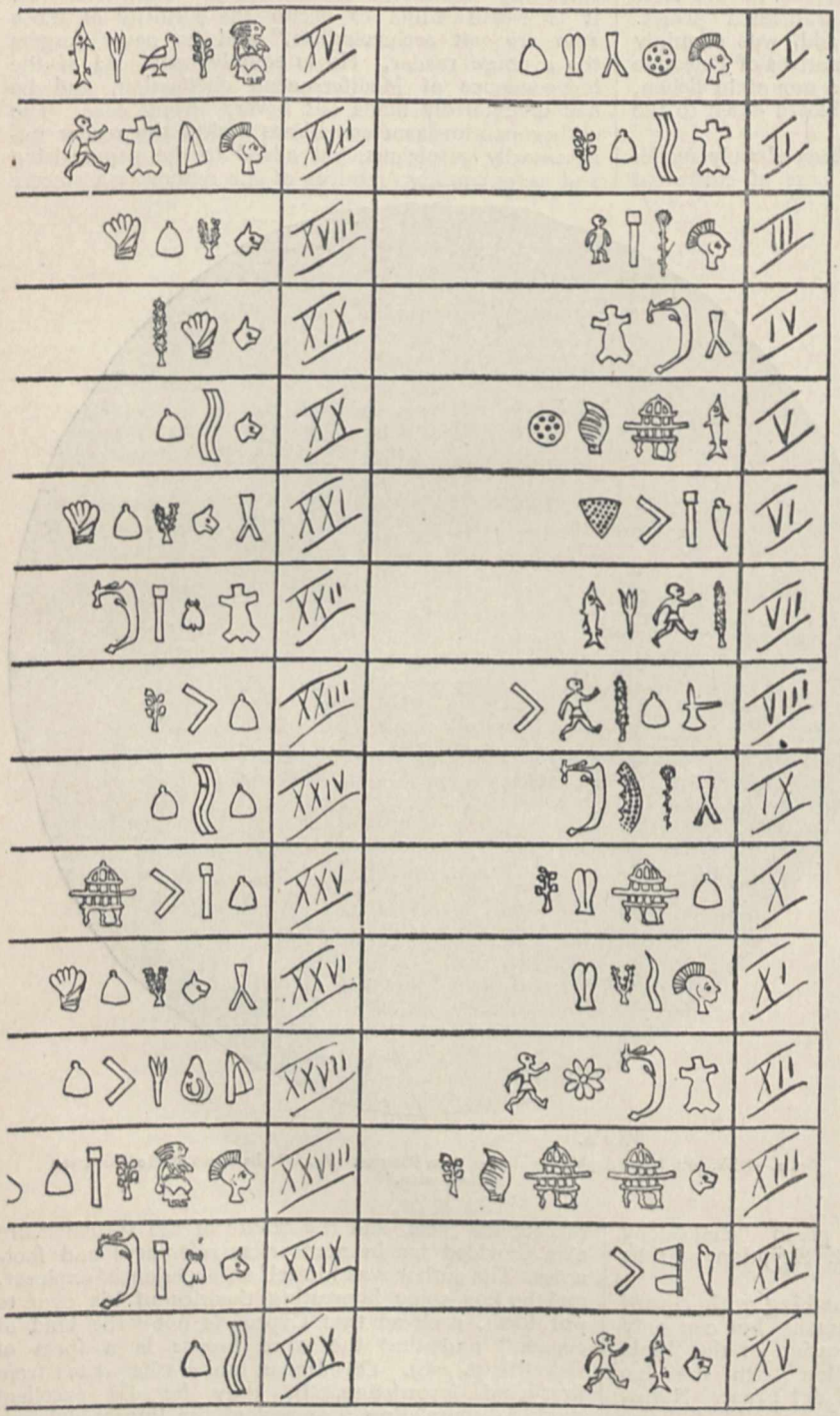
Face A.

FIG. 1.—Disk, with Hieroglyphic Inscription, from Phæstos. From "The Dawn of Mediterranean Civilisation."

1 "The Dawn of Mediterranean Civilisation." By A. Mosso, translated by M. C. Harrison. Pp. xxiii+424. (London: T. Fisher Unwin, 1910.) Price 16s. net.

very usefully illustrated, and the translator's work is excellently done.

On one important point the author gives the average reader more than the latter might expect. He takes us into the laboratory, with the usual result of making us a little uncomfortable. I refer especially to a section entitled "Dr. Evans's Chronology" (pp. 98–102). We have lately been in the habit of accepting without hardly a question the opinions expressed by experienced explorers respecting periods and stages of culture based on the depth and stratification of deposits. The author's remarks on this point are so important and disconcerting that his conclusion as regards the deposits at Phæstos should be cited here in full.



Face B.

FIG. 2.—Transcription of the Inscription on the Phæstos Disk. From "The Dawn of Mediterranean Civilisation."

"Dr. Mackensie has already expressed a doubt that a stratum may be missing at the end of the neolithic period in the soil of Knossos. My own conclusion would be to fix the duration of the neolithic occupation of Phæstos at about 2500 years, while for a complete estimate of the whole period up to the Christian era—the depth of neolithic strata in a pit at Knossos being seen to exceed 8 metres—Dr. Evans being of opinion that at a moderate estimate a period of 14,000 years from the first neolithic stratum at Knossos must be reckoned, in my opinion it should be estimated at not more than 7000 years, or possibly less.

"With every respect for the great authority of Dr. Evans, I should give a provisional character to these critical remarks until the doubtful points I have alluded to are cleared up. The chronological computation of the rapidity with which the level of the soil rises on sites of human habitation in the neolithic age and during later periods is a complex problem which depends on coefficients which are not constant, but variable. I am convinced that in the case of Knossos the quota of 1 metre for every 1000 years, as fixed by Dr. Evans, is too small" (pp. 101–2).

It is passing strange that an explorer with such a deep conviction of the variability of archæological coefficients has never a word to say of the results of a search for constant coefficients in astronomical data. Surely one-half of the archæological world knows nothing of the other half; at any rate, one would rather risk such a reckless statement than to suggest that such a fair-minded critic of archæological methods should, for no conceivable reason, suppress any evidence whatever. Any suppression of the kind would only intensify a retributive reaction.

Here in Britain astronomical archæology is now so much in evidence that every archæologist seems to have formed a definite opinion of its worth. The majority, perhaps, would prefer pointing out its worthlessness, but it happens that a majority in such a case might mean next to nothing, especially as I have not yet seen any demonstration of the worthlessness of the astronomical method involving sufficient technical knowledge to use the method itself. Round condemnatory statements

of that method have been made by some of the authorities whose own criteria are criticised by our author. Behold, now, the day of retribution!

The author gives a useful general account of the important find made by Dr. Pernier, of the Italian Archæological Mission, at Phæstos, Crete, in 1908. It was a clay disk inscribed on both sides with lines and pictographs. Judged by such standards as the author himself questions, the inscription is supposed to belong to the eighteenth century B.C. The authorities cited are very much divided as to what the inscription is and the affinities of the strange characters with known forms. Not one of those cited seems to have gone so far as Prof. Hempl, in *Harper's Magazine* for January, and Miss Stawell, in the *Burlington Magazine* for April, as to attempt a more or less complete interpretation.

In neither of the interpretations referred to is the possible calendric character of the document taken into consideration, and as I think it is a calendar, the opportunity for reproducing our author's illustrations of the document is my excuse for appending a brief outline of my findings.

In form the calendar is a rough copy of the use made of concentric circles. The pictographs on face A number 123, and not 122, as stated by our author; those on face B number 119. Each pictograph represents one degree of angular distance, and it is to be multiplied by three to make up the number of days in a year. Year A was $123\times3=369$ days, which on evidence given by Mommsen was once the length of a Roman year. Year B was $119\times3=357$ days. Assuming such a rotation as A B A, the sun would have travelled 365 pictographs or degrees in three years of the average length of 365 days. If the exact *locale* of the calendar were certainly known, its date might be made out by means of established formulæ. Its physical basis was a latitude where the apparent distance between the solstices was about 60° 50′. Of that figure I am fairly sure, and it would have roughly suited Crete in 1800 B.C. The latitude of Phæstos on an Admiralty chart is 35° 25′ N. It is much doubted, however, that the disk originally belonged to Phæstos, so that any calculation on the basis I have suggested would not materially help in fixing a date.

The calendar is quite complete, and a marvellous compendium of calendric contrivances. It is all based on the intersolstitial distance, expressed in integers, and divided by 3, 7, 17, and other numbers, an artificial system, it is true, but a very convenient one. The calendric significance of many of the pictographs stands clearly revealed when the numbers are noted. Some of them are very curious rebuses, a proof of considerable antiquity. For instance, the pagoda-like structure I felt sure stood for the number 20 in degrees and 60 in days, but for many a day I could not see either number in it. It is a four-storey building, the beams of each section numbering 5; hence $5\times4=20$, and $15\times4=60$. It indicates a legislative assembly, corresponding in significance and dates to the Tiocobrextio of the Coligny Calendar, and the entries under March 24 and May 24 in the Roman Calendar.

In all I have said so far there is hardly an element of speculation, and none of the ingenuity shown in such interpretations as those referred to. There is a precedent and an established formula to aid the inquiry at every step. A complete astronomical interpretation of the calendar will strike all students of our monuments, astronomically considered, as something quite familiar, while a sufficient scope will be left for authorities on ancient scripts to do all they can to determine the linguistic values of the pictographs, a subject I can hardly touch.

JOHN GRIFFITH.

MILITARY AVIATION AT HENDON.

THE demonstration of flying organised by the Parliamentary Aerial Committee, which took place on Friday last at Hendon, cannot be described as other than an unqualified success. If experts learnt no new lesson, if aviators acquired no new experience, the onlookers, including almost all those whose opinions would be sought and whose dicta may become law, must have had their eyes opened to the great possibilities as to the utility of the aeroplane in war.

A number of different types of machine, Farmans, Blériots, Cody, Roe, and Valkyrie were to be seen, and their respective merits compared. Besides exhibitions of rising quickly from the ground, descending near a given spot, turning and planing in the air, all of which were carried out in a superb manner, there were many tests having reference to warlike operations. A number of small dummy bombs were dropped from different machines on to ground marked out to represent the deck of a battleship. The idea was to test the possibility of attack by such means, but, although many good shots were made by dropping the missiles while travelling at a speed of perhaps 40 miles an hour, yet most of them were made from a height of only a few hundred feet, whereas to be of use in war they should be discharged from machines at least 2000 or 3000 feet above the ship. However, it is evident that if good shooting can be made in this way, it is only a matter of judgment and practice to be able to achieve good results at a much greater range. Another purpose to which such a method of attack is applicable is that of destroying dirigible balloons, and in such case the aeroplane might well be within a hundred feet of the target below it.

A more important experiment was that of discharging heavy weights, said to be 100 lb., from a flying biplane. It seemed probable that this might affect the balance of the machine, and cause it to pitch or jump, but careful observation showed that the aeroplane maintained a perfectly steady course, and was unaffected by the sudden loss of this load.

But the finest display, and perhaps the most practical experiment, so far as the immediate use of aeroplanes is concerned, was that of sending off a dispatch to a distance. Mr. Hamel went off on a Blériot monoplane to Aldershot, a distance of 32 miles "as the crow flies," though, as a matter of fact, the aviator went in a not perfectly straight line, in order to pick up familiar landmarks, and so make sure of his way.

Having handed in the dispatches at Aldershot, he returned with the reply, and it was a very impressive sight for those at Hendon to descry, high up in the sky, to the south-west, a small speck, estimated at 4,000 feet, which gradually approached and became recognisable as the monoplane, which, sweeping round a large circle, glided downwards and landed within a few feet of the starting-point. The message had been delivered and returned within two hours, the actual times being:—

Left Hendon	3·35
Arrived Aldershot	4·20
Left ,, ...	5·0
Arrived Hendon	5·35

Other events were the ascents of two staff officers on biplanes piloted by experienced aviators, who, without any previous experience, were to report on the position of certain troops which had been posted in the neighbourhood. This was most successfully accomplished. Short trips made by Mr. Balfour and by Mr. McKenna, First Lord of the Admiralty, tend

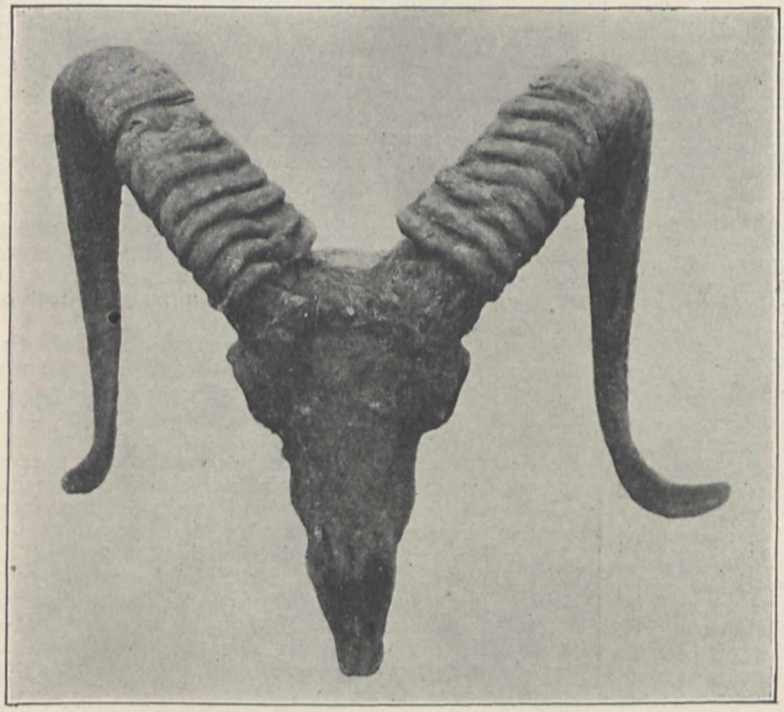
to bring home to the public the ease and safety of aeroplane travel.

One important item of the programme was not carried out. It was announced that if the circumstances were favourable the Army dirigible "Beta" would come up from Aldershot and take part in the proceedings. The weather proved perfect, it being almost a dead calm with bright sunshine. The "Beta" was ready and actually made one ascent, but for some reason which has not been given out she did not attempt the journey. Advocates of the aeroplane as being a more practical apparatus than the dirigible claim this as a triumph for their cause.

B. BADEN-POWELL.

SPORT AND TRAVEL IN CENTRAL ASIA.[1]

THIS book, as its writer says, is merely "a plain record of a year's wanderings in the lesser known parts of Central Asia for the purpose of sport and travel." Its author had eyes for little else than the quest of large game for the sake of their heads as trophies. Of the country through which he passed or of its people, he tells us little, and nothing at all of its other fauna or its flora, and of many of the topics of human and scientific interest which the general reader expects to find in travel-books of little-known regions. Even in regard to the large game themselves the bald narrative provides no new facts nor any intimate study of the animals or their haunts. The photographs of the heads, however, are of some interest, as the specimens hitherto figured are not numerous and the limits of several of the species are not yet clearly defined. The account of the camp outfit also may supply some useful hints to sportsmen who contemplate an excursion in those regions.



Ovis Karelini. From "Across the Roof of the World."

Starting from Kashmir, the author crossed the Pamirs by the usual route, shooting on the way an *Ovis poli*, the horns of which measured (doubtless along their inner curve, as usual) "under 50 inches"; but he saw a pair on a tomb at Kashgar which were 72 inches. Beyond Turkestan, in the Thian Shan, he shot two specimens of the great stag generally termed the "Asiatic Wapiti" (*Cervus canadensis songdricus*), locally known as "Boga" by the Mongols, with horns measuring respectively 48 and 49 inches, the latter pair carrying 14 points or tines. A specimen of the *Ovis karelini*, with horns "just over 40 inches," was shot there, also the Turkestan ibex, with a horn length of 55 inches—the record being 57½ inches—and several Siberian roedeer (*Capreolus pygargus*). It is rather surprising to read that the skins were merely rubbed with crude wood ashes as a preservative and nothing else. Continuing northwards through Dsungaria, Lieut. Etherton sighted, on the plain of Lake Ebi, what he believed were wild horses (*Equus prejevalski*). The Altai was crossed in mid-winter, too late to attempt following the *Ovis ammon*, for which that range is famous, so our traveller turned down the steppes of the Irtish and Obi valleys to the Trans-Siberian Railway near Tomsk, where civilisation was reached once more.

[1] "Across the Roof of the World."—A Record of Sport and Travel through Kashmir, Gilgit, Hunza, the Pamirs, Chinese Turkistan, Mongolia and Siberia. By Lieut. P. T. Etherton. Pp. xvi+437. (London: Constable and Co., Ltd., 1911). Price 16*s*. net.

NOTES.

IN consequence of the Whitsuntide holidays, the annual visitation of the Board of Visitors to the Royal Observatory, Greenwich, will take place on Friday, June 2, instead of on Saturday, June 3.

THE newly erected Cancer Research Institute at the Cancer Hospital is to be opened by H.R.H. the Duke of Connaught on Tuesday next, May 23, at 3 o'clock.

AN earthquake shock was felt at 8.50 a.m. on Tuesday last in the Ullswater Valley.

WE regret to learn from a Reuter telegram that Prof. Ernst Haeckel met with a serious accident on Tuesday. In endeavouring to reach a book from a high shelf he fell, breaking his hip bone.

WE regret to notice the death, at the age of eighty-two years, of Sir Nathan Bodington, Vice-Chancellor of the University of Leeds.

THE death is announced, at the age of sixty-five years, of Mr. Emerson M. Bainbridge, well known for his work in connection with coal-mining. In 1867 he was selected to report to the North of England Institute of Mining Engineers on the haulage of coal, and received for his services a valuable premium. Two years afterwards the Institution of Civil Engineers awarded him the Manby premium for a paper upon the probability of working coal at a depth of 4000 feet. Another paper, on the prevention of colliery explosions, was rewarded by the conferment of one of the Herman prizes. Mr. Bainbridge was a member of the Royal Commission on Coal Dust in Mines in 1891, and a juror of the Inventions Exhibition of 1883.

IT is announced in the *Revue scientifique* that a committee has been formed for the purpose of erecting a monument to the late M. Bernard Brunhes, who died last May at the age of forty-two years. M. Brunhes was for ten years director of the observatory at Puy-de-Dôme.

A MEETING of the Society of Tropical Medicine and Hygiene will be held at 11 Chandos Street, Cavendish Square, to-morrow—Friday—evening, when a discussion on the present position of the prophylaxis of malaria by quinine will be opened by Dr. W. Carnegie Brown, and a paper on the nature of Zambezi fever, by Dr. W. I. Bruce, of Chinde, and a note on cultural characteristics of a variety of the streptothrix of white mycetoma, by Dr. N. F. Surveyor, of Bombay, will be presented.

THE 129th Harveian Festival of the Royal College of Physicians of Edinburgh is to be held to-morrow, May 19, when Sir Alexander R. Simpson will deliver an oration on "Life and its Epiphanies."

THE Faraday Society has organised a general discussion on high temperatures, to be held on Tuesday, May 23, at the Institution of Electrical Engineers, Victoria Embankment, W.C. The following programme has been arranged:—Dr. Arthur L. Day will read a paper on recent advances in gas thermometry; Dr. J. A. Harker, F.R.S., will describe the high-temperature equipment at the National Physical Laboratory; Mr. H. C. Greenwood will read a note on boiling points of metals; and Mr. A. Blackie will speak on the behaviour of silica at high temperatures. Contribution to the discussion have been promised by Prof. Bodenstein on the maintenance of constant high temperatures, M. Féry on stellar pyrometry, and others. Dr. R. T. Glazebrook, F.R.S., director of the National Physical Laboratory, will preside. During the afternoon the society, by the invitation of the director, will visit the National Physical Laboratory to inspect the high-temperature equipment of the laboratory.

DR. HENRY HEAD, F.R.S., will deliver the Croonian lectures (upon "Sensory Changes from Lesions of the Brain") before the Royal College of Physicians of London on June 13, 15, 20, and 27.

AT the convention of the Incorporated Municipal Electrical Association, which is to take place at Brighton and at Portsmouth on June 27 to 30, the following papers are to be read and discussed:—electricity supply viewed from the municipal committee's standpoint, by Councillor H. Leese; modern wiring practice, by Mr. J. W. Beauchamp; internal-combustion engines in power stations, by Messrs. H. L. Howard and R. M. Carr. There will also be discussions on purchase of fuel and street and shop-front lighting, opened, respectively, by Mr. C. E. C. Shawfield and Mr. A. H. Seabrook.

THE annual general meeting of the Society of Chemical Industry is to be held in Sheffield on July 12. Dr. R. Messel has been nominated as president, and Sir William Crookes, F.R.S., Dr. G. G. Henderson, and Messrs. H. Hemingway and W. F. Reid have been nominated as vice-presidents.

THE ninety-fourth annual meeting of the Société Helvétique des Sciences Naturelles will be held this year at Soleure from July 30 to August 2. The first general meeting will take place on July 31, when the president for the year, Dr. A. Pfaehler, will give his opening address, and the following lectures will be delivered:—M. Georges Claude, on "La Liquéfaction de l'air, son état actuel et ses applications"; Prof. Ursprung, of Freiburg, on "Der heutige Stand des Saftsteigungsproblems"; Dr. H. Stauffacher, of Frauenfeld, on "Die Rolle des Nucleins bei der Fortpflanzung"; and Prof. Otto Schlaginhaufen, of Zurich, on "Reisen und Forschungen in Melanesien." The second general meeting will be on August 2, for which the following lectures have been arranged:—Prof. Abderhalden, of Berlin, on "Neuere Anschauungen über den Zellstoffwechsel"; Prof. P. Gruner, of Berne, on "Die neueren Vorstellungen über das Wesen der Elektrizität"; and Dr. Albert Brun, of Geneva, on "Les recherches modernes sur l'exhalaison volcanique." The annual meetings of the Swiss societies of botany, chemistry, geology, mathematics, physics and zoology will be held also at Soleure on August 1.

A COLLIERY and General Mining Exhibition, lasting a fortnight, was opened in Manchester on Friday last by Prof. Sir Thomas Holland, K.C.I.E., F.R.S., who in the course of his remarks said the exhibition contained methods for securing safety underground and rescue apparatus for saving life after accidents had occurred. The improved methods of machines on view had an important bearing on the economy of mining, and thus the exhibition would be of service in showing how our natural resources could be turned to full account. He reminded his hearers that large quantities of coal were destroyed in the process of mining it, and that every ounce of coal ore or mineral that was destroyed was destroyed once for all without possibility of replacement. He suggested that, if the colliery owners of Lancashire would get together in groups and employ young geologists to correlate the information that was available, a geological map of the district might be constructed the practical usefulness of which would repay its cost many times over.

THE first International Chemical Engineering and Industries Exhibition was opened on Saturday last at the Royal Agricultural Hall, Islington, by Lord Denbigh.

DR. E. J. RUSSELL, of the Lawes Agricultural Trust, having directed attention to the need and value of photographs illustrating the scenery associated with various geological formations, the Tunbridge Wells Natural History Society is offering for this purpose a series of prizes, of 2*l.* each, for the best set in the following subjects:—first, scenery of the chalk districts—hills, sections, valleys and combes; second, scenery of the Wealden sandstone formation—sections, &c.; third, scenery of the Tertiary beds; fourth, scenery connected with shingle, gravel or sand beds; fifth, river and marsh scenery. Messrs. W. Whitaker, F.R.S., and R. Child-Bayley, editor of *Photography and Focus*, have kindly promised to act as judges. Full details of the competition can be had on application (stamp should be enclosed) to Mr. Geo. Abbott, 2 Rusthall Park, Tunbridge Wells, and the prints should be sent to him on or before March 1, 1912.

ACCORDING to *The Athenaeum*, an expedition to south-east Arabia has been planned by the Danish Royal Geographical Society, the object being the mapping of parts of Oman and the studying of the ancient memorials and commercial prospects of the country.

THE Research Committee of the National Geographic Society of Washington has made an appropriation of 5000 dollars for continuing the glacier studies of the two previous years in Alaska. The work, beginning in June, will be done by Prof. R. S. Tarr, of Cornell University, and Prof. Lawrence Martin, of the University of Wisconsin, who have directed the National Geographic

Society's Alaskan Expeditions of 1909 and 1910 in the Yakutat Bay, Prince William Sound, and lower Copper River regions. The 1911 expedition will study briefly a number of regions of glaciers not previously investigated by the National Geographic Society, although partially mapped by the Alaska Division of the U.S. Geological Survey, the Boundary Commissions, &c. Work will be done on the present ice tongues and the results of glaciation in the mountains and plateaus of parts of the interior and some of the fiords of south-eastern Alaska, the former having lighter rainfall and smaller ice tongues than the Yakutat Bay and Prince William Sound regions.

To *Naturwissenschaftliche Wochenschrift* of April 30 Prof. Branca communicates a popular notice of the dinosaurian remains obtained from the Lower Cretaceous of the Tendaguru Mountains of German East Africa by the recent expedition from Berlin. The most noteworthy feature of these remains, so far as they have been examined, appears to be their gigantic dimensions, which largely exceed those of Diplodocus. The longest rib of the latter measures, for instance, 1·86 m., whereas some of the African ribs are no fewer than 2·50 m. in length. Again, the longest cervical vertebra of the former is 0·64 m., in contrast to which is one from Tendaguru—possibly not the biggest—measuring 2·10 m., while a humerus of the African dinosaur is 2¼ times as long as the corresponding bone of Diplodocus, measuring 2·10 m. (6 feet 10 inches) against 0·95 m. (3 feet 1 inch). It should, however, be borne in mind, although this is not mentioned by the author, that Diplodocus is not the largest known reptile, its femur measuring 1·542 m., or 5 feet 1¾ inches, against 6 feet 2 inches in that of Atlantosaurus. Still, as the femur is always a much longer bone than the humerus, the advantage is largely on the side of the African reptile. According to the author, the remains previously obtained from East Africa by Dr. Fraas were much larger than those of any other known dinosaur, but these are completely eclipsed by the new specimens. In addition to the dinosaurs, remains apparently referable to pterodactyles have been obtained. Remains have likewise been discovered in several other localities of German East Africa. Prof. Branca adds some remarks in regard to the pose and food of the sauropod dinosaurs, observing that if these reptiles subsisted on a vegetable diet, it is difficult to imagine how they obtained sufficient nutriment. The same difficulty, it may be mentioned, has occurred to another naturalist, Mr. J. Versluys, who has suggested in the *Zool. Jahrb., Abtheil. f. Systemat.*, vol. xxix., p. 425, 1910, that these reptiles fed on fishes. Prof. Branca is also exercised in his mind how the sauropods obtained sufficient calcareous matter for their enormous skeletons; but it may be pointed out that the supply of this substance would increase *pari passu* with the amount of food consumed. In this connection, it may be noted that *The Scientific American* of April 8 contains an illustrated account of the life-sized restorations of dinosaurs recently installed by Mr. Carl Hagenbeck in his Tiergarten at Stellingen, near Hamburg.

MR. L. L. WOODRUFF has contributed to the *Archiv für Protistenkunde* (vol. xxi., 1911) a remarkably interesting account of the results which he has obtained in breeding experiments with Paramœcium. Of late years there has been a tendency amongst biologists to accept the view that the multiplication of unicellular organisms by simple fission cannot go on indefinitely, but leads ultimately to exhaustion and even extinction of the family unless the failing vitality be renewed by conjugation. According to Mr. Woodruff, this only holds true when the organisms are exposed to a more or less constant environment. He finds that by subjecting the Infusoria to a varied environment (represented in this case by the culture medium), they can be made to keep on dividing indefinitely in a perfectly normal manner without conjugation or the use of artificial stimulation. The culture on which this conclusion is based has been kept under observation for nearly three and a half years, during which time over two thousand generations of Paramœcium have been produced, giving an average of about one division every fifteen hours.

IN the March issue of *The National Geographic Magazine* Messrs. Collins and Doyle, of the U.S. Department of Agriculture, describe a tour in southern Mexico undertaken with the object of investigating the causes of the immunity of the crop in that region from the destructive cotton-boll weevil. The results are not quite conclusive, but it appears that in some districts the practice of planting the cotton crop only in alternate years is a successful method of combating the weevil, and that in other places the boll is found to be naturally protected against its attacks by the abnormal growth of proliferating tissue, or in some cases that the aperture by which the weevil enters the boll was sealed up by the growth of the web of a small jumping spider (*Aysha minuta*).

AN interesting article on the plant knowledge that prevailed formerly among the Gosiute Indians is communicated by Mr. R. V. Chamberlin in the Proceedings of the Academy of Natural Sciences of Philadelphia (February). The tribe inhabited the desert region lying to the south-west of the Great Salt Lake in the State of Utah, but nevertheless made very extensive use of plant products for food and medicine. Green vegetables were prepared from the leaves of the composite *Balsamorhiza sagittata* and the umbellifer *Cymopterus montanus*. The tuberous roots of *Carum Gairdneri* were much esteemed, also the bulbs of *Calochortus Nuttalli*. Seeds were gathered from *Salicornia herbacea*, species of Atriplex and Chenopodium, *Sisymbrium canescens*, various composites, *Triglochin maritimum* and *Typha latifolia*; while the "nuts" of *Pinus monophylla*, formerly of necessitous importance, are still collected in quantity. Pharmaceutical remedies were prepared from the roots of *Ferula multifida*, *Valeriana edulis* and *Spiraea caespitosa*, and from the leaves of *Artemisia tridentata*.

THE annual report for 1910 issued by the director of Rothamsted Experimental Station reflects to a great extent the unfavourable conditions that prevailed during the summer. The yields of wheat, barley, and grass crops were all low, but mangolds were good, and a second crop of clover on one field was very large. A noticeable feature on the barley plots was the value of phosphate manuring, which becomes more marked in a wet and cold season. Striking evidence was obtained of the beneficial effects which result from preceding wheat with a leguminous crop. A report by the director and Dr. E. J. Russell on the soils in the south-east of England is being published by the Board of Agriculture, and a paper by Miss Brenchley dealing with the weeds prevalent in Rothamsted district is announced.

FROM the account of the gardens at Llanover, Monmouthshire, contributed by Mr. G. Went to *The Gardener's Chronicle* (May 6), it is evident that natural conditions and careful management have combined to produce a magnificent collection of trees. Mention is made of some fine specimens of *Sequoia gigantea* and a lofty tulip tree, all exceeding a height of 100 feet, and of specimens of *Alianthus glandulosa*, *Abies Smithiana*, and *Pinus excelsa*

almost as high. Fuchsias of the types of *globosa* and *Riccartonii* attain large proportions, and a plant of the *nobleanum* variety of *Rhododendron caucasicum* was estimated to cover an area 30 feet in diameter.

A DOUBLE number of *The Indian Forester* (January and February) contains an article on forest railways for the extraction of timber, communicated by Mr. F. A. Leete, in which he describes an original type of monorail experimentally tried in Burma; a note on wood-pulp testing, by Mr. W. Raitt; and a report on the system of afforestation with field crops in Berar. Mr. Raitt states that four Indian conifers, *Picea Morinda*, *Abies Pindrow*, *Pinus excelsa*, and *Pinus longifolia*, yielded long-fibred, strong pulps of good colour and quality, while weaker but useful pulps were obtained from six hard-wood trees, including *Bombax malabaricum*, *Populus ciliata*, and *Ficus bengalensis*.

A THICK volume, issued as vol. xiv., part i., of "Contributions from the United States Herbarium," is devoted to a compilation dealing with the lichens of Minnesota, in which Mr. Bruce Fink presents the data collected and conclusions formulated by several years' field work and study. Under the only American order of Ascolichenes, four suborders, Coniocarpineæ, Graphidineæ, Discocarpineæ, and Pyrenocarpineæ are delimited. The largest family, the Lecideæ, contains eight genera, of which Lecidea, Bacidia, and Buellia are the more important; Cladonia and Lecanora are also large genera. Artificial keys are provided for genera and species, and illustrations for one species of each important genus. Further, to add to its value as a practical handbook, the author has given an introductory account of lichen structures and modes of reproduction. Since the lichen flora of Minnesota is fairly representative of a large portion of the northern area of North America, the volume should be useful to British lichenologists for purposes of comparison.

THE agricultural experiment station attached to the Purdue University, Indiana, has succeeded in coming into very close contact with the farmers by means of educational trains, field trials, and illustrated circulars dealing with various practical questions. The educational train is almost unknown in this country; it consists of a coach for the staff, two "audience coaches," and a "palace-horse" car, in which are kept the animals used for the demonstrations. The train stops at convenient centres, and is met by the local farmers; the staff then give lectures and demonstrations dealing with matters of local interest. Of the popular circulars recently to hand, we need only mention one on wheat, in which stress is laid on the fact that the average yield in Indiana is only 13·3 bushels per acre, whilst on the college farm it is 28 bushels per acre. The farmer is advised how he may make up the deficiency and improve his own crops.

WITH the union of the South African colonies, the issue of separate agricultural journals has become superfluous, and they are now all merged into a new *Agricultural Journal of the Union of South Africa*, issued monthly in English and Dutch by the Department of Agriculture. The first number contains articles on the cultivation of recently introduced crops, cotton, bananas, citrus fruits, and others, and records experiments on partial sterilisation of soil for tobacco seed beds. Dr. Theiler describes "stiff-sickness" in cattle, a disease very similar to laminitis in horses, which he traces to *Crotalaria burkeana*, a plant occurring in the pastures. Altogether the new journal reflects very great credit on all concerned in its production.

THREE diseases of groundnut have been studied by Mr. F. W. South in the West Indies. A rust fungus, *Uredo arachidis*, is of very general distribution both on imported and on local varieties throughout all the islands. The amount of damage it is capable of causing appears to vary in different islands, as does the success of the control measures employed. A leaf-spot fungus, *Cercospora personata*, is more local and not as yet very serious. A root disease caused by a fungus not identified occurs in a number of the islands; its host plants are numerous and of a very general nature. No adequate method of control is known. Mr. South's observations are published in the West Indian Bulletin, vol. xi., No. 3.

WE have received the first report of the Mine Rescue Station Commission of the State of Illinois, which contains some interesting information. Illinois has taken the lead in the United States, and has been the first State to provide a rescue service for its coal mines. Three stations have been built, namely, at Benton, Springfield, and La Salle. In general design and equipment they appear not to differ greatly from those already erected in Great Britain, containing a lecture room, a training chamber, store rooms, &c. Unlike most European rescue stations, they also contain dormitories, which are probably rendered necessary by the conditions of the case; the intention appears to be that men being trained in rescue work should give up their whole time to the training, and should live at the rescue station during their period of training; it seems to be considered that a fortnight should suffice for this purpose. A novel feature here is the provision of a travelling rescue station in the form of an old Pullman car, which has been re-fitted so as to carry rescue appliances, oxygen cylinders, and other requisites; one of these will be attached to each rescue station, where it will stand on a siding ready, so that a locomotive can be coupled up to it and it can at once be taken to the scene of any accident. This idea is well worthy of adoption in other places. Of course, each of the Illinois rescue stations has also its motor-car for road work. The Commission does not express its preference as yet for any one of the numerous forms of rescue appliances that have been designed during the last few years, and rather implies that it has not yet come across any thoroughly satisfactory pattern. Finally, and as perhaps the most important point of all, let it be noted that this is a State enterprise, and that the State pays all expenses, which already amount to some 15,000*l*.

The Journal of Genetics, the first number of the first volume of which appeared in November, 1910, is, as stated in that issue, "a periodical for the publication of records of original research in Heredity, Variation and allied subjects. The Journal," so the announcement continues, "will also, from time to time, contain articles summarising the existing state of knowledge in the various branches of Genetics, but reviews and abstracts of work published elsewhere will not, as a rule, be included." The number before us contains a detailed and copiously illustrated account, by Dr. R. N. Salaman, of his hybridisation experiments with the potato. The characters dealt with pertain to certain morphological features of the leaf and tuber, and also to the colour of the latter. The same laws of dominance do not hold with the wild *Solanum etuberosum* as with the domestic varieties of potatoes. In *S. etuberosum* it was shown that immunity to the attacks of *Phytophthora infestans* is inherited as a recessive character. There is a very interesting paper by F. Keeble and Miss C. Pellew, in which it is shown that the character tallness, treated by Mendel as a single

character, is capable of analysis into two characters, length and thickness of internode, which are inherited independently of one another. L. Doncaster and F. H. A. Marshall describe the results of experiments designed, amongst other reasons, to test the hypothesis put forward by Dr. Rumley Dawson in his Causation of Sex, that the right ovary gives rise exclusively to male-producing and the left ovary to female-producing ova. The results do not support Dr. Dawson's view. The journal is well printed and well illustrated, and is of a convenient size. We wish it success, which it will doubtless achieve.

IN *Mitteilungen aus den deutschen Schützgebieten*, Heft 1, K. Langbeck discusses the data obtained by means of self-registering raingauges on the Cameroon mountain. Situated near the equator, and swept by the south-west monsoon winds of the west coast of Africa, almost the heaviest rainfall in the world has been here recorded, Debundja receiving a mean annual rainfall of 10,149 mm., and Bibundi of 10,701 mm., so far as observations go at present. The article deals with the twelve months April, 1909, to March, 1910, and within this period the maximum rainfall occurs during the forenoon in the rainy season, and after midday in the dry months of the year. High values were recorded from 2 a.m. to 10 a.m. between June and October, and from noon to 4 p.m. and 6 to 7 p.m. between November and May. Utilising the data of previous years, a general excess of rainfall between 6 p.m. and 6 a.m. to the extent of about 60 per cent. is found, so that too great reliance must not be placed on a short period only. The investigation, however, is interesting, and as additional material is accumulated these apparent discrepancies will doubtless be explained. In the same number are published two maps of German South-west Africa, scale 1 : 200,000 and 1 : 400,000, which include the coast region from the Orange River up to lat. 26° S. A short description of the geography and the meteorology of the area is also given.

WE have received from the observatory at Rio Janeiro a pamphlet entitled "Codigo Mnemo-Telegraphico," by Sr. N. Duarte, chief of the meteorological section, for the compilation and translation of weather telegrams, &c., by the use of words instead of figures, with the view of preventing mistakes in transmission. The principle bears resemblance to the *technica memoria* sometimes used in schools, with much advantage, for remembering dates, &c., by substituting letters for figures to form words. The present system is ingenious, and when the key is mastered the messages may be composed or deciphered without reference to the code. But it is not at all likely to compete successfully with the international telegraphic code now generally in use.

WE have received from Major R. A. Marriott a pamphlet entitled "Why we may expect Warmer Winters," in which he seeks to revive a theory enunciated by his friend Major-General Drayson, whose scientific merits he wishes should be more fully recognised. We sympathise with his loyalty, but cannot accept his deductions. Major-General Drayson claimed to have discovered a "second rotation of the earth," and it is urged, as we think somewhat disingenuously, that there is evidence to show that General Drayson's reasoning was sound, and that errors have arisen in astronomical calculations from neglect of the principle. The practical effects of the neglect are urged as more important than the theoretical. Astronomers have assigned an erroneous value to the change of the obliquity of the earth's axis to the ecliptic. Instead of being limited to a quite small angle, the obliquity, it is urged, will change as much as 12°, naturally causing very great changes in the climate. Given the change, the result may be admitted, but inasmuch as the annual increment is only 40·9″, and the minimum is not reached until the year 2295, it is evident that from this cause there can be very little effect until after 2680 A.D., for whatever effect is produced in the first 385 years will be as slowly undone in the succeeding period of equal length. The author, of course, has greater scope when he applies his theory to geological changes, as in the case of the Ice age. But here his periods seem to be too short, as for the purposes of ordinary life they are too long. On this point, however, we cannot insist, for we do not know the date of the observed phenomena with sufficient precision to apply calculation. Within historic times, the facts are scarcely borne out. If we compute from General Drayson's data, the obliquity of the ecliptic at the earliest trustworthy observation, 230 B.C., we get the value 24° 19′ 20″, while the observed obliquity was only 23° 51′ 20″; the rate of change is made, therefore, more than twice as great as that of the observed. The price of the pamphlet is a modest penny, but unfortunately the name of the publisher is not given.

THE difficulty of determining the true temperature of the radiating surface has been the greatest obstacle in practically all investigations of the radiating properties of metallic and other surfaces. A method of overcoming this difficulty is described by Mr. C. E. Mendenhall in vol. xxxiii., No. 2 (p. 91), of *The Astrophysical Journal*. In his experiments the author folded a piece of thin, flat, conducting ribbon of, say, platinum, parallel to its length, so that it formed a **V**-shaped cavity, and found that optical pyrometer observations of the temperature within the wedge-shaped aperture, particularly in one with reflecting walls, give the true temperature of the outside surface of which the radiation is to be studied. Various experiments with filaments of pure platinum verified the accuracy of the method.

THE stability of the atom under changes of molecular kinetic energy has been investigated anew by Mr. Harry Clo, who tested the stability by the resistance of the atom to ionisation; previous investigators have failed to find any certain dependence of atomic stability on the temperature. A specially constructed cylinder containing hydrogen or air was surrounded by an electric furnace raised to various measured temperatures, and the contained gas submitted to the ionising influence of the γ rays of radium. The results, published in a paper appearing in No. 2, vol. xxxiii., of *The Astrophysical Journal*, indicate that the ionisation of air is independent of the temperature of the gas to within 0·2 per cent., up to 600° C., and that the same independence is exhibited by hydrogen up to about 430° C.; a variation of above 200 per cent. in the absolute temperature of a gas fails to affect the stability of the atom sufficient to change the ionisation more than about 0·1 per cent.

THE Bulletin of the Imperial Society of Naturalists of Moscow for 1910 contains (pp. 79–212) a long mathematical investigation, by Prof. Ernst Leyst, of formulæ representing the action of one magnet on a second. After dealing with the ordinary simple conception of a magnet as composed of two point poles of opposite sign, Dr. Leyst considers the much more complicated case—applicable to thin-walled hollow cylindrical magnets—where each pole is regarded as a fine circular ring of positive or negative matter. In the most general case the mathematical operations are heavy, and the resulting formulæ long; the

coefficient of one single term occupies eight pages. More especial attention is paid to the two standard positions of Gauss and the two standard positions of Lamont. These have been treated with more or less completeness by several previous magneticians, amongst whom Lamont and Borgen are specially mentioned; but, according to Leyst, few if any of his predecessors who have given formulæ for all four cases have wholly escaped printers' errors. Expression is given to the belief that the differences between results obtained for the horizontal component of the earth's magnetic force with different magnetometers are due in large measure to insufficiency in the deflection formulæ employed. There seems, however, no reference to the theoretical or experimental work on this question carried out of late years in this country and in India.

The Electrician for April 14 contains an abstract of the last three of Sir J. J. Thomson's Royal Institution lectures on radiant energy and matter. They dealt with the distribution of energy in the spectrum of a black body, the relation between radiation and absorption of a body, the character of the absorption of gases, and the nature of radiation and of light waves. The same number of *The Electrician* contains a summary of the lecture on the deflection of the positive rays of the vacuum tube as a new means of chemical analysis. Since the ratio of the deflections of a particle in the electric and magnetic fields depends on the quotient of the electric charge carried by the mass of the particle, an examination of the deflections allows some deductions to be made as to the composition and charges of the particles. Oxygen, for instance, appears to exist in the tube in nine modifications, and these help us to understand why the same chemical substance is so often capable of giving entirely different spectra under different conditions.

THE illuminating engineers of America appear to have commenced a crusade against the evil of "glare" in artificial illumination, and the subject is given a prominent place in several of the American scientific journals. *The Scientific American* for April 15 contains an article on light and shadows ministering to eye comfort, by Mr. E. C. Chittenden, of the Bureau of Standards. He considers that the present method of lighting large rooms by lamps concealed in recesses close to the ceiling gives too great uniformity of illumination to be pleasant to the eye, and prefers visible lamp fixtures provided with fittings of prism glass, which send the light in the direction required. According to the April number of *The Illuminating Engineer of New York*, an American Association for the Conservation of Vision has been formed, and the editor sums up a few of the questions at issue as follows:—(1) Is glare so injurious to the eyes as is generally believed? (2) Is indirect lighting good or bad? (3) Is the Cooper-Hewitt lamp injurious to the eyes?

A SUPPLEMENT to *The Electrician* of May 12 devotes nearly 200 pages to special articles on the present position of electric power in mining. Since the corresponding supplement was issued three years ago, new rules have been issued by the Home Office dealing with the use of electrical appliances in mines, and one of the articles is devoted to the elimination of risk from explosion and from shock in the use of electricity. Other articles deal with the supply of power, either from a public or from a private station to the colliery, the winding plant, the wiring of the mine, coal-cutting machinery, haulage plant, pumps, switches, and electric hand lamps. Each is written by a man well qualified to deal with his subject, *e.g.* Prof. W. M. Thornton, Mr. H. J. S. Heather, and Mr. W. B. Shaw.

MESSRS. NEGRETTI AND ZAMBRA have submitted to us a pair of folding prismatic binoculars, which we have carefully tested. The chief feature is the manner in which the binoculars may be folded for ease in carrying to fit into a case $3\frac{1}{2}$ inches wide and only *one inch thick*. This is achieved by mounting the prism in which the first two reflections occur separately from the prism producing the last pair of the four reflections of the usual prismatic system. This has not resulted in any sacrifice either in power, aperture, or—so far as we can see—in illumination. We have ascertained that the magnification and field of view as given by the makers, viz. 5·5 diameters and 8·3°, are approximately correct, and these compare very well with the ordinary prism-binocular. The focussing is smooth, the introcular distance can be adjusted, and for a small range the focus can be separately adjusted for each eye. The only criticism we have is of the spring catches which hold it in position for use, which do not appear quite strong enough. Incidentally, the glasses provide very interesting evidence of the power we possess of rotating our eyes in their sockets (by means of the oblique muscles). If the spring catches are released while looking through the glasses, and the bodies are slightly rotated, as in folding them, the images seen by the two eyes rotate in *opposite* directions. It will be found that for a few degrees either way the eyes are able to follow, and to fuse the images into one.

IN the paragraph on a fresh-water rhizocephalan in our last week's issue, the *Records of the Indian Museum* is quoted as *Records of the British Museum*.

OUR ASTRONOMICAL COLUMN.

THE BRIGHT METEOR OF APRIL 30.—Mr. Harrison Hill, of Abbey Road, N.W., writes to say that he also observed the brilliant meteor which was seen, as reported in these columns last week, by the Rev. T. E. R. Phillips. At midnight on April 30 Mr. Hill's attention was arrested by a sudden and bright light, which appeared to be a large star, in the S.W. sky. This object increased rapidly in size and apparent brightness, and then disappeared. Although Mr. Hill has frequently observed "shooting stars," this meteor especially impressed him by reason of its lack of apparent motion and its exceeding brightness.

THE SPECTRUM OF NOVA LACERTÆ.—A comprehensive study of the spectrum of Nova Lacertæ is published in No. 194 of the Lick Observatory Bulletins by Prof. W. H. Wright. Spectrograms were secured early in January with spectrographs attached to the 36-inch and 12-inch refractors, but subsequent observations were prevented by a protracted storm which set in after January 6. Altogether, some 140 wave-lengths are given as positions of lines, or as maxima, minima, or limits of bands. As remarked by Prof. Wright, the interpretation of this complex structure of the spectrum is a difficult problem in which great caution must be used. There is one point to which he directs specific attention, however. In the comparison iron-spark spectrum the air lines appear as usual, and show a large measure of agreement with many of the bright-band maxima in the star. This is shown by a table comparing the nitrogen wave lengths given by Exner and Haschek and Neovius with the stellar wave-lengths. But it should be noted that the strongest nitrogen line, λ 3995, is absent from the star spectrum, as are also some of the fainter lines in the spectrum of the gas; neglecting the lines of intensity two and less, there is, however, a striking agreement except for some discrepancies in wave-length such as might easily occur in the measures of the involved nova spectrum. This is interesting and suggestive, but, as Prof. Wright says,

the existence of nitrogen in the star can hardly be said to be proved.

Bright bands, possibly related to two found in gaseous nebulæ, were seen in the January spectra of the nova, and a spectrogram taken on March 30 shows that the nova had then arrived at the nebula stage; bands at or near λλ 4861, 4959, 5007, 5752±, and 6563 were recorded.

THE RADIAL VELOCITY OF α CYGNI.—The study of thirteen spectrograms taken at the Pulkowa Observatory confirms the variability of the radial velocity of α Cygni, first discovered at the Yerkes and Lick observatories in 1910. In No. 38 of the *Mitteilungen der Nikolai-Hauptsternwarte zu Pulkowo* Herr G. Neuimin publishes the data and results he obtained from the measures, and directs special attention to the fact that the velocities deduced from eighteen metallic lines vary considerably and consistently from those obtained from the measures of the three hydrogen lines Hδ, Hγ, and Hβ. The range of velocities, relative to the sun, as derived from the metallic lines, is from −17·6 to +2·47 km., and from the hydrogen lines −21·1 to +5·5 km.; the mean difference between the two sets of velocities, from seven plates on which both sets were measured, is +9·1±1·21 km. per sec.

Prof. Belopolsky confirmed this result by independent reductions, using seven iron, two each calcium and magnesium, one helium, and four hydrogen lines. Apparently the helium line agrees with the hydrogen lines in differing consistently from the lines of the various metals; the results show a mean difference, metallic−hydrogen, of +7·1±0·9 km. On two of the spectrograms the calcium lines H and K are apparently double.

THE DISTRIBUTION OF VARIABLE STARS.—Plotting the positions of 678 variable stars given in the *Annuaire du Bureau des Longitudes* (1909), M. Anestin, of Bucharest, finds the known agglomeration in the Milky Way and the condensations in Aquila, Lyra, Cygnus, Sagitta, Cepheus, and Cassiopeia. Near the N. pole of the galaxy, between 10h. and 12h. R.A. and +20° to +40° declination, there is but one variable as compared with twenty in a fourth the area in Aquila and Lyra. Long-period variables show a tendency to grouping, but the irregular variables are more evenly distributed except for an agglomeration in Cygnus.

In the southern hemisphere, 664 variables crowd towards the galaxy, but between 6h. and 10h. R.A. there appears a space almost devoid of them, which covers part of the region, 6h. 30m. to 14h., also devoid of novæ. The region thus avoided by the temporary and variable stars is, as M. Flammarion pointed out, the least complex and least dense large area of the Milky Way (*L'Astronomie*, April, p. 184).

THE VARIATION OF S ARÆ.—No. 3, vol. xxxiii., of *The Astrophysical Journal* (April, p. 197) contains an interesting paper by Dr. A. W. Roberts, in which the author propounds a theory to account for the peculiar light-curves of such "cluster-variables" as S Aræ. The general features of this type of light-curve are short period, a long stationary minimum, a very sudden rise to maximum, and a leisurely decline to minimum. After carefully studying the variation of S Aræ, Dr. Roberts suggests that such a light-curve may result from a combination of two distinct variations. The primary curve would be that of a Cepheid variable, depending upon an intrinsic variation of a bright star. The superimposed curve would be that of an Algol variable, and the theory demands that this shall be caused by the eclipse of the very bright, but relatively small, satellite by a larger, dark primary; the satellite is the Cepheid variable. There are various objections to such a theory, but the main observed facts are in favour of it. The great variation of the smaller star might be explained by the fact that the distance separating the pair is very small; thus the smaller companion may be revolving in a path which carries it through the rarer atmosphere of the larger star, the absorption of this atmosphere accounting for the change in apparent brightness.

THE "ANNUAIRE ASTRONOMIQUE" FOR 1912.—The Royal Observatory of Belgium is to be congratulated upon getting this useful *Annuaire*, for 1912, published so early, for although it necessitates omissions from the *revue* section, it facilitates the work of a number of the practical astronomers the book is intended for. The comprehensive list of observatories is omitted from this issue, but is to be republished every two or three years. In addition to the usual tables, ephemerides, "phenomena," &c., there are valuable articles on the tides, the universal time system, and, in a supplement bound with the *Annuaire*, Dr. Stroobant's work on the recent progress of astronomy.

THE ROYAL SOCIETY CONVERSAZIONE.

THE gentlemen's conversazione of the Royal Society was held in the society's rooms at Burlington House on Wednesday, May 10. The fellows and guests were received by Sir Archibald Geikie, K.C.B., president of the society, and many objects and experiments of scientific interest were exhibited. During the evening the Hon. R. J. Strutt gave a lecture on the afterglow of the electric discharge and on an active modification of nitrogen, and Mr. Joseph Barcroft lectured on adaptation to high altitudes in relation to mountain sickness. Experiments were shown by Prof. Strutt to prove that the well-known "afterglow" of Geissler tubes containing air is a phosphorescent flame, produced by the reaction of nitric oxide and ozone formed in the discharge. It was shown that nitrogen gives rise to a different kind of afterglow. The latter is regarded as resulting from the formation of an active modification of nitrogen, which slowly reverts to the ordinary form with luminosity. It was also shown that acetylene is spontaneously inflammable in this active nitrogen, and burns to cyanogen, the flame showing the characteristic spectrum of that gas.

Following our usual custom, we give a summary of the official description of exhibits, related subjects being here brought together for convenience of reference.

The Astronomer Royal.—(1) Model of orbit of Jupiter's eighth satellite. The model shows the path of the satellite around Jupiter from 1908 to 1916 as predicted by Dr. P. H. Cowell from the observations made in 1908 and 1909. The orbits of satellites VI. and VII. and of the inner satellites are also exhibited to scale and in their proper planes. The scale is 80 inches equal 1 solar unit, or 1 inch equals 1,160,000 miles. (2) Globe showing the motions of the two main star streams. The model has been constructed to show how an examination of the directions of motion of the stars reveals the presence of two great streams of stars. The statistics of the motions in different parts of the sky are summarised by the diagrams on the globe; it can be seen that for each region there are two "favoured directions" of motion in which the stars move in greatest numbers. These directions are traced on the globe, and converge to two apices. *The Director, Khedivial Observatory, Helwan, Egypt.*—Photographs of Halley's comet taken with the 30-inch Reynolds reflector by Mr. H. Knox Shaw. The photographs exhibited cover the period from April 16 to June 10, 1910. *Lowell Observatory, Arizona, U.S.A.*—(1) Photographic negatives of Halley's comet taken at the Lowell Observatory, May 4 to June 5, 1910. (2) Plates of slit spectrograms of Halley's comet. (3) Plates of slitless spectrograms of Halley's comet. Three important deductions follow from the photographs and spectrograms:—(i) The identification, by Dr. Slipher, of the three chief bands in the comet's spectrum as those which Mr. Fowler has shown to be the bands of carbon monoxide when under very low pressure. (ii) The totally diverse gaseous constitution pointed out by Dr. Slipher between the emissive constituents of the head and tail—the bright gases of the one being strong where those of the other are weak, and *vice versa*. (iii) Measurements by Prof. Lowell on knots in the photograph showed an accelerated velocity away from the head, as follows:—

	Angular distance from the nucleus to the point measured in the tail	Velocity of the point of the tail away from the nucleus
Knot 1	1′ 28″	13·6 miles a sec.
Knot 2	3 12	17·2 ,, ,,
Knot 3	4 36	19·7 ,, ,,
Knot 4	6 15	29·7 ,, ,,

This, taken in connection with the spectrograms, disclosed

the significant fact that the accelerated knots were composed, to the extent of 75 per cent. of gases, not of solid particles, and that, therefore, *molecules* not only could be, but actually were, repelled by the action of the sun—contrary to current theory. *The Royal Astronomical Society.*—Series of photographs of nebulæ taken by Prof. G. W. Ritchey with the 60-inch reflector of the Mount Wilson Observatory, California, in 1910. *Mr. A. Fowler, F.R.S.*—Spectrum photographs showing the composition of the tails of comets. The spectra of the tails of comets exhibit a number of double bands, which the photographs prove to be identical with bands obtained from vacuum tubes containing carbon monoxide at a pressure of about 0·01 mm. An additional band, due to nitrogen, was present in comet Morehouse. *Solar Physics Observatory, South Kensington.*—(1) Spectroheliograms of the sun. Obtained on Friday, April 28, 1911, about six hours before the time of total eclipse at Vavau, and on Saturday, April 29. Composite pictures are shown of the prominences on the limb and the flocculi on the disc, taken in K_2K_3 (calcium) light. (2) Diagrams illustrating the southern hemisphere surface air circulation. (i) Scheme of general suggested circulation. (ii) Curves showing time difference of pressure changes. (3) Observations of Halley's comet at Fosterdown, Caterham. (i) The temporary observatory showing the three instruments used: 9-inch Henry prismatic camera, 10 feet focus, with one prism of 45° angle; 2-inch quartz calcite prismatic camera, 18 inches focus, with one prism of 30° angle; 6-inch Dallmeyer doublet camera, 4 feet focus. (ii) Plate showing single and double nucleus of comet, drawing of visual spectrum, and photographic spectrum. (4) Photographic laboratory spectra. Showing the flutings of titanium, vanadium, and chromium, employed in the reduction of the spectra of Antarian stars α Orionis, ο Ceti, α Scorpionis, &c.

Prof. R. W. Wood (Johns Hopkins University, Baltimore).—(1) Fluorescence and resonance spectrum of iodine vapour, with monochromatic excitation. Development of band spectrum by presence of helium. Light from a mercury arc is focussed at the centre of a large glass bulb, highly exhausted, and containing a small crystal of iodine. The iodine vapour shows brilliant fluorescence, and the spectroscope shows resonance spectra excited by the two yellow and the green mercury lines, which can be observed separately by interposing absorbing screens between the lamp and the bulb. In a bulb containing iodine crystals and helium at 2 mm. pressure, excited in the same way, the spectroscope shows the band spectrum of iodine superposed on the resonance spectrum. The collisions with the helium molecules apparently effect a transfer of energy from the excited electron system in the iodine molecule to all the other systems. In helium at 10 mm. the band spectrum alone is seen, as in the case of iodine vapour *in vacuo* excited by white light. (2) Echelette diffraction gratings. Gratings ruled with groove of known form on gold-plated copper by a crystal of carborundum. Used for work in the infra-red, and for experimental determination of the energy distribution in the spectrum in relation to the wave-length and the form of groove. The oblique faces of the grooves show a curious oblique image by reflection when the incidence is perpendicular to the plate. *Mr. Eric S. Bruce.*—Photographs and prints descriptive of types of dirigibles. The exhibit is descriptive of various types of airships on the lighter-than-air principle. *Mr. W. H. Dines, F.R.S.*—Working model of winding gear used for kite-flying at Pyrton Hill. *Prof. P. V. Bevan.*—Anomalous dispersion in metallic vapours. Anomalous dispersion at the red lines of potassium. The dispersion is produced by the method well known through the experiments of Prof. R. W. Wood with sodium vapour. Dispersion is also shown at the two violet lines of rubidium.

A. W. Clayden.—An actinograph or radiation recorder. The pen records the difference between the temperatures of two similar bimetallic spirals, of which one is blackened and exposed to radiation, while the other is bright and is shaded by a polished tin cover.—*Sir Henry Cunynghame and Prof. Cadman.*—(1) Contrivance fitted to miners' safety lamps for the detection of fire-damp. The contrivance consists of a small piece of asbestos soaked in carbonate of soda, which can, at will, be introduced into the flame of the lamp without the necessity of lowering it. The presence of small percentages of gas is immediately indicated by the appearance of an orange-coloured cap of the same character as appears when a wire, charged with soda, is introduced into a Bunsen gas flame. (2) A differential hygroscope (Sir Henry Cunynghame). The device consists of two thermometers, one with a wet and the other with a dry bulb. Instead, however, of being placed apart as usual, the stems of the two are brought into juxtaposition. They are not equally divided, but are so arranged and divided that when the top of the column of one of them sinks below the top of the column of the other, any desired hygrometric state of the air is at once seen by simple inspection without any scale or reference to any table, and irrespective of the temperature.

Messrs. Elliott Brothers.—The Anschütz gyro-compass. A practical application of a gyrostat as a mariner's compass. The apparatus consists of a gyrostat so suspended that its axis points to the true north, thus avoiding the necessity of any considerations of magnetic variation. The "directive force" is considerable, and on that account the apparatus can be made use of to transmit its indications to various points in a ship. *Mr. A. Mallock, F.R.S.*—Model of a "detached escapement" for pendulum clocks. The pendulum is free, in the sense that during the swing it makes no intermittent contacts with any solid. Near the end of each swing an electric contact is made by a fine wire dipping in a mercury cup. The current then established passes through the coils of an electromagnet, which, by means of a "remontoir" working a reciprocating lever, causes a very weak spring to act so as to maintain the oscillation. Constant density in the air surrounding the pendulum is approximately secured by the covering bell glass, the edge of which dips in a deep but narrow annular canal partly filled with mercury. An alteration of 1 inch in the height of the barometer alters the density of the enclosed air by about one part in a thousand. *Sir William Ramsay, K.C.B., F.R.S., and Dr. R. W. Gray.*—A micro-balance. This balance, made essentially from the designs of Steele and Grant, registers about 1,20,000th of a milligram. It is comparatively insensitive, one at University College being more than ten times as sensitive. The plan of adding small weight was worked out at University College; it consists in altering the apparent weight of the air in a sealed quartz bulb, suspended from one arm by a silica fibre, by altering the pressure of air in the balance-case. It was with a balance of this type that the density of niton was determined with less than one-tenth of a cubic millimetre. *Mr. J. J. Manley.*—Analytical balance with protected beam. The beam of this balance is completely enclosed by an auxiliary inner case, which is made of magnalium and fitted with plate-glass shutters. Beneath the base-plate of the case, baffle-plates are attached to the pan-suspensions and pointer. These baffle-plates intercept and deflect any convection currents ascending from the experimenter's hand, and so prevent them from striking the beam. By these combined devices, very great uniformity in the temperature of the balance beam may be maintained. *The National Physical Laboratory.*—A simple apparatus for measuring small thicknesses and displacements (exhibited by Mr. E. H. Rayner). *Dr. A. O. Rankine.*—A method of measuring the viscosity of a small quantity of gas. *The National Physical Laboratory.*—Portable potentiometer for temperature measurements with thermo-couples (exhibited by Dr. W. Rosenhain and Mr. S. W. Melsom). *Mr. Alfred W. Porter, F.R.S.*—An anomaly in the lagging of wires and pipes. A sheath consisting of a bad thermal conductor (like asbestos or glass) surrounding a sufficiently narrow hot body assists the escape of heat instead of retarding it. This effect is shown by means of a platinum wire heated electrically. Parts of the wire are covered with glass. Where the cover is the wire keeps quite cool (at about 100° C.) even when the bare part is at 1000° C. Examples of lagged steam-pipes are also exhibited.

Sir William Crookes, O.M., F.R.S.—Collection of old radiometers and otheoscopes. These experimental instruments were made by the exhibitor during his researches on repulsion resulting from radiation, and were used to illustrate the papers when they were read before the Royal Society in the years 1875–8. *Sir James Dewar, F.R.S.*—Radiometer acting by the pressure of mercury vapour given off by the liquid between the ordinary temperature and

−25° C. Radiometer, in concentrated beam of electric arc, stopped by charcoal liquid-air vacuum, and started again by mercury vapour at a pressure of about one fifty-millionth of an atmosphere. Activity again arrested on freezing out the mercury vapour in liquid air. *Mr. Francis Fox.*—(1) Radium bromide from pitchblende found in Trenwith Mine, St. Ives Consolidated Mines, St. Ives, Cornwall. (2) Specimen of rich pitchblende ore from the mine. *Mr. C. T. R. Wilson, F.R.S.*—Exhibition of the tracks of ionising particles in gases. (1) Tracks of α particles from radium through air. (2) Tracks of ionising particles produced by X-rays in air. The trail of ions left by each ionising particle is made visible by condensing water upon the ions. *The National Physical Laboratory.*—Ionisation in the electric furnace (exhibited by Dr. J. A. Harker, F.R.S., and Mr. C. G. Eden). *Prof. J. Norman Collie, F.R.S.*—Tubes showing electric discharge through neon. (1) Tubes showing the electric discharge through neon at high pressures. (2) Table showing the canal rays in neon. *Mr. C. W. Raffety.*—Enlarged photographs of the forms assumed by the brush discharge in air at reduced pressures. *Prof. E. Wilson and Mr. W. H. Wilson.*—(1) An improved high-tension discharge apparatus. (2) A high-tension electrostatic wattmeter (Prof. E. Wilson). *Prof. J. A. Fleming, F.R.S.*—Experiments showing visibly the oscillatory discharge of a condenser by Hemsalech's method, and its magnetising action on finely divided iron cores. *Mr. S. G. Brown.*—(1) Telephone relays. (2) Model of electrical stethoscope.

Prof. A. Liversidge, F.R.S.—(1) Series of sections of gold nuggets and photographs to illustrate the same. (2) Specimens and sections of Australian meteorites, and photographs. *Prof. W. J. Pope, F.R.S.*—Photomicrography in natural colours. Photomicrographs of rock sections, chemical preparations, and crystal interference figures are exhibited. The photographs were taken between crossed Nicol prisms by the Dufay process, in which the colours of the objects are reproduced. *Prof. E. G. Coker.*—Interference colours produced by transparent materials under stress. A beam of plane or circularly polarised light is passed through a plate of xylonite cut into any selected shape and loaded in any convenient manner. The material when stressed behaves like a doubly refracting crystal, and the two rays, into which the incident beam is divided, produce interference colours when passed through a Nicol's prism. The stress distribution may be inferred from the colour fringes produced. *Prof. J. Eustice.*—Experiments on stream-line motion in curved pipes. By means of filaments of coloured water, it is shown that when water is flowing from a straight to a curved pipe some of the filaments approach the sides of the pipe and cross from the outside to the inside of the curve, close to the walls. Several colours are used in the glass pipes, and the interlacing of the filaments caused by the vortex motion is clearly exhibited. *Mr. C. E. Larard.*—Twisted, cylindrical, and castellated metal specimens. *Mr. J. E. Marsh, F.R.S.*—(1) Experiments showing the separation of a homogeneous solution into three layers when the solution is warmed. (2) Solutions of certain salts in ether not miscible with excess of ether.

Prof. W. M. Thornton.—The electric charges associated with vegetable cells. When an electric current is passed through a weak emulsion, in water, of typical animal and vegetable cells, such as blood corpuscles, yeast, bacteria, and unicellular algæ, the animal cells appear to be driven to the positive pole, the vegetable cells to the negative, provided that the latter are from fresh, active growths. The movement reverses with the direction of the current, and is dead beat. *The Director, Royal Botanic Gardens, Kew.*—Cushion plants and their seedlings. The exhibit includes specimens and photographs of the balsam bog of the Falkland Islands (*Azorella glebaria*, A. Gray, Umbelliferæ), with a series of living seedlings raised in the Royal Botanic Gardens, Kew. *The John Innes Horticultural Institution.*—(1) "Chimæras" and Winkler's graft-hybrids, from Prof. E. Baur (Berlin). (2) A case of coupling in Pisum, between roundness of seed and power to produce tendrils, in the ratio 63 : 1 : 1 : 63. *Mr. A. D. Hall, F.R.S.*—A biological factor in soils limiting the activity of bacteria in producing plant food. Bacteria play an important part in the production of plant food in the soil from the accumulated organic residues; indeed, when other things are equal, the fertility of the soil is closely connected with the amount of bacterial activity. It has been shown, however, that a factor exists in ordinary soils limiting the activity of bacteria; this factor is biological, and appears to consist of large destructive organisms. When soils are kept in moist, warm conditions and well supplied with organic matter, as in a greenhouse, there is a marked accumulation of the limiting factor; a similar accumulation occurs in the soils of sewage farms. On the other hand, dry soil conditions are unfavourable to the factor. Heating the soil to 55° C., prolonged drying at lower temperatures, or treatment with various antiseptics such as toluene, kills the factor and leads to a marked increase of bacterial activity. In field and greenhouse soils there is a large production of plant food, and in sewage-farm soils an increased rate of decomposition.

Prof. H. E. Armstrong, F.R.S., and Dr. E. F. Armstrong.—The action of stimulants (hormones) in promoting enzymic activity. The specimens shown are in illustration of results described in recent communications on the functions of hormones in stimulating enzymic change in relation to narcosis and the phenomena of degenerative and regenerative change in living structures, and on the functions of hormones in regulating metabolism. Like the barley grain, leaves are shown to be provided with protective differential septa through which strong acids, salts generally, and substances such as the sugars do not pass, but which are freely permeable by organic vapours, weak acids, ammonia, and a few salts (mercuric chloride, &c.). The passage of the excitant into the leaf is shown in the case of the common laurel (*Prunus laurocerasus*) by the liberation of hydrogen cyanide, and in the case of the spotted Japanese laurel (*Aucuba japonica*) by blackening due to the decomposition of the glucoside aucubin. The active substances are for the most part non-electrolytes, which have little, if any, chemical activity. *Prof. R. T. Hewlett and Mr. J. E. Barnard.*—(1) The bactericidical action of light produced by a quartz mercury vapour lamp. Experiments on the bactericidical action of light indicate that a quartz mercury vapour lamp, in relation to its current consumption, is the most economical source at present available. The most actively bactericidical region in the carbon arc spectrum is that portion of the ultra-violet between λ 3280 and 2260. These radiations are produced freely by the mercury arc, and the action extends still further, practically to the limit of transmission by quartz. Owing to the almost entire absence of heat radiations in the mercury arc, any arrangement for heat absorption becomes unnecessary. This is an advantage of considerable moment, as any such method at present in use substantially increases the necessary exposure. (2) Apparatus for disintegrating bacterial and other organic cells. The apparatus consists of a metal containing vessel, in which a number of steel balls are placed, and which is caused to rotate. The balls are kept in position at the periphery of the vessel by a central steel cone, which, by suitable means, is prevented from rotating. Grinding action takes place between the steel balls and the inner surface of the vessel. The efficiency of the method is high, as after subjecting bacteria to the grinding process for from fifteen to twenty minutes, very few, if any, whole cells remain. Even those that are apparently whole have evidently parted with their cell contents, as may be demonstrated by the difficulty of staining them by any recognised bacteriological method. *Mr. Henry Crookes.*—Photographs and living cultures of *B. phosphorescens*, showing the germicidal action of some metals. Nutrient gelatin-agar is poured into Petri dishes containing small pieces of metal; when the medium has set, the surface is infected with *B. phosphorescens*. After twenty-four hours the bacteria grow luxuriantly, except in a zone surrounding the piece of metal, which remains entirely sterile. The extent of this *death-zone* varies with different metals. *Prof. M. C. Potter.*—Electrical effects accompanying the fermentative activity of yeast. The apparatus shown consists of a glass jar containing a porous cylinder, and into each of these are introduced solutions of glucose of equal concentration. Two platinum electrodes are placed one in the jar and one in the porous cylinder, and on the introduction of yeast into one of the solutions, the whole constitutes a type of galvanic cell. *Mr. S. G. Shattock and Mr. L. S. Dudgeon.*—(1) Resistance of *Bacillus pyocyaneus* to drying *in vacuo*. Experi-

ments devised to ascertain how far this factor might be *per se* lethal to bacteria in insterstellar space. A growth of *Bacillus pyocyaneus* raised from a thin film of a culture (made in peptone water) spread on glass and kept dried *in vacuo* for four months. The vacuum was produced by Sir James Dewar's method (a bulb of powdered charcoal surrounded by liquid air, after exhaustion by pump); after five days the vacuum was maintained by sealing off the tube. Light was excluded throughout. The bacillus when dried in the air (light excluded) dies within three months. The behaviour of this bacillus *in vacuo* is exceptional. Its maintenance of vitality corresponds with that of certain seeds under similar conditions. (2) Microscopic sections of urinary calculi from the human subject.

Hon. N. C. Rothschild.—Model of *Xenopsylla cheopis*, the tropical plague flea. *Mr. F. Enock.*—Photomicrographs of new species of British Mymaridæ. The insects comprised in the subfamily Mymaridæ are ovivorous in their habits, laying *their* eggs in those of various Homoptera and Coleoptera. Hitherto only thirty-five species have been recorded. The photomicrographs are part of the hundred to one hundred and fifty new species (many as yet unnamed) collected or bred during the past thirty-five years. *Sir W. B. Leishman, F.R.S.*—A parasite found in cases of infantile splenic anæmia. In cases of this disease, occurring in Tunis, Italy, Sicily, Malta, Portugal, and elsewhere, a protozoon—*Leishmania infantum*, Nicolle—has been found by C. Aicolle and others. It resembles closely the parasite of kala azar—*Leishmania donovani*, Laveran—and that of Oriental sore.—*Leishmania tropicum*, Wright. The disease is extremely fatal, and appears widespread in the Mediterranean littoral. It has recently been proved to be identical with the fatal disease of children known as "ponos," which occurs in some of the islands of the Grecian Archipelago. The parasites have also been found in dogs, and it is probable that they are transmitted from the dog to the child by the bite of some insect. *The Lord Avebury, F.R.S.*—(1) Moth from Peru (Caligo) imitating an owl. (2) Elytron of beetle (Pachyrhynchus). (3) Butterfly from Borneo (Ornithoptera-Brookeana) mimicking the tips of the leaflets of a pinnate leaf emerging from the deep shade of a tropical forest; the midribs of the leaflets and the serratures of the edges are well represented. *Mr. H. Eltringham.*—Colour drawings illustrating African mimetic butterflies. *Prof. Poulton, F.R.S., Mr. C. A. Wiggins, Mr. W. A. Lamborn, and Mr. E. G. Joseph.*—Recent observations on mimicry, protective resemblance, &c., in African and South American butterflies and moths. *Dr. Deane Butcher.*—Osmotic growths. Osmotic growths are mineral productions simulating the forms of organic life. They are obtained by sowing a mineral seed or nucleus in a concentrated inorganic mother liquor. The nucleus reacts with the liquid to form an insoluble gelatinous precipitate at the surface of contact. This semi-permeable extensible membrane is distended by the osmotic pressure within, and grows by a process of intussusception, branching and putting forth terminal organs as it reaches a solution of lesser concentration. Osmotic growths were first described by Prof. S. Leduc in his work on "The Mechanism of Life." *Dr. G. H. Rodman.*—(1) Stereo-radiographs of monkey and tortoise. (2) A set of transparencies illustrating the development of the X-ray tube.

The Cambridge Scientific Instrument Company.—A new large sliding microtome. This instrument is a very powerful one, and will cut sections of superficial measurements up to 150 by 120 mm. (6 inches by 4¾ inches) through decalcified bone or cartilage. *Dr. W. J. Dakin.*—Sections showing stages in the sporogony of a new coccidian parasitic in the whelk. *The Marine Biological Association of the United Kingdom.*—(1) The culture of marine diatoms as food for developing larvæ. Some of the difficulties in the way of rearing marine larvæ in the laboratory have been overcome by keeping them in sterile sea-water and feeding them with cultures, as pure as possible, of suitable diatoms. (2) A collection of living marine animals from the neighbourhood of Plymouth. *Dr. W. S. Bruce.*—Deep-sea invertebrates: new or rare species taken by the polar ship *Scotia* in Antarctic seas during the Scottish National Antarctic Expedition (1902–4). *Mr. C. Tate Regan.*—Sketches illustrating instantaneous colour changes in sea-perches from the Bermudas. The sketches show colour phases observed in the New York Aquarium; these fishes are constantly changing their colour and markings; this is accomplished by the expansion and contraction of chromatophores, or pigment cells.

Mr. A. W. Clayden.—(1) Footprints from the Permian sandstones at Poltimore, Devon. Numerous footprints have been discovered during the last two years in the sandstones mapped in the Survey maps as Lower Sandstones They are of two types. Neither can be exactly matched from any of the known localities at which footprints of Permian age have been found, either in Great Britain, America, or Germany. They bear, however, a general resemblance to those obtained at Corncockle Moor and Penrith, though differing in detail. *Mr. R. W. Hooley.*—Skeleton of *Ornithodesmus latidens*, a pterodactyl from the Wealden shales of Atherfield, Isle of Wight. *Mr. W. Taylor.*—Remains of fossil reptiles from the Triassic sandstone of Lossiemouth, Elgin. *Prof. W. M. F. Petrie, F.R.S.*—Roman portraits, first century A.D. These portraits are painted with coloured wax upon thin panels of cedar. On some a fresh coat of paraffin has been now added for security. They were placed over the faces of the mummies and bandaged down round the edge. They are from the same cemetery, at Hawara, Egypt, as those in the National Gallery, a site now exhausted by the British School of Archæology in Egypt. *Dr. Vaughan Cornish.*—Photographs of surface waves. *Dr. Tom G. Longstaff.*—Mountain photographs.

THE IRON AND STEEL INSTITUTE.

THE annual general meeting of the Iron and Steel Institute opened on May 11 under the presidency of his Grace the Duke of Devonshire. The meetings were held at the Institution of Civil Engineers. The Bessemer gold medal for 1911 was presented to Prof. Henri Le Chatelier, of Paris, who attended for this purpose. The Carnegie gold medal was awarded to Mr. Felix Robin, who has conducted researches on the wear of steels and their resistance to crushing. Carnegie research scholarships have been awarded to Messrs. W. M. Guertler, of Berlin, G. Hailstone, of Birmingham, R. M. Keeney, of Colorado, U.S.A., and G. Dietrich Röhl, of Freiberg, Saxony. Messrs. J. Newton Friend, of Darlington, and T. Swindon, of Sheffield, have had additional grants made to them to enable their researches to be extended and completed.

Sixteen papers in all were presented for discussion; the principal points dealt with in a few of these are given below.

Dr. J. E. Stead contributed some notes on the welding up of blow-holes and cavities in steel ingots. The evidence advanced shows that, if the blow-holes in steel ingots are subcutaneous, *i.e.* under the skin and having no opening to the atmosphere, and the heating of the metal is sufficiently high, say 1000° C. and above, the cavities will weld up completely on being rolled or forged, provided they contain no foreign matter. It is doubtful whether pipe cavities can be so readily welded. The upper ends of the pipes in ingots are open to the gases of the heating furnace, and the cavities become coated with oxide scale, which prevents the metallic surfaces from coming into contact. If the pipe is deep and is bridged over at intervals with diaphragms of solid steel, it is not improbable that welding below these bridges might be effected, provided that the imprisoned gases become forced back into the steel and do not form layers of highly compressed gas between the steel surfaces, and so prevent these surfaces from coming into direct contact. Prof. Howe has suggested that forged steel blooms should be heated for a long time to above the welding point, so as to complete the reabsorption of the gas. This is based on two assumptions: first, that the gases of the cavities are capable of being forced by pressure into the hot steel and of becoming occluded there; secondly, that what gas is not so forced into the metal will diffuse into it during prolonged heating at a high temperature. Prof. Howe's suggestion calls for experimental evidence as regards the quantity of mixed gases or of any gas which can be forced by pressure into solid steel, and also as regards how much of it will come out again on removal of the pressure, and it is understood that a research has

been undertaken with the view of settling these important points.

Messrs. E. F. Law, W. H. Merret, and W. P. Digby have studied welds, and in their paper present the results of their investigations. Defining a weld as the actual fusion together of similar or allied metals, the authors have carried their investigations into the region of the characteristic microstructure of both good welds and unsuccessful attempts to produce welds, a subject on which there has hitherto been very little work done. No matter what the process may be by which two metals are welded together, there must always be an area, more or less sharply defined, of altered molecular construction. The authors show that each process of welding has its own hall-mark. For example, it is possible to say whether an electric weld has been made by an arc or by a resistance method from the evidence afforded by polishing and etching alone. Without annealing to restore the original structure, acetylene and water-gas welds have each their own marked characteristics. Resistance welds are seemingly less prone (with the exception, perhaps, of acetylene welds) to oxidation, but the extrusion of the metal renders good working, while the metal is still plastic, of supreme importance. Arc welds are most prone to oxidation, and many will hesitate to rely on such a process in those positions where corrosion is likely to occur. When the welded metal is not likely to be subjected to corrosion, the excellent fusion of the metal renders the method commendable. Flame welds should receive adequate working and manipulation while in their heated condition. Water-gas welds may be abnormal through the use of oxidising flames; acetylene welds certainly require annealing to break down the crystalline structure in the vicinity of the weld.

Prof. H. C. H. Carpenter has continued his investigations on the growth of cast irons after repeated heatings. His principal results up to date may be summarised as follows:—phosphorus tends to diminish growth; sulphur is never present in commercial cast irons in sufficient quantity to have more than a small influence on growth, which is, however, in the direction of retardation; manganese always retards the rate of growth, and diminishes the absolute amount in the majority of cases. Dissolved gases have no influence on the growth of an iron containing more than 3 per cent. of silicon; if the silicon does not exceed 1 per cent. they may be responsible for a growth of at least 10 per cent. The simplest and most rapid test for forming an opinion as to the growth that is liable to take place in any particular grey iron is to estimate the silicon, and then read off the approximate growth from the following table:—

Silicon, per cent.	Approx. growth, per cent.	Silicon, per cent.	Approx. growth per cent.
1·00	15·0	2·50	31·0
1·25	18·5	2·75	32·5
1·50	21·5	3·00	34·0
1·75	24·5	3·25	35·5
2·00	27·0	3·50	37·0
2·25	29·0		

If the iron contains 0·3 per cent. of phosphorus and upwards, the growth will be from 2·5 to 4 per cent. lower than the above figures, and if more than 0·5 per cent. of manganese is present, the rate of growth will be diminished and the amount of growth somewhat lessened. An alloy containing 2·66 per cent. of carbon, 0·587 per cent. of silicon, and 1·64 per cent. of manganese, showed no signs of growth after 150 heats, but, on the contrary, a slight contraction, viz. about 0·13 per cent. It is a tough material, and its mechanical properties were improved by this treatment. It begins to freeze at about 1346° C., and appears to be a suitable material for annealing ovens, rolls, fire-bars, and the grids of muffle furnaces. Probably it could be used for ingot moulds in an iron foundry without cracking.

The influence of impurities on the corrosion of iron is dealt with in a paper by Mr. J. W. Cobb. Interpreting the results of the author's experiments on the basis of the electrolytic theory of corrosion, it may be stated that pure iron is definitely electro-positive to most of its impurities. Among such impurities were found phosphide, sulphide, carbide, oxide, and silicate of iron. With carbon (graphite) the effects were particularly marked. All the iron alloys tried (excepting ferro-manganese) were also electro-negative to pure iron. With the sulphide and silicate of manganese little or no current flowed. Manganese and 80 per cent. ferro-manganese were found definitely electro-positive to iron. Every piece of commercial iron showed electrical effects with any other, and the effects between portions of the same piece were always sufficient to induce corrosion when the other conditions were satisfied. The presence of an impurity determines so many corrosion centres for iron, and so its influence depends more on quality and distribution than on quantity; thus a more homogeneous iron, even if chemically less pure, may be more highly resistant to corrosion. Other papers bearing on corrosion were contributed by Mr. P. Longmuir and by Messrs. J. Newton Friend and J. H. Brown.

Mr. W. H. Hatfield gives experimental results of the influence of vanadium upon the physical properties of cast iron. As an instance where vanadium has increased the life of locomotive cylinders, a case is quoted where cylinders made of cast iron not treated with vanadium wore 1/32-inch per 100,000 miles, whereas vanadium cast-iron cylinders showed only microscopic wear after running 200,000 miles. The present experiments show that additions of vanadium have a definite influence upon the physical properties of cast iron, and that this influence is mainly that of assisting the carbon to persist in the combined state. The persisting carbides, physically, do not differ materially from the normal carbides found in the cast iron; owing, however, to the actual presence of much of the vanadium in the carbide, that carbide is rendered more stable.

Messrs. A. McWilliam and E. J. Barnes give records of a lengthy series of experiments on the influence of 0·2 per cent. vanadium on steels of varying carbon content.

A paper on the chemical and mechanical relations of iron, chromium, and carbon is contributed by Profs. J. O. Arnold and A. A. Read. This paper is in continuation of the work of the authors already published, and gives an account of a number of experiments to determine the composition of the carbides separated from a series of annealed steels containing various percentages of chromium, the percentage of carbon being practically the same in each. The mechanical properties of these alloys under static and alternating stress, and their microscopic features, have also been investigated.

Iron-silicon-carbon alloys are dealt with in a paper by Dr. W. Gontermann. Some of the work performed at the Institute of Physical Chemistry at Göttingen has already been published, and the present report contains further particulars. The paper contains many diagrams and photographs of models showing graphically the properties of this series of alloys.

The magnetic properties of some nickel steels, and notes on the structures of meteoric iron, form the subject of a paper by Messrs. E. Colver-Glauert and S. Hilpert, of Berlin. A 5 per cent. nickel steel is hardest (magnetically) when quenched in the neighbourhood of 900° C. Quenching from higher temperatures results in a softer material. The changes which occur during thermal treatment of a 25 per cent. nickel-iron alloy are of a far more complicated nature than has been thought previously. At high temperatures there probably exists a product which may be preserved by rapid quenching, and is then strongly magnetic, and persists to the temperature of liquid air. This product does not exist in the region between about 600° C. and 900° C. There is very little connection between the magnetic properties and metallographical structure. There is no sharp magnetic change point for this alloy below zero, but the permeability gradually increases as the temperature decreases from about −50° C. to −180° C. The magnetic properties of a 33 per cent. nickel-iron alloy are only very slightly affected by thermal treatment. The microstructures of commercial nickel steels are practically the same as those of meteoric iron.

Messrs. A. McWilliam and E. T. Barnes complete their series of papers on steel with another on the properties of heat-treated 3 per cent. nickel steel.

Messrs. F. A. Daubinè and E. V. Roy, of Aubone, France, give an account of a process for the desiccation

of air by calcium chloride. The authors have investigated the appliances necessary for drying large volumes of air, and an appliance has been installed at the Differdauge Steelworks, Luxemburg, where it is now in normal working. In this process, the volume of air to be dried is made to traverse a mass of calcium chloride by means of a fan. Water is circulated through pipes bedded in the calcium chloride for the purpose of carrying away the heat generated by the absorption of water by the chloride. The hydration of the calcium chloride is arrested when the outside pellicle of the broken pieces commences to liquate, and a regeneration operation is employed for the purpose of rendering the calcium chloride capable of being employed for desiccating fresh volumes of air.

THE INTERNATIONAL PHILOSOPHICAL CONGRESS AT BOLOGNA.

THE fourth International Congress, which met at Bologna under the presidency of Prof. Enriques, was formally opened on April 6 by the Duke of the Abruzzi. It has been by far the best attended of the series, the total number of members being more than five hundred, and has been most hospitably entertained by the committee and the various municipalities. The general tone of the debates was much more cordial than usual, and the congress was fortunate even in its conclusion, for the next day a general strike was declared in the town and province.

It is difficult to say what exactly we should expect from such gatherings. It is clear that they can never produce any definite result; but the contact of personalities does sometimes bring into clearer light the existence of general tendencies of thought which otherwise might not have been so definitely perceived. This congress did bring to light the existence of such a tendency, and this was the quite evident decline in the importance of "system" in metaphysics. Philosophy does seem to be steering away from its traditional form. It is beginning to form a more fluent and a less rigid and systematic conception of truth. The working out of this tendency is connected with and was most clearly shown in the discussions of what really formed the main problem of the congress, the one it has spent the most time over—that of the relations between philosophy and science. This problem practically resolves itself into the question as to whether philosophy has any right to an independent existence, and it is perhaps one of the surest signs of the renaissance and vitality of the subject that it can discuss such a question with enthusiasm. This key-note of the congress was struck by Prof. Boutroux in his opening speech. Charming though this was in manner, it was not remarkable for profundity of thought, and offered no more original solution than that science, quite legitimately for its purposes, considered the world impersonally, and that it was the business of philosophy to reintroduce for a complete synthesis the element which science left out.

The same subject formed the theme the following day of a paper by that picturesque personality, Fra Gemelli, monk, biologist, and editor of the *Revista Nee-Scolastica*, which drew a reply from Prof. Hans Driesch, in which he explained the scientific use of his conception of entelechy, as distinct from Aristotle's more metaphysical use. The same subject continued to be discussed each day, until the debate finally culminated in the lecture, that was awaited with the greatest curiosity, that which was given by Prof. Henri Bergson, who is perhaps the most discussed and the most interesting philosopher in Europe at the present time. The main point he tried to establish in his *conférence* was that there were two different, and indeed inverse, ways of acquiring a knowledge of reality, the one that of scientific analysis, and another which he described as a kind of intuition, which should be the method of philosophy. Unfortunately, however, this is not the conception that philosophy has formed of itself. It has always attempted to use the same method as the science of its day; it has always attempted to do for the world in general what particular sciences have done for particular fields. It has conceived itself as the complete science, and therein lies the reason of its failure.

This is true historically; Greek philosophy is nothing but the extension into a different field of the method which prevailed in the science of the times, that of geometry. We get a similar phenomenon in modern philosophy. For the static geometrical concepts of the Greek, substitute the conception of scientific law, extend this to the general problem of reality as the Greeks did geometry, and you get the predominant types of modern philosophy. Always you get philosophy pursuing the same method as that of science, that of intellectual analysis, and having the same ideal, that of a complete science of existence. Now, said Bergson, philosophy, so long as it persists in following this method, is doomed to disappear, for it being obviously not wanted in the field of any particular and successful science, it must pursue its activities in the fields where science has not yet penetrated, *i.e.* in the field of the unknown; and this is not a very secure position for it, for as soon as science begins to penetrate the same field, and there is a contradiction between its conclusions and the conclusions of philosophy, it is philosophy that must give way, not science.

The only future of philosophy, then, lies in a recognition of the fact that it must pursue a different method entirely to that of science. It must give up the attempt to give a complete intellectual representation of the cosmos. There remains the allied question of the place of system in philosophy. Looking at the extraordinary complicated constructions of the great systematic philosophers, they certainly seem to have been animated by the conviction that they were creating a science of the real. But, said Bergson, that is only superficial appearance. If you study, say, Spinoza long enough, you will find that the whole elaborate system was merely the language by which he expressed one perfectly simple intuition, a thing which would be stated in one sentence if you yourself had been in a similar state and could at once recognise it. Here comes, then, the absurdity of explaining a philosopher by his sources—you only by that method catalogue the material by which he expressed himself. The important and central thing in a philosopher is a kind of intuition akin to that of the artist, and differing fundamentally from the kind of activity you get in science.

To get to the detailed work of the congress, particularly the work done in the various sections of logic, theory of science, esthetic, ethic, general philosophy, and psychology, one can only say that it was very abundant and very unequal, considerable so far as the magnitude of the subjects raised was concerned, and very little so far as actual results obtained go. This sterility was in great part due to the defective organisation of the congress and to the persistent keeping to the tradition of a free choice of subjects and free individual communication, with the result that there is never time to really discuss in a serious way the subjects raised. For this reason the most interesting work of the congress was done at the general meetings in the afternoon, and we refer here to the lectures which attracted the greatest attention.

The mathematician Henri Poincaré examined the question which has been raised by Boutroux and certain other philosophers as to whether the laws of nature may change. In a world which evolves continually are the laws, *i.e.* the rules under which this evolution takes place, alone exempt from all variation. Such a conception could never be adopted by the man of science without denying even the possibility of science, but the philosopher has the right to pose the question. Imagine a world in which there was no difference of temperature. Certain laws would be discovered by the inhabitants, such as, for example, that water boils at a certain fixed pressure. Suppose, now, that in course of time this uniform temperature changed, all the laws would now change; water would boil at a different temperature, and so on. Now, however perfect might be the conductivity for heat of this planet, it would doubtless not be absolute, so that one day a physicist of genius might with his delicate instruments detect these imperceptible differences. A theory might then be erected that these differences of temperature had an effect on physical phenomena, and, finally, some bold speculator might affirm that the mean temperature of the world had varied in the past, and with it all physical laws. May there not be some physical entity as yet as entirely unknown to us as was temperature to the inhabitants of this

imaginary world, which might vary and so create in the same way a change in all the laws?

Poincaré found something analogous to this, at any rate, in the ideas now being brought forward on the subject of mechanics, and which were later in the congress put forward by Prof. Langevin, whose name is known in connection with work in radio-activity. It is now asserted that the laws of mechanics, once considered absolute, are not so. They must be changed, or at least enlarged. They are only approximately true for the velocities to which we are accustomed, and cease to be so for velocities comparable to that of light. One might say that, as a result of the constant dissipation of energy, the speed of bodies has much diminished, since their activity gets transformed into heat. Thus remounting back to the past, one would find an epoch when velocities comparable to that of light were not uncommon, and when, as a consequence, the classical laws of dynamics were not true. But if, on the other hand, we consider these laws as only approximate laws, and consider the laws of motion of molecules as the true laws, we can keep our faith in the immutability of laws in general. There is not, then, a sole law that we can enunciate with the certainty that it has always been true in the past. Nevertheless, there is nothing to hinder the man of science from keeping his faith in the principle of immutability, since no law can descend to the level of a secondary law without being replaced by another law more general and more comprehensive.

Prof. Durkheim, the celebrated sociologist, examined the question of "judgments of value" and social ideals. How do they arise? They cannot be accounted for on utilitarian principles, for they are often in direct conflict, not only with individual, but even with collective utility. They assert values which go beyond the practical. Must we, then, assume that the ideal is of a different nature from the world of fact. By no means. The ideal values are created in periods of great excitement, such as, for instance, the Renaissance and the French Revolution, when life for a time turns aside from the merely useful. Whilst the intenser life of such periods must of necessity soon die down, the judgments of value and the ideals they create survive into the periods of greater tranquillity, and it is from this that the apparent contradiction between the ideal and world of fact is born.

Prof. Ostwald, the exponent of "energetics," put forward a curious hypothesis in his paper "La Volonté et sa base physique" on the connection between the second law of thermodynamics and the mental phenomena of will. He started from general considerations drawn from Comté's and his own classification of the sciences. The notion of the antecedent and more general sciences finds a regular and systematic application in the subsequent and more special ones, while at the same time these latter require, in addition, the use of new conceptions. There is, for example, a mathematic and a geometry of chemistry, but not a chemistry of mathematics or a biology of physics. He then examined in this light the conception of energy. It appears for the first time in the domain of the physical sciences, and for that reason, while it has no application in the more general sciences of mathematics and logic, it should play an auxiliary part in biology, psychology, and sociology. The laws of the lower sciences cannot adequately explain the phenomena dealt with by the higher, but they provide the framework inside which the latter must work. How does this work out in detail? What meaning have the laws of energy applied to mental life? Just this—that whatever else mental life is, it has to work inside the limits of the second law of thermodynamics. Each individual is occupied all its life with the task of making circulate through its own body a part of the general course of "free" energy on its way to energy of a lower intensity; and further, as only part of this energy can be usefully employed, the rest being wasted in heat, so whatever else mental life may be it must first be directed towards getting as much out of this dissipation as possible. In the effort to increase this percentage, to save energy, comes, in Ostwald's opinion, the whole phenomena of the will. He does not pretend that the second law is an adequate explanation of all mental process, but it is the conditioning framework inside which all the rest must work. It is the dominating fast of mental life. It is this which makes the tremendous importance of the will. All human activity is devoted to get the most out of this limited energy. (Incidentally, one may note the resemblance to Mach's conception of science as a process of economy of thought.) It is this conception of the "degradation of energy" which forms the basis of all the processes in which Schopenhauer saw manifestations of the fundamental will.

The English element at the congress was very small, being responsible for only eleven papers out of a total of 200. Among these the most important was Dr. Schiller's paper on error, which provoked, as any exposition of pragmatism always does at these meetings, a most lively discussion. There was also a paper by E. S. Russell on vitalism, and an interesting little note by Miss Constance Jones sketching out a new law of thought, which attempted to lead logic out of the barrenness of the law of identity, and which she enunciated in the phrase: "Every subject of predication is an identity (of denotation) in diversity (of intension)."

The next congress will be held in London in 1915, under the auspices of the University, and it is hoped that this will create a greater interest in these meetings than has heretofore been the case in this country.

RESEARCH AT THE NATIONAL PHYSICAL LABORATORY.[1]

THE representative character of the work done at the National Physical Laboratory is well shown by the eight papers in the volume before us.

Nos. 1 and 2 are by Dr. Chree, and are entitled "Some Phenomena of Magnetic Disturbances at Kew" and "Discussion of Results Obtained at Kew Observatory with an Elster and Geitel Electrical Dissipation Apparatus from 1907–9."

No. 3 is the ninth report to the Alloys Research Committee of the Institution of Mechanical Engineers, on "The Properties of Some Alloys of Copper, Aluminium, and Manganese," by Messrs. Rosenhain and Lantsberry. This is a voluminous paper, and occupies more than half of the entire volume. It is the direct outcome of the eighth alloys research report on the properties of the alloys of copper and aluminium. The study of any ternary system of alloys is a work of considerable magnitude. As the authors remark (p. 65), "If we suppose for the sake of comparison that the study of alloys to the extent of one for every range of 2 per cent. in composition constitutes a sufficiently complete investigation of any system, then in any series of alloys of two metals, such as copper and aluminium, the study of some fifty alloys would meet these requirements, while the corresponding degree of completeness in the case of a ternary system would require the study of no less than 1250 alloys." Very few industrial alloys, however, belong, strictly speaking, to a binary system. The majority are ternary, or even more complicated mixtures, and it is therefore of great industrial importance as well as of scientific interest that the study of such systems as the above should be undertaken.

The authors have not attempted to cover the entire field, but have contented themselves with experimenting on the addition of manganese to the most promising binary mixtures revealed in the eighth alloys report, which are situated at the ends of the system.

At the copper end they have found that certain ternary alloys present advantages over the best binary alloys, these consisting chiefly in a "higher yield point . . . a slightly higher ultimate stress and an undiminished ductility," in the static tests. A hot-rolled bar of a bronze containing approximately 10 per cent. of aluminium and 1 per cent. of manganese gave an ultimate stress of 42 tons per square inch with 30 per cent. elongation. In the dynamic tests, however, there is very little to choose between the binary and ternary systems. Three alloys were found to offer remarkable resistance to abrasion, and in this respect considerably surpassed ordinary tool steel, and as they machine quite readily they might very well be tried in cases where this property is of primary importance, *e.g.* in the form of turbine blades which have to withstand high velocity steam. As regards constitution, the authors have found that

[1] The National Physical Laboratory: Collected Researches, Vol. VII. 1911, pp. iii + 228.

" within the limits of the alloys studied, the constitution of the ternary alloys very closely resembles that of the binary alloys of aluminium and copper; manganese influences the properties of the alloys in a manner somewhat similar to that of aluminium, but at a different rate."

At the aluminium end the results have been less favourable. The most promising alloy appears to be one with 3 per cent. of copper and 1 per cent. of manganese, which in the form of a chill casting gave a tensile strength of 12 tons per square inch and an elongation of 13·5 per cent. on 2 inches. In the form of rolled bars, however, the authors say, " there does not appear to be any advantage in using the ternary alloys as compared with the alloys of aluminium with copper alone."

The remaining papers are as follows:—

(4) " Report on the Progress of the National Experimental Tank," by Dr. R. T. Glazebrook.

(5) " On the use of Mutual Inductometers," by A. Campbell.

(6) " Comparative Life Tests on Glow Lamps," by C. C. Paterson and E. H. Rayner.

(7) " On a Method of Counting the Rulings of a Diffraction Grating," by G. W. Kaye.

(8) " The Expansion and Thermal Hysteresis of Fused Silica," by G. W. Kaye.

In view of the extensive application of fused silica or quartz glass to physical and chemical operations, the last-named paper is of considerable interest. A curve is given from which the mean coefficient of expansion over any desired range between −190° C. and 1100° C. may be derived. From this curve it appears that two change-points exist, one at −80° C., the other at about 1000° C. As regards linear hysteresis, the author concludes, " Silica over a range of 0° C. to 400° C. has nothing to fear in comparison with either Invar or Jena thermometry glasses. . . . There is practically nothing to choose between the different kinds of fused silica." A silica standard metre is being completed at the laboratory.

H. C. H. C.

SPECIALISATION IN UNIVERSITY EDUCATION.

THE March issue of *The Johns Hopkins University Circular* contains an account of the celebrations in connection with the Commemoration Day of the University held on February 22. Dr. James Bryce, the British Ambassador to the United States, was the principal speaker, and in his address discussed the tendency to over-specialisation in university education. Mr. R. Brent Keyser, the president of the Board of Trustees, read a statement of the plans for the development of the new site for the University. Nine years ago, he said, at the time of the raising of the Million Dollar Endowment Fund of 1902, the University received also the gift of the Homewood property. This property, under the deed of gift, is to become the permanent home of the University when, in the judgment of the Board of Trustees, the interest and welfare of the University permit. A plan for development has been provided which will admit of growth and alteration to suit the changing needs of future years. To-day we have been given, he continued, means to accept the offer of 50,000*l.* from the General Education Board, and the total amount pledged, part of it already paid in, amounts to nearly 240,000*l.* With great wisdom, the General Education Board, the aim of which is to help the cause of education of the whole country, has provided that at least 100,000*l.* of this amount shall be retained as a permanent endowment, the income only to be used, so that the institution might not be crippled in its real work by the expenditures incident to large building operations, and by the greatly increased expense which will come from living in such an enlarged environment.

Mr. B. H. Griswold, jun., chairman of the committee on the endowment and extension fund of 1910, said 1500 gifts, ranging from one dollar to 20,000*l.*, totalling nearly 240,000*l.*, and substantially every dollar of it from Maryland, with the exception of the gift of the General Education Board and contributions of non-resident alumni, had been secured. Apart from the original gift of the founder and apart from all legacies, the citizens of Maryland and the alumni of the University, before the last appeal was made and answered, had bestowed, by direct gift, upon the University since its foundation more than 600,000*l.* The exact amount contributed to date to the 1910 Endowment and Extension Fund is 238,635*l.* Of this sum, 50,000*l.* was given by the General Education Board, 48,000*l.* by the trustees of the University, 60,000*l.* was subscribed by the alumni, and the balance of more than 80,000*l.* was given by those to whom we have given the simple but honourable degree of " Friends of the University." A few special gifts may be mentioned: there is one of 4000*l.* to the department of romance languages, one of 2000*l.* for the Edmund Law Rogers fellowship, and 2000*l.* for the Hutzler library.

Mr. Bryce's address applies equally to British as to American universities, and it is here reprinted in an abridged form.

A remarkable feature of the thirty-five years over which we look back is the wonderful development of the various departments of human knowledge, and especially those which are concerned with the sciences of nature, into special branches, each of which has been tending to become more distinct from the others. So far from finding ourselves approaching the end of human knowledge, we find that the more we know the more remains beyond to be known, and that the realm of the unknown seems to be always increasing with every addition to our knowledge. It is as though the path which we are following were always diverging into a number of different paths which tend to separate from one another, and lead us into untrodden solitudes to which we see no end. Within the recollection of most of us, new branches of science have made good their place, and have become recognised as separate fields of inquiry, and along with this it has befallen that the great majority of scientific inquirers now, so soon as their general scientific education has been completed, begin to devote themselves to one particular branch of investigation and throw their whole energy into pushing it forward. A man is now not a " natural philosopher " in the old sense of the term, but belongs to some one of the specific branches into which natural philosophy has become divided. The same thing has happened in those practical arts which depend upon the application of science. They, too, have multiplied by division, and thus new practical professions have grown up, which were scarcely thought of forty years ago.

The same thing has of necessity happened in university education. We have now in all organised universities professors of a large number of distinct branches of knowledge, which were formerly lumped together as being one branch under one professor.

So also among the students the tendency is for those who have advanced some way to begin to devote themselves to one particular line of study and investigation. Both the teacher and the student are naturally fascinated by the prospect of discovery. The professor likes best to lecture upon the subject in which he is pushing forward his own investigations, and the student is able to find in them the most attractive field of experimental research.

This sort of specialisation has become inevitable, but there is a consequence attached to it which has seemed almost equally inevitable, namely, that part of the time which was previously given to general study, to a knowledge both of natural science in general and of other subjects, has now had to be devoted to this special study. The field of nature is unlimited. Human curiosity is unlimited. But human life and the capacity for using our time and our powers in the acquisition of knowledge remain within very narrow bounds.

Accordingly, the problem which to-day confronts us in all universities is how to find time both for these specialised studies, which have become so much more absorbing, and also for a survey and comprehension of the general field of human knowledge which is necessary in order to make the university graduate a truly educated and cultivated man, capable of seeing the relations of his own particular study to others and of appreciating the various methods by which discovery is prosecuted. This problem of reconciling special with general study, although most urgent in the sciences of nature, shows itself in what may be called the human subjects also.

However, the difficulty I am referring to arises chiefly

in the sciences of nature. These are now tending to overshadow all other studies, partly perhaps because the practical applications to which they are turned have become very numerous and of immense industrial importance for men and nations, and partly also because we are all fascinated by the progress of discovery, and are so eager to attain certitude that we are disposed to turn from those inquiries in which complete certitude is unattainable to those in which we can find an absolutely firm basis in the laws of nature; and it is in the natural sciences that the subdivision and specialisation of which I have been speaking has gone furthest.

Accordingly, the problem to which I have referred has two aspects. It raises the question of a mastery of the principles of the sciences of nature in general as against a highly specialised study of some one department in those sciences. It also raises the question of the respective claims of the study of physical science, or some branch of it, as against the claims of what may be called the human sciences, or, if you prefer it, human subjects.

What do we mean by general intellectual cultivation as opposed to special knowledge? Without attempting a complete definition—nothing is more dangerous than a definition—I will suggest a description. We mean such a knowledge of the main facts and distinctive methods of various branches of human knowledge as give a general idea of the relations of each branch to other branches, that is to say, of what truth and certitude mean in different departments of study, and what are the various paths by which truth may be reached or approached. If you asked me to indicate what this would include, I should make some such answer as this. In the sphere of natural science, it would include a knowledge, not necessarily wide, but sound and exact so far as it went, of some deductive science such as geometry, and of some science of observation such as a branch of natural history, geology, for instance, or some department of biology, or of such a science as chemistry. On the human side, it would include a knowledge of one of what may be called the abstract subjects, such as psychology or logic or ethics, and of one of the observational subjects such as economics or politics. It would include a knowledge of the principles of language, and of at least one foreign tongue, ancient or modern, preferably an inflected tongue; and, finally, it must include the record of human effort and development through the past, that is, history, which shows us how man has grown from what he was in the past to be what he is in the present, and holds out hopes of what he may be in the future. Without at least an elementary knowledge of these, no man is properly equipped for a life of study and thought, or for those branches of practical life which require a wide intellectual outlook. It is not necessary to-day, as it would have been fifty years ago, to argue that every educated man should have some knowledge of deductive science and of the observational and experimental sciences of nature.

Specialisation is not only inevitable for the progress of discovery, but in many minor ways excellent. It is a splendid thing for a great university like this to have among its professors men, each of whom is abreast of the highest development of some particular line of inquiry and knows how that line of inquiry ought to be prosecuted, so that it holds within its own walls, so to speak, an accumulated mass of various knowledge, representing what the world has yet attained. The scientific specialist makes interesting company—when I have a chance I always try to get beside him at dinner—because he is able to tell us what we seek to know of the progress of discovery in the growing sciences, and we have only to ask him to get at once, without the labour of consulting books, the latest results in the clearest form. The scientific investigator, moreover, seems to have, on the whole, the happiest kind of life that is now possible. Does he know how happy he is? Engaged in the discovery of truth, he has for his helpers all others engaged in the same pursuit, and knows that all his labours are working towards a noble and useful end. He is free from the vexations that beset the business man or the lawyer or the politician. If he has not a happy life, granted good health, it is probably his own fault, for what is finer than to be, as Bacon says, *minister et interpres naturae*?

Admitting all this, and much more that might be said on behalf of specialisation, it is nevertheless right to present to you some dangers that seem to arise from the immense extension of the specialising tendency and from the predominance, in particular, of the study of the natural sciences to the exclusion of other subjects. The phenomena of nature may no doubt be slowly changing, and as we know that even among those bodies which we call the fixed stars the positions of the stars towards one another alter, so oxygen and hydrogen may be different now from what they once were, and the proportion of the elements in the compound bodies may alter. The sciences of nature are occupied with that which is permanent and unchangeable. They deal with those laws which we believe, so far as our knowledge goes, to be immutable, to have been operative in the past, and likely to be operative in the future, as they are operative now. He who is entirely occupied in studying these unchanging laws does not learn thereby how to deal with that which is mutable and transient. But the mutable and the transient include, not only most of what concerns our daily life, but the whole immense field of knowledge which covers the human subjects. The realm of ideas, beliefs, theories, feelings, institutions, habits, in fact the whole realm of human thought and conduct, belongs to the sphere of the transitory and changeable. In investigating this realm, we have to walk by methods which are not only not the same, but are even more difficult than those which belong to the sciences of nature. The investigation of probability is more perplexing and less satisfying than those inquiries at the end of which stands certain and immutable truth. Those who try to apply the same formulæ and methods to the human subjects which they apply to nature are in danger of failing, as Herbert Spencer, for instance, failed when he entered the field of history and that of political or social phenomena.

Sixty years ago people complained, and complained justly, of the narrowness of those, even of some eminent men, who had been trained entirely on the old scheme of education, which largely consisted in grammatical studies, and especially in a knowledge of the ancient languages. Men otherwise highly gifted and instructed who had been so trained often failed to appreciate the interest and value of the study of nature, and showed a strange incapacity to understand its methods. Francis Bacon has warned us against that absorption in a particular set of ideas, that prepossession in favour of one particular view which he classes among the *Idola Specus*, the phantasms of the cave which surround the man who sits in the dark recess of his own line of thought unillumined by the light of the broad sky. So now the devotion to any special study, whether in the sphere of natural science or not, tends to narrow the mind and prevents the faculties from attaining their highest development. Many of the greatest discoveries have arisen from bringing together facts and ideas drawn from different regions the relations of which had not previously been discerned. The more you extend the range of knowledge, the more you increase the chances of such discoveries. Most of the great men to whom the progress of science is due were not trained as specialists, but had minds that ranged far and wide over the field of knowledge.

Someone has said that the chief end of education is to stimulate curiosity, to make a man ask about all things familiar or unfamiliar, the how and the why, to discover matter for inquiry in things which other people have passed over without thinking of the problems they suggest, to retain that activity and versatility and freshness which are the most characteristic marks of a forceful and creative intellect. Is it not wonderful how many things were overlooked in the past which now we feel to need investigation, and may there not be things now that ought to be investigated which we are passing over as familiar? The ancients must have noticed the difference in the aspect and structure of different kinds of rock, for instance. The differences between gneiss and limestone, between basalt and slate, stared them in the face. They saw fossil shells in the strata. But it did not occur to them to seek the explanation of these things, and geological science is not yet two centuries old. The wider the range of a man's interests, the more susceptible he is to ideas of many

kinds, the greater is the pleasure which life can afford him, the better can he contribute to the progress of the world both by stimulating others and by himself pointing out the way in which advances can be made. A university has to think, not only of forming specialists, but of making these specialists better by giving them a wide range of knowledge, and still more of sending out men who sustain the level of taste and insight in the whole community and are fit to be its intellectual leaders.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—A public meeting under the auspices of the University Eugenics Society will be held in the new lecture-room, Emmanuel College, by permission of the master and fellows of the college, on Monday, May 22, at 8.30 p.m. The Rev. Prof. Inge, D.D., Dean Designate of St. Paul's, will give an address on "Some Social and Religious Aspects of Eugenics."

OXFORD.—The preamble of the Statute exempting students in natural science and mathematics from examination in Greek passed Congregation on May 16 by 156 to 79.

LONDON.—Presentation Day was on Wednesday, May 10. The Chancellor (Lord Rosebery) presided, and an unusually large number of graduates were presented. A precedent was established this year by the presentation of cadets of the Officers' Training Corps who had gained War Office certificates or proceeded to commissions in the Army. The principal's report showed that the total admissions to the University in 1910–11 were 4255, compared with 4053 in the previous year; internal students, 4350, compared with 4185; and total candidates in examinations leading to degrees or diplomas, 12,681, compared with 12,787. The number of degrees or diplomas granted was 1222. Reference was made to extension of university professoriate, following the appointment of a large number of board of advisors. Among individual benefactions during the year, the most important were those of Sir Francis Galton for eugenics (40,000*l.*), Mr. Henry Dixon for scientific investigations (8000*l.*), Dr. Charles Graham for medical and pathological research (33,500*l.*), and Sir Felix Semon for laryngology (1040*l.*). The report also referred to the notable development of student activities—military, athletic, and social. Lord Rosebery, in a short address, appealed for more adequate accommodation for the central premises of the University and for increased financial support from the authorities and city companies.

IT has been decided by the council of Armstrong College, Newcastle-upon-Tyne, to establish a professorship of philosophy at the college, and to appoint an additional demonstrator in physics.

The Lancet announces the appointment, by the Lord President of the Privy Council, of Sir Donald MacAlister, K.C.B., principal of Glasgow University, as his representative on the International Committee for Post-graduate Medical Instruction.

THREE scholarships in naval architecture have been instituted at the University of Liverpool by the General Committee of Lloyd's Register of Shipping. Each scholarship is of the value of 50*l.* a year for three years, and one will be vacant annually. The first election will take place this year.

TWO cases of importance to persons taking part in competitive examinations were settled at the Bow Street Police Court on Saturday last. The defendants were tutors at a coaching establishment, and therefore debarred from taking part in the examinations of the Royal Society of Arts. Notwithstanding their ineligibility, they duly competed under assumed names and gained prizes. The Royal Society of Arts, being anxious that their examinations should be inviolate, and to make it clear to all that people are not allowed either by the rules of the society or the law to compete in examinations in a way which is detrimental to other candidates, took action in the matter, and they are to be congratulated on the result, the defendants being found guilty and punished.

ACCORDING to *Science*, at its recent session the legislature of Kansas voted approximately 200,000*l.* for the State Agricultural College at Manhattan for the next biennium. The funds provide for one wing of an agricultural building, with a detached laboratory for the cutting and curing of meats. The first wing of the new building is to cost 25,000*l.* Two more wings are to be added as the money is voted, each complete in itself. The legislature also provided a special fund for various objects, including money for experiments in the western part of the State in cooperation with the Federal Government; for soil surveys, also in cooperation with the United States Government; for experiments in producing improved wheat, corn, and other crops. The college has this year approximately 2500 students, more, it is said, than are enrolled in any similar institution in the world. The cost per student in this institution in 1910 was 21*l.*

WE learn from *The Belfast News-Letter* that the Library and Technical Instruction Committee of Belfast contemplate making a collection of kinematograph films of educational value for public exhibition in that city. Mr. F. C. Forth, the principal of the Technical Institute, a week or two ago gave a very successful introductory demonstration of the advantages of the kinematograph for teaching the character of various operations and movements that students may perhaps never be able to see for themselves, and which are but poorly represented by the simple lantern-slide. Among the films shown there were illustrated metallurgical works, a visit to Niagara Falls, cheese mites, a fresh-water hydra, rotifers, the circulation of protoplasm in the water weed, the circulation of blood in a frog's foot, chameleons feeding, toads fighting, and the development of a flower.

ON July 14 the King will open the new buildings of the University College of North Wales, which have been completed at a cost of about 112,000*l.*, exclusive of the site, which was presented by the citizens of Bangor. Of the total cost, rather under 10,000*l.* remains still to be collected, and the sums already received include 16,800*l.* from Carnarvonshire, 18,350*l.* from London, 1350*l.* from the staff, and 3500*l.* from old students. The quadrangle of buildings, which is flanked on three sides by the class-rooms and offices, has been completed on the fourth side by the Great Hall specially presented by Sir Pritchard Jones. The removal of the arts classes to the new buildings has given increased accommodation to the science departments, and among the gainers the agricultural and forestry departments may be noted. That theory and practice are not always inconsistent is evidenced by the large number of prizes secured by the former department at agricultural shows.

THE council of the Institution of Civil Engineers has made arrangements to hold a conference on the subject of the education and training of engineers on June 28 and 29 at the institution. The subject-matter to be discussed at the conference will be dealt with in three groups, namely, general education, scientific training, and practical training. Among other topics which will receive consideration at the meetings may be mentioned:—the extent to which mathematical and scientific subjects should share with other subjects of literate education the attention of schoolboys who intend to enter later the engineering profession; the question of specialised entrance examinations for university and college courses of study in engineering science with a view to the curricula to be followed, and also of the inclusion in the latter of courses in modern languages; the relation of practical training to college study—whether, or to what extent, before, sandwiched, or after its conclusion; the position and uses of engineering laboratories in relation to education at college; the value of a university degree in engineering science in relation to professional competence; the requirements of practical training in works, with the necessary complement of scientific study; practical training in workshops or on works of construction, with special reference to training in the engineer's office; the relation of engineering employers and colleges from the point of view of the practical training of college students; workshop training as a preliminary to practical training in other branches of engineering.

A COMPLIMENTARY banquet to Prof. H. E. Armstrong, F.R.S., took place at the Hotel Cecil on Saturday, May 13. Although intended, in the first instance, to take the form of a demonstration of affectionate regard on the part of his old students, it was soon found necessary to extend the scope of the celebration, which thus became the occasion for one of the largest scientific gatherings of recent years. The toast of the guest of the evening was proposed by the chairman, Prof. W. J. Pope, F.R.S., and was seconded by Mr. Maurice Solomon. The guests included Sir William Crookes, Sir James Dewar, Sir Chas. Lawes, Profs. H. B. Baker, A. Brown, Clowes, Crossley, Divers, Henderson, Kipping, and Wynne, Messrs. W. Barlow, G. T. Beilby, H. T. Brown, Cross, Hall, R. Messel, R. L. Mond, F. B. Power, and J. E. Stead amongst the chemists; engineering was represented by Profs. Perry, Dalby, Mather, and Sumpner; education by Principal Miers, Mr. R. Blair, Dr. J. H. Cowham, Prof. R. A. Gregory, Mr. A. L. Soper, and Mr. C. M. Stuart; law by Mr. W. Phipson Beale, K.C.; and literature by Prof. M. A. Gerothwohl. On two occasions the Chemical Society has met in order to celebrate the jubilee of five of its past presidents, but we believe that only one similar gathering has previously been organised by a group of chemical students in honour of their professor. The success of the enterprise was most gratifying; "Central" students of every year, from the date of the opening of the college to the present day, united with chemists and others from all over the country, to the number of 230, in honouring one whose influence has been felt and valued by an exceptionally wide circle of admirers and friends.

THE following regulations with reference to the newly founded prize in memory of Lord Kelvin have just been issued by the University of Glasgow:—(1) The prize shall consist of a gold medal of the value of 10*l*., together with the balance of the income of the capital fund accumulated during three years. (2) The adjudicators shall be the principal, the professor of natural philosophy, and the professor of mathematics. (3) The prize shall be awarded by the Senatus, on the recommendation of the adjudicators, at intervals of three years (the first period beginning with 1911) to the author of a thesis or published work in natural philosophy, including therein mathematical and experimental physics, which has been submitted and approved for the degree of Doctor of Science during the period, and which gives evidence of original research worthy in the opinion of the adjudicators of this special distinction. (4) In making their recommendation, the adjudicators shall have regard to the written reports presented to the faculty of science by the examiners and additional examiners appointed under Section X. of University Court Ordinance No. XXVI. (5) Not more than one award shall be made in each period of three years, and the prize shall not be divided. The adjudicators may, if they think fit, recommend that for a particular period of three years no award be made, and, in that case, the income of the prize shall be added to the capital fund. (6) The Kelvin prize and the William Jack prize shall not be awarded to the same person. (7) After the year 1920 the regulations may from time to time be modified by the Senatus, with the approval of the University Court, provided always that the prize shall continue to be awarded to graduates of the University for special distinction in original research relating to mathematical and experimental physics.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, May 11.—Sir Archibald Geikie, K.C.B. president, in the chair.—C. T. R. **Wilson**: A method of making visible the paths of ionising particles through a gas. The paths are made visible by condensing water upon the ions immediately after their liberation, an expansion apparatus being used which works without appreciable stirring up of the air. The trails of ions formed by the α particles from radium have in this way been made visible and photographed, very dense and sharply defined rays of cloud being formed on expansion. Air exposed to β rays gives clouds consisting mainly of faint straight threads radiating from the source; these have not yet been photographed. In air exposed to γ rays, the cloud is again in the form of straight threads traversing the cloud chamber—the tracks of β particles from the walls. The cloud formed in air exposed to Röntgen rays is entirely concentrated in minute streaks and patches. A photograph shows these to consist mainly of fine threads not exceeding a few mm. in length, and generally far from straight, probably the tracks of kathode rays produced in the air by the X-rays. The whole of the ionisation would appear, as Bragg has already suggested, to be effected by the kathode rays derived from the X-rays.—W. H. **Dines**: The vertical temperature distribution in the atmosphere over England, and some remarks on the general and local circulation. This paper gives an account of the results of some 200 observations made in the British Isles in the years 1908, 1909, and 1910 on the temperature of the upper air. It discusses the annual variation of the temperature up to 14 kilometres, and shows that the annual range remains fairly steady, with a total amplitude of about 12° C. up to 11 km., above which the range suddenly drops to 3°, and the times of the maxima and minima go back two months. The question of the daily variation at great heights is then discussed. The relation between the temperature at various heights and the height of the barometer at the surface is dealt with, and it is shown how over a low-pressure area with the barometer below 740 mm. the temperature of the first 8 km. is very low, reaching at 7 km. a value of nearly 10° C. below its average value, and that above 10 km. it is considerably above the average. In the anti-cyclonic parts the conditions are reversed, and it is warm below and cold above. The height at which the isothermal region is met with in summer and winter and in times of high and low barometer is then referred to. A statement with regard to the existence of similar conditions that have been found to exist on the Continent is also given. In the second part of the paper various theoretical considerations are taken into account. It is shown that if an extensive and strong wind exists in any part of the atmosphere, warm air will be found somewhat below it on its right hand, and cold air above it on the right, with converse conditions on the left, and it is pointed out that this agrees with the distribution of temperature that is found to exist at the various levels of cyclones and anticyclones.—Prof. W. N. **Hartley**: Some mineral constituents of a dusty atmosphere.—Dr. H. Stanley **Allen**: The path of an electron in combined radial magnetic and electric fields. The path of an electron in a radial electric field superposed on a radial magnetic field is found to lie on a circular cone the vertex of which coincides with the magnetic pole. If the surface of the cone is developed into a plane, the trace of the path is a conic section with the vertex as focus. The solution in the particular case in which there is no electric field has been given by Poincaré; the path is then a geodesic line on the surface of the cone, and, of course, becomes a straight line when the cone is developed. In cases which can be realised experimentally, the developed path is hyperbolic, and does not in general differ greatly from a straight line. An account is given of some experiments carried out to illustrate the theory. The first observations were made with a focus tube in which the antikathode was the pole of an electromagnet. The phenomena observed are easily explained in terms of the theory. Other vacuum tubes were prepared in which a fine pencil of kathode rays could be produced by means of a Wehnelt kathode. In a radial magnetic field the stream of electrons assumed a spiral form, and a number of photographs were obtained showing the spiral paths on a cone of revolution.—Dr. R. A. **Houstoun**: The absolute measurement of light—a proposal for an ultimate light standard. A thermopile cannot be used for the measurement of candle-power, because it gives the same value to the energy of every wave-length, invisible as well as visible. The author has, however, found by spectrophotometric investigation in the ultra-violet, visible, and infra-red parts of the spectrum that if a filter consisting of aqueous solutions of copper sulphate and potassium bichromate in a particular strength in glass cells be placed before the thermopile, then this filter stops the ultra-violet and infra-red entirely, and lets through a fraction of each wave-length in the visible spectrum pro-

portional to its visibility. In other words, it weights each radiation according to its visibility. The voltage on a tantalum lamp was varied over a wide range, and its candle-power as read by thermopile and filters agreed well with the readings of a photometer. Owing to the high sensitiveness of the galvanometer required, the method is not suitable for commercial application, except perhaps for integration photometry, when a number of thermopiles might be connected in series with the one galvanometer. The importance of the method lies in the fact that it provides a satisfactory basis for heterochromatic photometry independent of the Purkinje phenomenon at all intensities. The author therefore proposes to use it for defining the unit of light intensity. He would define the latter as that source, the total intensity of radiation from which at a distance of 1 metre after passing through his filters would be x ergs/sq. cm., sec. For the standard candle x should be about 0·8.—Prof. A. C. **Dixon**: Harmonic expansions.

Royal Microscopical Society, April 19.—Mr. H. G. Plimmer, F.R.S., in the chair.—E. J. **Spitta**: Low-power photomicrography, with special reference to colouring methods.—E. J. **Spitta**: Report on Grayson's rulings.—E. J. **Shepherd**: The reappearance of the nucleolus in mitosis. This was an addendum to the author's previous paper, communicated in April, 1909, on the disappearance of the nucleolus in mitosis. In the present communication the author said that with a view to ascertain how and when the nucleolus makes its reappearance, the diaster stage is the one which calls for most careful study and observation. At or about the time of the formation of the dispirem, and before the diasters have lost their characteristic shape, a looping in the chromatin is observed, the number of loops varying in each daughter nucleus. It is in these loops that the nucleoli will appear, but it must not be inferred that a nucleolus will appear in each loop, as there are frequently more loops than nucleoli. The latter make their appearance when the division of the cell is well marked, and when the interzonal fibres have generally disappeared. From the results of his research, the author was of opinion that the nucleolus is a product of the chromatin injected into the loops by a process which can best be described as a "streaming in" process. A full account of the technique of staining and methods adopted, &c., which have led to the above conclusion, will be found in The Journal of the Royal Microscopical Society.—J. **Murray**: Second portion of a report from the Shackleton Antarctic Expedition of 1909 on the Canadian rotifera. Forty-two species (all bedlloids) were collected among mosses. They included five new species, *Callidina asperula*, *C. canadensis*, *Mniobia obtusicornis*, *M. montium*, and *Harbrotrocha maculata*. There were also a number of peculiar varieties of other species. *Callidina asperula* has since been found in Ireland by the Clare Island Survey. Twenty-seven bedlloids were previously recorded for the United States. Six of these occurred in their collections, so that the number of bedlloids now known in North America stands at sixty-three species, but a number of these were of doubtful value. Among the rarer Canadian species were *Philodina australis* (Australia and Canada), *Callidina speciosa* (British Guiana and Canada), *C. zickendrahti* (Russia and Canada).—Señor Domingo **de Oureta**: A new piece of apparatus for photomicrography, with the microscope in the inclined position.

Geological Society, April 26.—Prof. W. W. Watts, F.R.S., vice-president, in the chair.—A. **Wade**: The Llandovery and associated rocks of north-eastern Montgomeryshire. The area dealt with is near Welshpool, and comprises part of the Severn Valley and the whole of the Vale of Guilsfield. In the succession worked out, the Ashgillian and the Valentian are distinguished for the first time, while the distinction between the Wenlock and the Ludlow beds is brought out by means of graptolite zones. The stratigraphical succession is shown by traverses. The district is shown to be transitional in character between neighbouring districts on almost every side. The structure of the area is that of an anticline with "keystone" faulting. The two boundary-faults of the arch have considerable downthrows. An account is given of the Welshpool Dyke. The glacial geology of the area is described, three series of deposits being observed:—(1) a high-level series; (2) a low-level series; and (3) a stratified series. The Guilsfield Valley is shown to have been occupied by a glacial lake, and the reversed drainage of the Cefn-Yspn Brook is shown to be connected with a "col" through which the overflow water drained.—Dr. J. D. **Falconer**: Geology of northern Nigeria. The protectorate covers an area of about 255,000 square miles, over half of which crystalline rocks are exposed at the surface. Hard, banded gneisses of an Archæan type are intermingled with quartzites, phyllites, schists, and gneisses of sedimentary origin, so as to suggest that the two series, while originally unconformable, have been later affected by a common folding and foliation along axes predominantly meridional in direction. The two series have also been pierced by igneous intrusions of a granitic type. Folded and faulted rocks of Cretaceous age are found. These Cretaceous rocks are overlain unconformably by a horizontal series of sandstones, grits, conglomerates, and ironstones, which in Sokoto province contains intercalations of Middle Eocene limestone. Volcanic activity occurred during Tertiary times, and gave rise to fields of basaltic lava in Bauchi and Bornu, as also to numerous puys of trachyte, phonolite, olivine-basalt, and nepheline-basalt throughout southern Bauchi, Muri, and Yola. Repeated minor oscillations during the latter part of the Tertiary era culminated in the elevation of the Bauchi plateau, the depression of the Chad area, and the establishment of the present river-system.

PARIS.

Academy of Sciences, May 1.—M. Armand Gautier in the chair.—B. **Baillaud**: Remarks on the "Annales de l'Observatoire de Paris" containing the observations made in 1892.—P. **Villard** and H. **Abraham**: A direct-reading electrostatic voltmeter for very high potentials. A simplified voltmeter capable of giving accurate readings up to potentials of 300,000 volts.—E. L. **Bouvier**: The Pycnogonides of the *Pourquoi Pas?* This group is well represented in the Antarctic regions, more species being found there than in the Arctic regions.—M. **Jarry-Desloges**: *Résumé* of the physical observations of the planet Mars made in the opposition 1909–10, with remarks on the quality of the telescopic images in various regions. The appearance and disappearance of the white polar cap corresponds with a fixed Martian date. No regularity, however, can be traced as regards the changes in form and shade of the dark spots, which, especially in the equatorial regions, do not appear to be related to the seasons. No evidence could be obtained of the existence of a liquid state resulting from the disappearance of the white polar substance.—Jules **Drach**: Determination of the lines of curvature of the Fresnel wave surface.—J. **Hadamard**: The fundamental solution of partial differential equations of the parabolic type.—L. **Godeaux**: Linear congruences of conics.—MM. **Claude, Ferrié,** and **Driencourt**: Radio-telegraphic comparisons of chronometers by the method of coincidences between Paris and Bizerta. It has been definitely established by these experiments that radio-telegraphic comparisons by the method of coincidences are capable of giving the difference of time between two chronometers 1000 miles apart, and with an accuracy of at least 0·01 sec.—C. **Raveau**: Interference fringes from a linear source of light.—M. **Estanave**: Photographs with changing colours. A description of a method of obtaining a photograph the colours of which change according to the angle of observation.—M. **Aubert**: Thermo-diffusion.—Walter **König**: The displacement of ultramicroscopic particles produced by very rapid sound shocks. A theoretical explanation of some experimental results recently described by MM. Henri and Lifschitz.—M. **Pomey**: The propagation on a telegraph line of the current due to a constant electromotive force.—Jean **Perrin**: The determinations of molecular magnitudes. A criticism of several methods based on Stokes's law. For the charge of the electron, the value $4{\cdot}24\times10^{-10}$ is regarded as more probable than the usually accepted $4{\cdot}8\times10^{-10}$.—Jules **Roux**: The charge of the electron. Determinations on sulphur particles lead to the value $4{\cdot}17\times10^{-10}$.—A. **Blanc**: The ionisation produced by phosphorus.—Georges **Moreau**: The ionisation of salt vapours by a corpuscular radiation.—F. **Leprince-Ringuet**: Study

of the state of insulation of an alternating network by means of voltmeters interposed between a pole and the earth.—Jacques **Duclaux**: The application of the kinetic theory to the study of the phenomena of catalysis.—Œchsner **de Coninck**: Determination of the molecular weight of uranyl, UrO_2. The reduction of H_2UrO_4 by pure hydrogen at a red heat led to a molecular weight of 270·66 for UrO_2, as against 270·5 deduced from the atomic weight 238·5 for uranium.—H. **Henriet** and M. **Bouyssy**: A method for measuring the impurities in a confined atmosphere. Metallic vessels containing a freezing mixture of ice and salt were suspended in the room, the ice being melted and weighed. The amount of reduction of a solution of potassium permanganate and chromic acid was determined, and this taken as a measure of the impurity of the atmosphere.—MM. **Taurel** and **Griffet**: The determination of the proportion of combined sulphur in a mixture of different forms of sulphur.—Frédéric **Aronssohn**: The mineral composition of the bee. Fifteen elements were determinable in the ash, including arsenic, copper, manganese, and zinc.—Jean **Pougnet**: The action of the ultra-violet rays upon the green pods of vanilla. Ultra-violet light produces the odour of vanilla in fresh green pods; manganese salts accelerate this action.—Lucien **Daniel**: Biometrical researches on a graft hybrid between the pear and quince trees. After six years' cultivation, no flowers have been produced on this hybrid. A study of the leaf dentition shows the influence exerted by the subject on the graft.—A. **Marie** and Léon **MacAuliffe**: The height and general morphology of French women.—MM. **Landsteiner, Levaditi,** and **Prasek**: Attempts to transmit scarlatina to the chimpanzee.—C. **Vaney** and G. **Tainturier**: The degenerescence of some larval forms of *Hypoderma bovis*.—Carl **Störmer**: The results of photogrammetric measurements of the altitude of the aurora borealis at Bosekop during February and March, 1910.

MELBOURNE.

Royal Society of Victoria, March 9.—Prof. E. W. Skeats, in the chair.—J. **Mann**: Papuan timbers, some of the properties of six species. These, known as Ulabo, Tamanau, Alaga, Madave, Kokoilo, and Ilimo, are now being exported. Mechanical tests for strength, and for calorific value, charcoal, and ash were made, and the results are tabulated. Ulabo, which is a dark heavy wood, is of engineering value and white-ant proof, while the others are useful for general joinery and, being well coloured and figured, for cabinet work.

DIARY OF SOCIETIES.

THURSDAY, MAY 18.

ROYAL SOCIETY, at 4.30.—The Properties of Colloidal Systems. II. On Adsorption as Preliminary to Chemical Reaction: Prof. W. M. Bayliss, F.R.S.—Inbreeding in a Simple Mendelian Stable Population, with Special Reference to Cousin Marriage: S. M. Jacob.—On the Direct Guaiacum Reaction given by Plant Extracts: Miss M. Wheldale.—Transmission of Amakebe by means of *Rhipicephalus appendiculatus*, the Brown Tick: Dr. A. Theiler.—On Distribution and Action of Soluble Substances in Frogs deprived of their Circulatory Apparatus: S. J. Meltzer.—The Discrimination of Colour: Dr. F. W. Edridge-Green.

ROYAL INSTITUTION, at 3.—Air and the Flying Machine. I. The Structure of the Atmosphere and the Texture of Air Currents: Dr. W. N. Shaw, F.R.S.

ROYAL GEOGRAPHICAL SOCIETY, at 5.—Research Meeting. Principles of the Construction of Vegetation Maps: Dr. C. E. Moss.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Automatic Telephone Exchange Systems: W. Aitken.

FRIDAY, MAY 19.

ROYAL INSTITUTION, at 9.—Recent Experiments with Invisible Light: Prof. R. W. Wood.

SATURDAY, MAY 20.

ROYAL INSTITUTION, at 3.—Phases of Bird Life. I. Flight: W. P. Pycraft.

MONDAY, MAY 22.

ROYAL GEOGRAPHICAL SOCIETY, at 3.—Anniversary Meeting.

ROYAL SOCIETY OF ARTS, at 8.—Rock Crystal: its Structure and Uses: Dr. Alfred E. H. Tutton, F.R.S.

TUESDAY, MAY 23.

ROYAL INSTITUTION, at 3.—The Brain and the Hand: Prof. F. W. Mott, F.R.S.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.15.—The Classification of the Prehistoric Remains of Eastern Essex: S. Hazzledine Warren.—On a Prehistoric Skeleton from Walton-on-Naze: Dr. A. Keith.

ZOOLOGICAL SOCIETY, at 8.30.

FARADAY SOCIETY, at 8.—Recent Advances in Gas Thermometry: Dr. A. L. Day.—The High Temperature Equipment at the National Physical Laboratory: Dr. J. A. Harker, F.R.S.—The Boiling Points of Metals: H. C. Greenwood.—The Behaviour of Silica at High Temperatures: A. Blackie.—On the Maintenance of Constant High Temperatures: Prof. Bodenstein.—On Stellar Pyrometry: M. Féry.

WEDNESDAY, MAY 24.

LINNEAN SOCIETY, at 3.—Anniversary Meeting.

ROYAL SOCIETY OF ARTS, at 8.—Architecture in America: Frank M. Andrews (New York).

GEOLOGICAL SOCIETY, at 8.—On the Geology of Antigua and other West Indian Islands, with reference to the Physical History of the Caribean Region: R. J. Lechmere Guppy.

SOCIETY OF PUBLIC ANALYSTS, at 8.—The Composition of Milk: H. Droop Richmond.—Notes on the Analysis of Margarine: Cecil H. Cribb and P. A. Ellis Richards.—Observations on some Methods of Estimating Cocoanut Oil and Butter in Butter and Margarine: Cecil Revis and E. Richards Bolton.—The Estimation of Quinine as the Acid Citrate, in certain Organic Liquids: T. Cockburn and J. W. Black.—The Determination of the Amount of Dissolved Oxygen absorbed by Sewage Effluents containing Nitrite, and of the Amount of Nitrite in Sewage Effluents or Water: R. W. Clarke.—Further Analyses of Ghee: Cecil Revis and E. Richards Bolton.

THURSDAY, MAY 25.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: Experiments on the Compression of Liquids at High Pressures: Hon. C. A. Parsons, F.R.S., and S. S. Cook.—An Optical Method of Measuring Vapour Pressures; Vapour Pressure and Apparent Superheating of Solid Bromine: C. Cuthbertson and Mrs. M. Cuthbertson.—The Vacuum-tube Spectra of Mercury: Dr. F. Horton.—The Production of Characteristic Röntgen Radiations: R. Whiddington.

ROYAL INSTITUTION, at 3.—Air and the Flying Machine. II. Conditions of Safety for Floaters and Fliers: Dr. W. N. Shaw, F.R.S.

ROYAL SOCIETY OF ARTS, at 4.30.—N.W.F. Province of India: W. R. H. Merk.

SATURDAY, MAY 27.

ROYAL INSTITUTION, at 3.—Phases of Bird Life. II. Migration: W. P. Pycraft.

ARISTOTELIAN SOCIETY (at Oxford in conjunction with Mind Association).—A Symposium on the Relation of Psychology to Metaphysics: G. F. Stout and A. Smith.

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