THURSDAY, AUGUST 15, 1912.

CANCER PROBLEMS.

(1) *The Cause of Cancer.* Being part iii. of "Protozoa and Disease." By J. Jackson Clarke. Pp. xi + 112 + viii plates. (London: Baillière, Tindall and Cox, 1912.) Price 7*s.* 6*d.* net.

(2) *Preventable Cancer.* By Rollo Russell. Pp. vii + 168. (London: Longmans, Green and Co., 1912.) Price 4*s.* 6*d.* net.

(3) *Further Researches into Induced Cell-Reproduction and Cancer.* Vol. ii. Consisting of papers by H. C. Ross, J. W. Cropper, and E. H. Ross. (The John Howard McFadden Researches.) Pp. 125 + ix plates. (London: John Murray, 1912.) Price 3*s.* 6*d.* net.

(4) *The Local Incidence of Cancer.* By Charles E. Green. Pp. 36; illustrated. (Edinburgh and London: W. Green and Sons, 1912.) Price 1*s.* net.

IT is impossible at the present time to state definitely that cancer cannot be due to a specific micro-organism, but the general arguments against this view are so strong that it is difficult for anyone making such a claim to obtain a patient hearing. Some forms of malignant growth necessitate the supposition, if a specific parasite be the true cause, that the parasite should pick out remote, different, and minute groups of cells, leaving adjacent and apparently unprotected groups untouched. The embryo escapes infection from maternal malignant disease of the uterus, and the mother is not infected, though the fœtus contained in her body may develop the disease and be born with it in an advanced condition. There are many other and perhaps more cogent arguments the enumeration of which cannot be included in the space of a short review.

(1) Dr. J. Jackson Clarke's book is a further plea for his protozoan parasite of cancer. His enthusiastic belief in his parasite has apparently caused him to overlook the difficulties in the way of accepting his view. Certain well-known facts connected with malignant growths are quite incompatible with Dr. Clarke's parasite. Of course, it is more than probable that several different parasites are indirectly the cause of cancer. The spirochæte of syphilis as an example is sufficient. But this is quite a different thing from a specific microorganism for cancer. Advocates of the parasitic theory who have a thorough knowledge of the class of organisms among which they place their parasite may be said to be practically non-existent. Dr. Clarke can scarcely be placed among those who have any particular knowledge of protozoa, for he treats the existence of Haeckel's monera as being a generally accepted fact, and bases arguments upon them which are of fundamental importance to his theory.

(2) Mr. Rollo Russell, attacking the cancer problem from the statistical point of view, comes to the conclusion that the disease is largely due to food and drink taken at a high temperature, and to the free use of wine, beer, spirits, flesh, coffee, tea, and tobacco. The use of statistics may be very misleading, and Mr. Russell has made the mistake of comparing statistics which are in no way comparable. There is also much that suggests that Mr. Russell's facts are in other respects not sufficiently comprehensive or accurate to justify his conclusions. For instance, it is important to his theory that the lower animals should suffer less than man from cancer. He puts forward much evidence in support of this view, some of it consisting of actual figures; the rest is merely the expression of opinions.

Mr. Russell concludes that cancer is very rare or absent in wild mammals, comparatively common in domesticated mammals, and far more common in civilised man. He has omitted mice, which animals for some years past have been under observation, almost in millions in various laboratories, with the result that cancer has been proved to be nearly as common among mice as among civilised men. Perhaps if other animals were kept in as large numbers and under as careful observation, it would be proved that the frequency of cancer did not vary in the manner suggested by the particular figures and opinions collected by Mr. Russell. Again, Mr. Russell says that the stomach is the commonest site of cancer in man, the liver being next. This is not so. Primary cancer of the liver, which is evidently implied, is very rare. There are probably several causes of cancer. Diet may be among them, but Mr. Russell has not proved this.

(3) The previous publications by Mr. H. C. Ross and his collaborators relating to "Induced Cell Reproduction and Cancer" have already been noticed in these pages. The present excursion into the unknown inspires no more confidence than those which preceded it. The accuracy of the observations now described depends upon the accuracy of those described before, and they in turn depend upon the accuracy of an equation in which degrees of temperature, minutes of time, and cubic centimetres of solutions are added together. It is difficult after such a beginning to

take these observations seriously, particularly as they necessitate the abandonment of every generally accepted belief with regard to mitosis. Surely Flemming, Boveri, Strasburger, and a hundred others were competent observers, and with regard to the fundamental facts connected with mitosis, and disputed by Mr. Ross, all are agreed!

The further descriptions of cell phenomena given in the present volume only serve to make clearer the obvious necessity of at least an elementary knowledge of a subject before undertaking original research therein. Various cytological terms are used in a manner which suggests that the authors are unfamiliar with the structures these terms were invented to specify. With regard to their statement that what they call Altmann's granules go to form the chromosomes, no better advice could be given than that they should study the already voluminous and rapidly growing literature relating to chondriosomes, to which the chief contributors are perhaps Benda, Meves, Duesberg, Prenant, Fauré-Frémiet, and G. Arnold.

(4) Mr. Green believes that "the lie of the ground seems to have a mysterious influence on the local incidence of cancer," and that this "can only be explained by its relation to the elimination and removal of products of coal combustion from the houses or from their neighbourhood." He claims, perfectly correctly, that houses built in hollows or on the sides of hills are most likely to suffer from smoky chimneys, and hence that people inhabiting such houses are most subject to the action of the products of coal combustion. He produces statistics and other evidence professing to show that cancer is most prevalent in towns situated in hollows and on steep or hilly sites. That various superficial forms, such as chimney sweep's and Kangri cancer, may be caused by some local irritant not unconnected with the combustion of coal or some other substance is probable, but it is difficult to connect internal cancers with coal. Again, Mr. Green's classification of towns is not altogether in accordance with fact. Glasgow has one of the lowest death-rates from cancer. Mr. Green places it among the towns occupying a flat site, as his theory, of course, demands. A considerable portion of Glasgow is probably as hilly as any town in the United Kingdom, and the hills are of that steep nature most likely to produce smoky chimneys. The Royal Cancer Hospital, itself in the middle of the town, is surrounded by inclines so steep that it is practically unapproachable by wheeled vehicles except in one direction.

C. E. W.

SCHOOL MATHEMATICS.

(1) *Geometry for Schools.* Vols. i.–iv. By W. G. Borchardt and the Rev. A. D. Perrott. (Cambridge Mathematical Series.) Pp. xiv + 325 + xiv. (London: G. Bell and Sons, Ltd., 1912.) Price 3*s.* 6*d.*

(2) *Algebra for Beginners.* By C. Godfrey, M.V.O., and A. W. Siddons. Pp. xi + 272. (Cambridge University Press, 1912.) Price 2*s.* 6*d.*

(3) *A School Algebra.* Parts ii and iii. By H. S. Hall. With answers. Pp. x + 301–550 + xxxix–lix. (London: Macmillan and Co., Ltd., 1912.) Price 2*s.* 6*d.*

(4) *Examples in Arithmetic.* Part ii. Taken from "A School Arithmetic." By H. S. Hall and F. H. Stevens. Pp. v + 117–281 + xxiii–xxxix. (London: Macmillan and Co., Ltd., 1912.) Price 2*s.*

(5) *The Calculus for Beginners.* By W. M. Baker. (Cambridge Mathematical Series.) Pp. viii + 166. (London: G. Bell and Sons, Ltd., 1912.) Price 3*s.*

OUR mathematical reformers are to-day fairly well agreed on the teaching of school mathematics; their opinions may be found in the various reports of the Mathematical Association and in the Report on the Geometry Syllabus by the American "National Committee of Fifteen." It is an interesting study to consider how far writers of text-books adopt these opinions, why they deviate from them, and what an author who holds these reforming opinions may do to advance them.

It is, for instance, remarkable with what unanimity the early introduction of solid geometry is recommended—only less remarkable than the rarity with which one finds that recommendation carried out. Messrs. Borchardt and Perrott (1) make a noble effort, and give, in the first six pages, a valuable little explanation of a number of three-dimensional terms; but the remainder of the 325 pages now before us appear to be restricted to two dimensions. And we have noticed a similar falling off in other authors. What is the explanation? The truth is that three-dimensional work is difficult and little suited to the capacity of the beginner. Little is possible at an early stage beyond the occasional discussion of a problem in which the data are in three dimensions, but the reasoning in reality two-dimensional.

The book on algebra by Messrs. Godfrey and Siddons (2) leaves us wondering. To avoid misapprehension, we say at once that it is a good book, undoubtedly good, for these authors could not write anything but good. But for the work

of leaders of thought it is curiously old in form. They give rules for the treatment of signs on the removal of brackets, which we cannot imagine either of them using in actual teaching; we imagine them constantly carrying the boys back to the meaning of the expression under consideration, until the boys have absorbed the rule without ever putting it into words. And the quantity of manipulation: there are tons and tons, enough to wear down the teeth of the most omnivorous boy. All this manipulation cannot be intended for the boy of mathematical ability; he will acquire all necessary manipulative skill on a tenth of it. It cannot be intended for the non-specialist; he does not need such manipulative skill, and if he does acquire it he has no time left for the more human mathematical studies to which he ought to push on.

We are forced to conclude that the book is cast in this form to meet the demand of the market. We have no blame for suiting the book to the demand; on the contrary, we sympathise. Better to publish this book, which is the best on the market though weak in some ways, than an ideal book which no one would use. What we do suggest is that our leaders of thought should write books which meet the demand, and at the same time mark portions of the book for omission whenever circumstances allow it, in order to wean the teacher and examiner from useless studies.

In Mr. Hall's "School Algebra" (3) we find the same excess of manipulative exercises as in Godfrey and Siddons. On the other hand, we hail with delight his plan of using infinite series without proof of their validity. A clear consciousness of the concepts of mathematics is the first desideratum; abstruse proofs are for the few. A little more telescoping of the customary mathematical course and the non-specialist will be able in his school career to attain to the ideas of the calculus.

One desirable piece of telescoping is the omission from the compulsory course of permutations and combinations. They provide, of course, good mental gymnastic. As regards progress in knowledge, they lead up to the binomial theorem; so that they cease to be necessary in a course which assumes the validity of that theorem. At the same time, their discussion gives rise to many elegant theorems, and it is therefore well to leave them available for the leisure hour of the boy who fancies them.

Messrs. Hall and Stevens' "Examples in Arithmetic" (4) includes the treatment of stocks and shares. No doubt examination requirements necessitate their inclusion, but we should be glad to see their omission recommended for schools the circumstances of which allow it. The difficulties lie in the terminology and in the pupil's ignorance of the transactions involved; there are no arithmetical difficulties. Again, continued fractions, which at an earlier time provided the only means of obtaining approximations to complicated quantities such as surds, are now superseded by decimals, and might with advantage disappear from books on arithmetic.

The pruning away of unnecessary excrescences from the school course makes possible the inclusion of the infinitesimal calculus, which is more and more coming to be recognised as a regular school subject, and we welcome Mr. Baker's little book (5) as helping towards that desirable consummation. Mr. Baker no doubt caters for the boy who will need the calculus as part of his technical equipment in later life, and for that boy he rightly provides logical proofs of all theorems. In course of time the non-specialist boy will study the calculus in place of stocks and shares, permutations and combinations, and such things; and this boy should have a book on the lines suggested by Mr. Newbold in his little paper on "Higher Mathematics for the Classical Sixth Form," in which the ideas of the subject are evolved from the discussion of interesting everyday problems.

THEORETICAL AND APPLIED PHYSICS.

(1) *Heat and the Principles of Thermodynamics.* By Dr. Charles H. Draper. New and revised edition. Pp. xv+428. (London: Blackie and Son, Ltd., 1911.) Price 5*s.* net.

(2) *Laboratory Problems in Physics.* To accompany Crew and Jones's "Elements of Physics." By F. T. Jones and Prof. R. R. Tatnall. Pp. ix+81. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1912.) Price 2*s.* 6*d.*

(3) *Outlines of Applied Optics.* By P. G. Nutting. (Blakiston's Science Series.) Pp. ix+234. (Philadelphia: P. Blakiston's Son and Co., 1912.) Price 2 dollars net.

(4) *Elements of Hydrostatics.* With numerous examples. For the use of schools and colleges. By George W. Parker. Pp. viii+150. (London: Longmans, Green and Co., 1912.) Price 2*s.* 6*d.*

(5) *Junior Heat.* By Dr. John Satterly. Pp. viii+184. (London: W. B. Clive, University Tutorial Press, Ltd., 1912.) Price 2*s.*

(1) IT is refreshing to find, occasionally, an elementary text-book in which the author has been bold enough to depart from the stereotyped mode of treatment and introduce new features. Such is the case with the second edition of Dr. Draper's book. The author's intention, as expressed in the preface, of revising the book

in the light of new methods of investigation, has been very successfully carried out in the first part, which deals with the experimental side of heat. While the fundamental treatment of the subject has not been neglected, special attention has also been directed to comparatively recent work. The chapters on the various methods of measuring temperature and that on the liquefaction of gases are both excellent, and will greatly add to the usefulness of the text-book. The second part is devoted to the consideration of the principles of thermodynamics, which, for the most part, are expressed clearly and in a simple manner. Several important applications of the principles are shown, and a large number of numerical examples, both in this and the first part of the book, are given.

There is, however, a rather serious misstatement in connection with the meaning of the second law. After stating this law in the form due to Clausius, viz. "It is impossible for a self-acting machine, unassisted by any external agency, to convey heat from a colder to a warmer body," the author at a later stage makes the statement, "It must be remembered that this law applies only to engines working in reversible cycles and to reversible cyclic processes." This undoubtedly suggests that a self-acting engine performing an irreversible cycle *may* convey heat up temperature. In fact, all actual self-acting engines *do* perform irreversible cycles of operations, and surely they are not to be regarded as cases of violation of the second law. What is probably meant by the above unfortunate statement is that *cyclic* processes only must be considered. With regard to the scope of the book, the standard is about that required for pass degree examinations, and the elementary use of the calculus has very properly been adopted.

(2) In writing this book the authors have added another to the already numerous works of this kind. In many respects it is similar to others previously reviewed in these pages. Instructions for the performance of a large number of experiments in the various sections of physics are given, each description being accompanied by a few questions bearing on the experiment. Some of the questions seem rather unnecessary. In the experiment on the simple pendulum, for instance, the student is supposed to have discovered that T varies as $\sqrt{l}$, and is then asked if T varies as $\frac{l}{\sqrt{g}}$, which is quite obviously contradictory to his previous discovery. Again, he is told that $T=2\pi\sqrt{\frac{l}{g}}$, and is asked if g can be computed provided T and l are known. The experiments on the spectrum are unsatisfactory. The student is supposed to be able to distinguish between continuous and line spectra, using a slit $\frac{1}{8}$ in. wide and *no lens system*.

(3) This book is quite an unusual one, and deals with a most interesting subject. It is primarily designed for those who contemplate taking up work in the varied fields of lens design, illuminating engineering, colorimetry, photography, radiometry, pyrometry, etc. A training in theoretical optics is assumed, and only those possessing this will thoroughly appreciate the book in all its detail. A great deal of information is compressed into a small volume, and the suddenness with which the subjects change on this account is rather embarrassing to the reader. This is particularly the case with the introduction, where a general description of the results of investigations in light is crowded into twenty-five pages. Nevertheless the book is a considerable step forward, and may be regarded as a sort of forerunner to a more pretentious treatise, which the author hopes will presently be produced.

(4) This is a class-book upon the same lines as the author's "Elements of Mechanics." It treats in quite an elementary fashion of the fundamental principles of the statics of liquids and gases. Applications to the determinations of specific gravities are given, and various forms of apparatus depending on the principles are described. Numerous examples, taken from university examination papers, are appended to the chapters.

(5) This book is also quite elementary in character, and includes all that is required for the Junior Local Examinations. The author claims to discourage the use of mathematical formulæ, yet they appear to occur quite as frequently in this book as in others of the same type. It is true, however, that many numerical examples of the application of the formulæ are given.

FOOD AND HYGIENE.

(1) *The Science of Hygiene.* A Text-book of Laboratory Practice for Public Health Students. By Walter C. C. Pakes. New edition, revised by Dr. A. T. Nankivell. Pp. xi+164. (London: Methuen and Co., Ltd., 1912.) Price 5*s.* net.

(2) *Text-book of Hygiene for Teachers.* By Dr. R. A. Lyster. Pp. viii+496. (London: W. B. Clive, University Tutorial Press, Ltd., 1912.) Price 4*s.* 6*d.*

(3) *Experimental Domestic Science.* By R. Henry Jones. (Heinemann's Science Manuals.) Pp. ix+235. (London: W. Heinemann, 1912.) Price 2*s.* 6*d.*

(1) THIS book consists of the chemical and microscopical sections of the 1900 edition, revised and extended. It is intended for

public health students, and deals with the analysis of water, foods, beverages, soil, air, and disinfectants, with chapters on microscopy and meat inspection. The directions are clear and concise, and adapted for the examination for the diploma. The reactions are shortly explained, and examples of calculation given.

Several errors in the 1900 edition appear again, *e.g.* iron alum is given as $(NH_4)_2Fe_2(SO_4)_46H_2O$. On page 63 NO_2 should be N_2O_3, and on page 134 a drawing of manilla hemp (*Musa textilis*) is given under a description of ordinary hemp (*Cannabis sativa*). One might mention that ashing is not necessary for the detection of boracic acid in milk, and that the addition of potassium permanganate in the Kjeldahl process is neither necessary nor advisable. In spite of a few such errors and omissions of some modern processes, the book may be recommended as a useful laboratory companion for public health students.

(2) This book is divided into three parts, "The School," "The Scholar," and "The Medical Supervision of School Life." It deals with the subjects in a practical, common-sense manner on a physiological basis. There are chapters on elementary physiology, so that readers without previous physiological training may appreciate the reasons for the hygienic conditions demanded.

The important subject of ventilation is well treated, the standard demanded high, but not impossible. In the chapter on foods and digestion it is a relief to note that food-testing has not been included, as is so often done in books on hygiene with unsatisfactory results. In this chapter, however, fats are wrongly described as hydrocarbons, and ptyalin is said to convert starch into grape sugar instead of malt sugar. The book is readable, and may be recommended to teachers and others as a practical and useful text-book.

(3) Almost the first of its kind, this book deals mainly with experimental work in foodstuffs, and is intended for use in domestic science schools. The aim is admirable, and much of the book is excellent, but in attempting simplicity experiments are described and results stated that will tend to perpetuate just the types of error and inaccuracy that are already too prevalent. On page 20 the author appears satisfied with results that vary from 12 per cent. to 25 per cent. The conclusion arrived at from another experiment is that cream has the same specific gravity as water. It is difficult to say how far we are justified in simplifying experiments at a sacrifice of accuracy and truth, especially for those who are not in a position to examine the results critically.

A number of errors occur, *e.g.* the boiling of milk several times is described as pasteurisation. We are told that the tannin of coffee precipitates gelatine, and that potassium palmitate and stearate are soft soaps. In a book written for students who have little or no training in science, accuracy and caution in interpreting results are most important. However, the book contains many good suggestions for this kind of work.

OUR BOOKSHELF.

The Effects of Errors in Surveying. By Henry Briggs. Pp. xi+179. (London: Charles Griffin and Co., Ltd., 1912.) Price 5*s.* net. (Griffin's Scientific Text-books.)

THE author of this volume directs attention to the inadequate treatment of errors in surveying as compared with astronomical, physical, or chemical research, and offers the present work as a discussion of the subject from the special point of view of the surveyor. His contention is perfectly valid, and the cause of this neglect may be traced to the very small amount of instruction in the highest grades of surveying which is given in this country. The analysis of error forms an introductory chapter, and in it the average error has been selected for use in the book as being simpler and more convenient, though we are inclined to doubt whether the advantage of the mean error in giving greater weight to the large errors in a series is advisedly abandoned. The best shape of triangles, the propagation of errors in traversing, with especial reference to mining surveys, and in triangulation, occupy most of the volume.

The book is clearly written, and will lead to an improvement in the work of surveyors if it brings home to them the desirability, as well as the economical advantage, of systematically determining the errors of the methods which they adopt, as well as of the observations which they make. An equally desirable result would be the incorporation in all manuals of surveying of a consideration of the errors to be anticipated in all surveying operations, both in the simpler kinds and in the more advanced; for this should be as normal a feature of such works in this country as it is on the Continent. This same mathematical determination of errors should also find a regular place in the compilation of maps and plans as a control upon the empirical methods which are too exclusively employed at the present time.

H. G. L.

Der Mythus von der Sintflut. Von Georg Gerland. Pp. vi+124. (Bonn: A. Marcus und E. Weber's Verlag, 1912.) Price 3 marks.

IN this little work Prof. Georg Gerland has published an interesting study, on comparative lines, of the different deluge-myths which occur in the traditions of many races all the world over. He first gives an outline of the various forms under which the legend is encountered, arranging his material on a geographical basis. As is natural, he begins the series with the "Western-Asiatic-Semitic" accounts, analysing the Biblical narratives and indicating the extent of their depend-

ence on the Babylonian versions. He then turns to Africa and shows how not only the ancient Egyptians but also various modern races in that continent possess traditions of a similar character. In subsequent sections he continues his survey of beliefs for which evidence has been forthcoming in Australia, Melanesia and Polynesia, the Malay States, the peoples of Central and East Asia, North and South America, and the Indo-Germanic races. And he points out the remarkable recurrence of the story or myth of a sudden and destructive deluge. This nearly universal tradition he would not explain as a single original legend which has spread over the whole world, any more than he would trace it to an actual flood or deluge. The explanation he puts forward is that the deluge story in its numerous variations is a mythological presentment of celestial phenomena, reflecting the clouding over of the bright heavens by heavy rain-clouds, the differing details of the various forms of the legend being projected in accordance with the universal laws of anthropomorphic symbolism. It is the fashion at present in Germany to explain most mythologies by an astral system of interpretation, and Prof. Gerland's conclusions will be welcomed by adherents of the astral school. The weakness of all such theories is that the astrological myth is a product, not of primitive races, but of peoples that have attained a comparatively cultured and reflective stage of thought; and to explain a primitive myth by astrological theory is really to put the cart before the horse. But Prof. Gerland states his case in a remarkably able and persuasive manner, and the book embodies a valuable survey over an extremely wide range of study. L. W. K.

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 Effects of Friction in a Vacuum on Thorium Oxide.

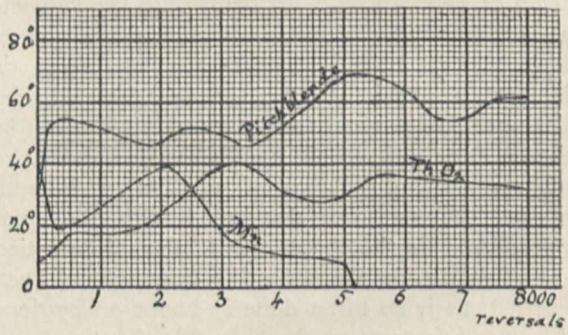
FOR two years past I have been experimenting on the action of sand, powdered beryl, and other substances within vacuum tubes of soft, fairly conducting soda glass, and I have obtained interesting results respecting the outflow of electrons when the tubes are insulated by sulphur blocks and worked on a rocker. The electrodes and a belt of tinfoil on the outside are connected by thin wires to three electroscopes with graduated scales, and the potentials at various stages of the experiments are found to fall gradually, in the case of sand, from a height symbolised by readings of 60° or more down to zero after some thousands of rockings, and this without any visible effect on the glass. The electrons are swept away and the tubes become absolutely dead. The passage of a current from an induction coil through them accelerates the sweeping process, and rest, even for a year, does not revive their action.

The case is essentially different from that of mercury in quartz. The nature of the glass renders each tube a form of closed conductor. It contains no insulated charge, but develops electricity within itself, shows flashes in the dark, and maintains an outflow for many hours.

Recently, however, I have tried the substitution of pitchblende, thorium oxide, black oxide of uranium, and other metallic oxides for sand, testing signs, recording results, and earthing the electroscopes at the end of each 100 reversals.

As the total amount of activity is a principal point, I have added together, for the purposes of the curves, the readings of the two electrodes irrespective of sign; but I deal with signs in noting the behaviour of the substances. As control experiments, I made fresh tubes (like the others, 47 cm. long and 1·2 cm. internal diameter) containing barium peroxide and manganese dioxide. The former, after momentary action, ceased to show any effect whatever; the latter, acting very much like sand, reached a maximum of 40° (one electrode giving +28°, the other −12°), and then, falling away rather sharply, became absolutely dead after 5200 reversals. The uranium oxide (U_3O_4) acted very feebly, only reaching a maximum of +7°; but it continued during 3000 reversals to indicate that the inside of the tube was positively charged.

The thorium behaved very remarkably. Rising during the first 100 rockings only to +10°, the readings grew gradually higher. During the first 2500 reversals one electrode had shown a minute negative charge, the other a fast-growing positive charge; but at that point the whole interior became positive, and so remained, the readings going up to +40°. The



curve, drawn from readings taken on cessation of rocking, does not convey a due impression of the vigour of the action, or of its promise to continue unabated for an indefinite time; but we see in it a rise from inertness to strong electrification, and while we must, perhaps, look for a substratum of glass action, we know from sand and manganese and from barium peroxide that this either weakens and ceases altogether or does not occur at all. The thorium oxide is, of course, far from being a simple combination of thorium and oxygen. Radio-thorium, thorium X, and an emanation would alone complicate its action, and the constant movement in the tube would diminish the suppression of the positively charged α particles by the upper layers of the oxide, but the total of these effects is small. The sum of the radio-active powers of the thorium when at rest is so very limited that it is hard for one who has witnessed its vigorous action in a tube, and the strong positive charge developed, to keep from believing that friction in a vacuum has done that which no chemical process can effect.

This impression of a mechanically-produced increase of radio-activity was much strengthened by the behaviour of pitchblende in very fine powder. From the first moment the action was vigorous, and after a few hundred rockings the whole interior of the tube became negative and so remained. The readings rose quickly to a level much above the thorium figures, and then, after about 4000 reversals, made a yet greater upward start, which was maintained with an

obvious promise of continuance, until I was compelled to stop work. This curve also gives a poor impression of the great strength of the action. The β-rays seem to have had the upper hand in the case of pitchblende, just as the α particles had in that of thorium.

As an amateur I do not feel able to take the matter beyond this point. Accurate laboratory methods with the help of qualified assistants might give important results. RICHARD HOWLETT.

Park House, Walton-on-Thames, August 1.

Aged Sea Anemones.

IN 1904 Dr. J. R. Ashworth and I published in the Proceedings of the Royal Society of Edinburgh (vol. xxv., p. 1) observations on aged individuals of *Sagartia troglodytes* then and still in the possession of Miss Jessie Nelson in Edinburgh. After eight years these anemones are still in excellent health, having been in captivity for considerably more than half a century. In one respect I fear that we did them an injustice, namely in attributing cannibalism to them, the error being probably due to the observation of the birth of young from a parent the tentacles of which were not fully expanded. Recently I chanced to notice a young Sagartia attached to a small piece of seaweed floating free in the aquarium. A slight agitation of the water was sufficient to bring the young anemone in contact with the tentacles of one of the patriarchs of its own species. They immediately closed round it and a small part of the disk became emarginate. The greater part, however, was not sensibly affected, and the mouth remained closed. In less than two minutes the folded-in tentacles uncurled and the young anemone was thrust away with some force. It then came in contact with the tentacles of a second old Sagartia, and exactly the same thing occurred. Neither the young one nor the tentacles that had held it were apparently affected in any way. Immediately after the first old Sagartia had released the young one, I dropped on its tentacles, in the region which had temporarily been affected by contact with the latter, the body of a small isopod. The isopod was seized in exactly the same manner that the young anemone had been seized, but the movements soon spread to other tentacles, the mouth gaped open, and the isopod was swallowed. In other individuals of the same species I have noticed that small masses of food, such as this little isopod, remain apparently unobserved if dropped gently on to the disk within the tentacles without touching them, but that if the tentacles are then touched and in the movements that ensue come in contact with the food lying neglected on the disk, its presence is apparently realised and it is swallowed. N. ANNANDALE.

1 Marchhall Crescent, Edinburgh, July 30.

On the Nature of Stromatoporoids.

IN a letter to NATURE (July 18, p. 502) I stated that the Palæozoic Monticuliporas were siliceous sponges with a supplementary calcareous skeleton.

An examination of the Stromatoporoids—classed in the standard text-books (Zittel, Geikie, Steinmann) under Hydrozoa and Polyzoa—has led me to the conclusion that these fossils also are siliceous sponges. For I have found, both in the Hydractinioid and Milleporoid groups of Stromatoporoids, siliceous spicules of a kind related to, but not identical with, those of Merlia and Monticulipora. Frequently it is difficult to find the spicules, and it is not surprising that they have hitherto escaped observation. They are mostly microscleres of the sigma type, and require a magnification of about 1000 diameters to see clearly. Some care is necessary not to mistake edges of flakes of calcite for spicules.

The "Caunopora" tubes, at least those which I have examined in several typical Stromatoporoids, are not corals, as generally supposed, but tubes of a Chætopod worm. The supposed tabulæ are merely an expression of the segmentation of the Annelid. In some instances the worm is fairly well preserved, and the acicula abundant.

To return to Monticulipora, I find that some typical species of Favosites, Chætetes, and Rhaphidopora are siliceous sponges with supplementary calcareous skeletons of the Monticulipora type.

R. KIRKPATRICK.

British Museum (Natural History).

The Earthquake in Turkey on August 9.

THE recent earthquake, reported as felt in Constantinople, and as very destructive near the Sea of Marmora, has left its mark on the photographic traces of our unifilar and bifilar magnetographs, but not on the vertical force balance; and, contrary to expectation, the disturbance is more pronounced on the unifilar than on the bifilar curve. The Milne seismograph failed to record the time of the maximum disturbance otherwise than that it occurred either between 1.44 and 1.45 or between 1.47 and 1.50 a.m. on August 9, during which intervals the oscillations of the boom overstepped the recording limits. The time as registered on the magnetograms is 1.45 a.m., and this, as the true time of greatest earth oscillation, would lead us to expect an origin nearer to us than the Sea of Marmora.

W. SIDGREAVES.

Stonyhurst College Observatory, Blackburn.

A Flower Sanctuary.

I AM afraid that Sir Herbert Maxwell's suggestion that the plants of Cheddar pink offered for sale had been raised from seed cannot be accepted.

The Thalictrum referred to is *Thalictrum minus*, which is still abundant in the Gorge. As regards the Welsh poppy, it is good to know that this beautiful plant has increased its range; but, if by evil chance some dealer should exterminate it at Cheddar, visitors who love to see it growing there would derive small comfort from the knowledge that it continued to flourish in many other places. I hope that the appeal to "proclaim" these Cheddar plants will not fall on deaf ears. FRANK H. PERRYCOSTE.

Higher Shute Cottage, Polperro, Cornwall, August 10.

Striated Flints from the Chalky Boulder Clay.

FOR some time past I have been examining flints from the Chalky Boulder Clay of Suffolk, and have been struck by the almost entire absence of striæ upon them.

When striæ are present to any noticeable degree they are generally developed on the comparatively soft cortex of the flints, while where the stones have been broken and the hard interior exposed the scratches are not to be seen.

This appears to me to point to the conclusion that the glacial action which is held to have been the cause of the Boulder Clay and the striations on the flints could not have been of a very intense order, and therefore very different from that obtaining at some period prior to the deposition of the Suffolk Red Crag, the stones found at the base of this deposit often exhibiting the most definite and deep striæ *all over their flaked surfaces*.

Also I find in the Chalky Boulder Clay stones which show a small "island" of striated cortex left in the centre of a flaked surface, and this flaked surface is

sometimes not only unscratched, *but patinated or weathered.*

The patination is of the kind which is now to be seen on flints on the present land surface, and is generally, and I think rightly, supposed to have been caused by the slow action of various solvents present on that surface.

Thus it appears probable that these stones from the Boulder Clay were first scratched, then broken, and left lying on a land surface sufficiently long to be patinated, and finally incorporated with the clay.

It is also apparent that if marked striations on flints are a sign of intense glaciation, then those found at the base of the Red Crag must have been at some period subjected to a much greater degree of ice-action than was present when the Boulder Clay was being formed. J. REID MOIR.

12 St. Edmund's Road, Ipswich, July 30.

On the Sign of the Newtonian Potential.

PROF. LAMB, in the second edition of his "Hydrodynamics," made a change in the sign of the velocity-potential. Would it not be an advantage to change the sign of the Newtonian or gravitational potential also?

If this were done, the relation connecting field and potential ($F=-dv/ds$) would be true for gravitation as well as for electricity, and potential would always be potential energy divided by mass (or charge). Of course, there would be the disadvantage that the analytical definition $\gamma\Sigma\frac{m}{r}$ would have to be altered to $-\gamma\Sigma\frac{m}{r}$, which would conflict with the corresponding expression $\Sigma\frac{e}{r}$ for the electrical potential. Poisson's equation would also have to suffer a change of sign. However, it might be worth while to bring the physical definitions into agreement even at the cost of these analytical inconveniences. At present it sometimes happens that students are confronted with two irreconcilable definitions, one from the mathematical, the other from the physical, lecturer. The result is that they are never sure whether a plus or minus is to be used in any given case.

H. PIAGGIO.

University College, Nottingham, August 1.

A Point in Geological Nomenclature.

IN his review of Prof. Haug's "Traité de Géologie" (II.) in NATURE of August 1, J. W. G. asks the question: "Should it [the 'Quaternary'] not be Quartary?" He will perhaps be glad to be reminded of the fact that, so long ago as 1887, Prof. Hermann Credner, of Leipzig, used the term *das Quartär* (in linguistic consonance with *das Tertiär*) in the 6th edition of his well-known and invaluable text-book, and has retained it in the 10th edition (1906), breaking it up into (*a*) *Diluvium* (=Pleistocene) and (*b*) *Alluvium*, a most convenient division. A. IRVING.

Bishop's Stortford, August 3.

A Reversible Photochemical Reaction.

IN the preparation of some tungsten compounds I obtained a by-product which is reduced on exposure to sunlight, the reduction being marked by a change of colour and being accelerated by reducing agents. In the dark, in contact with the atmosphere, the original colour is gradually restored. The same effect is brought about instantaneously by oxidising agents. Will readers of NATURE who are acquainted with reactions of a similar type kindly inform me of publications on the subject? M. RINDL.

Grey University College, Bloemfontein, July 8.

NATURE AND MAN IN AUSTRALIA.[1]

PROF. BALDWIN SPENCER and Mr. Gillen are honoured by all ethnologists as the authors of two notable books on the tribes of Central Australia which afforded us more detailed information about the peoples they visited than had previously been given concerning any other Australian tribes, and at the same time gave rise to more discussion than has befallen any other records of savage men. Their last book is, from one point of view, a supplement to their earlier works, and from another it may be regarded as an independent record of a more general and popular character. "Across Australia" is not, like its forerunners, a monographic study of certain tribes, but, as its name implies, is a running commentary, so to speak, of a transverse section through the continent explained by two keen and experienced naturalists, one of whom has spent many years in the heart of the continent and had wandered hither and thither. The present account, therefore, is not the description of a single expedition, but combines the experiences of several journeyings, except so far as the most northerly third of their route is concerned.

The broad geographical features of Central Australia are clearly explained; the authors evidently incline to the view that a general desiccation, which dates from the Pleistocene period, is still taking place. The desert and poor steppe conditions and their bionomics are well described and illustrated; Fig. 19, with the mesas in the background, might very well be a photograph of a typical scene in New Mexico, except that the scattered clumps of vegetation are not sage brush. The characteristic plants of the several geographical areas are described, and attention is directed to a change of flora or fauna during the passage from south to north.

The keynote of the greater part of Australia is drought, and our authors give abundant evidence to show how all living things have to accommodate themselves to variable periods of greater or less desiccation alternated by copious rains and even floods, which subside and disappear with great rapidity. The inexorable necessity is laid upon plants and animals to take the utmost advantage of the very transient humid conditions, and to protect themselves as best they may against drought. The aquatic animals especially have adapted themselves to these variable conditions: very remarkable in this respect are several species of frogs belonging to three genera, which fill themselves, more particularly their bladder, with water till they become spherical, then burrow a foot or so in the mud, and thus tide over a year or eighteen months of drought. "The water is quite pure and fresh, and the natives take advantage of this supply when they cannot otherwise secure any." Water-beetles, snails, and other aquatic animals also æstivate, and their young have to mature quickly in order to take advantage of the

[1] "Across Australia." By Prof. Baldwin Spencer, C.M.G., F.R.S., and F. J. Gillen. Vol. I. Pp. xv+254+plates. Vol. II. Pp. xviii+255—515 +plates+maps. (London: Macmillan and Co., Ltd., 1912.) Price 21*s.* net.

wet spell, otherwise they perish. The temporary pools swarm with small crustaceans, some "which are closely allied to one another have red blood and others have not. For example, the various species of Limnadopsis and Limnetis are quite colourless, whilst their close allies, *Estheria lutraria* and *E. packardi*, have red blood. Whether it be connected with this fact or not, it is interesting to notice that the Estherias seem to be able to live longer than the colourless forms. . . . Speaking generally, the smaller the animal is, the more abundantly you find it."

FIG. 1.—Ceremony of Alkira-Kiuma, Arunta tribe. Throwing the novice up into the air. From "Across Australia."

Among other Australian anomalies is the finding of a true crab in the dry steppe lands of Central Australia. "It is apparently the same form, *Thelphusa transversa*, which has been recorded from Cape York in the north-east of Australia, and its presence in the centre of the continent points back to a time when there was a great inland sea. The crab has evidently been left behind, and has adapted itself, not only to fresh-water life, but to conditions which would, at first sight, appear almost fatal to crab life." In arid parts of Mexico and Colorado the honey ant stores up honey in its body so that the abdomen becomes spherical; so does the *Melophorus inflatus* of Central Australia; our authors discovered two species (*M. cowlei* and *M. midas*) in which the abdomen is not so swollen: "evidently these two are not so fully specialised in this respect." There are many other notes on the habits of animals which should not be overlooked by zoologists.

Those who are interested in the doings of natives will find first-hand accounts of the tribes met in the south-to-north traverse, the matrilineal Urabunna, the patrilineal Arunta, Kaitish, Unmatjera, Warramunga, Tjingilli, Umbaia, and Binbinga, and the Anula and Mara coastal tribes of the Gulf of Carpentaria, whose social organisation is somewhat different from that of the preceding tribes. The accounts of the sociology, customs, ceremonies, and beliefs of these tribes are sufficient to give the reader a very good idea of the effect of geographical control over a people, the stage of culture arrived at by an isolated savage community, and the local variations that occur. From these points of view it forms an admirable introduction to the study of the Australian natives, but of these the authors' previous books have already treated with greater detail. Every serious student of ethnology is acquainted with these books, and hence will find nothing new to him with regard to his special studies, but at the same time he should read the book so as to gain a more coherent conception of the conditions of existence in the central band of Australia, and to pick up scattered information concerning the utilisation of the plants and animals by the aborigines. The volumes are extremely well illustrated; all the figures and plates, except a few chiefly giving views of scenery, have, however, been previously published. The book is written in an interesting manner, and deserves a large sale.

A. C. HADDON.

FIG. 2.—Performance of a sacred ceremony of the sun totem, Arunta tribe. From "Across Australia."

THE SECOND INTERNATIONAL CONGRESS OF ENTOMOLOGY.

THE idea of an International Congress of Entomology originated at Tring, and it was on the initiative of Dr. Karl Jordan, curator of the Hon. Walter Rothschild's Zoological Museum, that a small number of entomologists, representing France, Belgium, Germany, and the United Kingdom, met at Burlington House during the spring of 1909 to consider details. At this meeting, which was presided over by the then president of the Entomological Society of London (Dr. F. A. Dixey, F.R.S.), it was arranged that the first congress should take place at Brussels, in August, 1910. The congress at Brussels proved to be very successful, and, before separating, its members decided that the second international congress should be held at Oxford in 1912, under the presidency of Prof. Poulton, F.R.S., Hope Professor of Zoology in the University.

The congress at Oxford has just terminated after a week which has been marked by papers and discussions of high value and interest, and the social side of which has only been marred by the extremely unfavourable conditions of weather. The attendance was larger than at Brussels, and included representative entomologists from France, Germany, Austria, Belgium, Spain, Turkey, Switzerland, the Netherlands, Hungary, Luxembourg, Sweden, Egypt, Chile, the United States, the Sandwich Islands, Canada, Borneo, and British East Africa, besides a large number from Great Britain and Ireland. The gathering was thus thoroughly representative, and, not only by the worldwide area from which its constituents were drawn, but also by the varied nature of the communications presented to it, the congress may claim to have rendered universal service over the whole field of entomology.

The formal proceedings of the congress opened on August 5 with an address of welcome by the president, Prof. Poulton. He pointed out the special advantages of Oxford as a meeting-ground for entomologists of all nations, alluding to the scientific traditions and historical interest attaching to the University and to those colleges (Merton, New College, and Wadham) which were affording special hospitality to the members of the congress. After giving a brief sketch of the history of the Hope Department and Professorship, and paying a graceful tribute to the industry and learning of his predecessor in the Hope Chair, the late Prof. Westwood, he exhibited and explained an extensive series of bred and captured specimens of the wonderful African Papilio, *P. dardanus*, tracing its geographical modifications across the continent from east to west and from north to south, and illustrating the gradual development of mimicry by the female, the polymorphism of the same sex, and the proportions of the different mimicking forms resulting from the eggs laid by a single parent.

After the president's address much interest was aroused by the Hon. N. C. Rothschild's paper on "Nature Reserves." The principle of the formation of such reserves, where the native flora and fauna may be allowed to flourish undisturbed, scarcely needs advocacy before any assembly of naturalists; but the congress was much gratified to hear from Mr. Rothschild that a society for the promotion of reserves was in course of formation, and would shortly issue its prospectus. This gives promise of effective practical measures. The remainder of August 5, and the greater part of the four succeeding days, were devoted to meetings both general and sectional, the latter dealing with such subjects as economic and pathological entomology; insect systematics and distribution; evolution, bionomics, and mimicry; nomenclature; morphology and anatomy.

In the first of these much attention was given to a paper by Sir Daniel Morris on behalf of W. A. Ballou on "Some Entomological Problems in the West Indies." The importance from the economic point of view of an accurate knowledge of the life-history of insect pests was clearly shown, and a hopeful account was given of the control of some of these pests by the introduction of their natural enemies. In view of present conditions, the question of the devastation of crops by insect agency is to some extent a problem of international politics. This point was well brought out in a paper by Mr. A. G. L. Rogers, a delegate from the Board of Agriculture and Fisheries. Mr. Rogers showed that in some cases of well-meant interference, more harm than good had resulted; international trade had been checked, while the pest which it was desired to exclude had broken the barrier. More systematic study of the conditions was necessary, and the proposal of an international commission to be formed in connection with the International Agricultural Institute at Rome was approved by the congress. Valuable contributions to the subject were made by Profs. Jablonowski (Budapest), F. V. Theobald (Wye), S. A. Forbes (Nebraska), and others.

The thorny subject of nomenclature gave rise to some animated discussion. An eloquent appeal was made by the veteran French entomologist, Charles Oberthür, in favour of the accompanying of every description of a new species by a figure. "Pas de bonne figure à l'appui d'une description, pas de nom valable," was the aphorism by which he announced his communication. A formidable attack on the position was delivered by Mr. L. B. Prout; and, in spite of the respect which M. Oberthür's great authority and persuasive speech commanded, it was evident that his proposal was regarded by the majority as impracticable. Dr. Horn, of Berlin, appeared as an advocate of the strict application of the law of priority, and further contributions were offered by Captain Kerremans (Brussels) and Dr. E. Olivier (Moulins). The outcome of the whole of these sectional proceedings on nomenclature

was the adoption at a general meeting of the congress of a resolution appointing an international committee of entomologists to collect the opinions of national committees, and to bring themselves into relation with the existing international committee on zoological nomenclature.

The subject of bionomics called forth some interesting communications. Among these were Prof. Poulton's demonstration of the remarkable mimetic phenomena exhibited by the forest butterflies of Uganda; and Dr. R. C. L. Perkins's series of colour groups in Hawaian wasps, showing the influence of a well-protected intruder upon the superficial aspect of members of the native fauna. The Rev. K. St. A. Rogers contributed an interesting paper on mimicry in an East African Lycænid; Messrs. Donisthorpe and Crawley gave a good account of the founding of colonies by ants; and Prof. W. M. Wheeler, of Harvard, criticised in a convincing manner the symbiotic interpretation of the association of leaf-cutting ants with acacia trees in Central America. An ingenious explanation of the mimetic polymorphism of *Papilio polytes*, founded on the breeding experiments of Mr. J. C. Fryer, was brought forward by Prof. R. C. Punnett, F.R.S., and evidence of the capture of butterflies by insectivorous birds formed the subject of a communication from Mr. C. F. Swynnerton, laid before the section by Prof. Poulton. Some excellent photographs from nature of butterflies in their resting attitudes were shown by Mr. A. H. Hamm, of the Hope Department.

Space will not allow of more than a bare mention of the sectional proceedings in the sections of morphology, systematics, and distribution, but among many papers of high interest may be specially enumerated those of Prof. H. J. Kolbe (Berlin) on the zoogeographical elements of continents; Prof. G. H. Carpenter (Dublin) on the Maxillulæ in beetle larvæ; Dr. G. Horváth (Budapest), Padre L. Navas (Barcelona), and Dr. F. A. Dixey (Oxford) on features in the wings of insects; of Dr. T. A. Chapman (Reigate) on regeneration in *L. dispar*; of Baron K. von Rosen (Munich) on fossil Termites; of Dr. P. Speiser (Labes) on geographical distribution and variation in certain insects; of Dr. P. Calvert (Philadelphia) on the Odonata; and of Mr. R. S. Bagnall (Oxford) on the Thysanoptera.

Among the papers read before general meetings were two of exceptional interest. One of these, by Dr. Adalbert Seitz, of Darmstadt, embodied the results of some experiments on insect vision, giving much evidence of the large part played by the sense of sight in the mutual recognition between the sexes. The other, by Prof. V. L. Kellogg, of Stanford University, U.S.A., brought forward some striking facts as to the distribution of the species of Mallophaga, many of these, according to the author, having become associated with their present hosts before the differentiation of the latter into separate species. Among other noteworthy communications made in general meetings of the entire congress were papers by Rev. G. Wheeler (London) and Mr. G. T. Bethune-Baker (Birmingham) on nomenclature; by Prof. J. H. Comstock (Ithaca, U.S.A.) on the silk of spiders; Prof. J. Van Bemmelen (Gröningen) on the development of the butterfly wing; Mr. J. W. Taylor on distribution; Mr. L. Doncaster (Cambridge) on sex-limited inheritance; Dr. Handlirsch (Vienna) on distribution; and Mr. S. A. Neave on his travels in East and Central Africa.

An exhibition of Acræine butterflies was specially arranged by Mr. H. Eltringham, to whose exertions as one of the local secretaries the success of the congress is largely due; and of Pierine butterflies by Dr. F. A. Dixey. The members of the congress were hospitably entertained on August 7 at Nuneham by the Rt. Hon. L. V. Harcourt, M.P., Secretary of State for the Colonies, and by St. John's College at Bagley Wood. On August 9 they met, to the number of nearly 150, at a banquet in the hall of Wadham College; and on August 10 they were received by the Hon. W. Rothschild, F.R.S., at Tring, spending there a most enjoyable and profitable day. The next congress will be held at Vienna in 1915, under the presidency of Prof. Anton Handlirsch.

ARTIFICIAL DAYLIGHT.

A NUMBER of researches has recently been made on the imitation of daylight by artificial means. There are many industries, such as dyeing, carpet manufacture, coloured silk, &c., to which an artificial illuminant which resembled normal daylight exactly would be very serviceable. In some cases, where very fine discrimination between delicate shades of colour is necessary, the work is practically brought to a standstill as soon as artificial light has to be used. In the same way a standard artificial daylight would be of considerable value to florists, drapers, &c., and might enable artists to work in the evening with the same facility as by day.

Practically all the present illuminants differ considerably from daylight in colour, usually having an excess of red and a deficiency in blue. Mr. T. E. Ritchie, in a recent paper before the Illuminating Engineering Society in London,[1] contended that the inverted arc gave the closest approximation, being apparently preferable to ordinary direct arc lighting. The reason for this seems to lie in the fact that reflection from a diffusing white ceiling tends to suppress the excess of blue-violet. In the United States the Moore vapour tube, in which carbon dioxide is subjected to a high tension electric discharge, is said to give a white light almost identical with daylight, and, indeed, to be more constant than climatic variations allow daylight to be. The carbon dioxide Moore tube seems to have been largely used in silk mills and elsewhere in the United States, but it requires an alternating current and a special form of in-

[1] *Illuminating Engineer* (London), February, 1912.

stallation, and does not appear yet to have been very much used over here.

In order to be really valuable, the resemblance to daylight should be very exact. Various special screens have been used with enclosed arc lamps as "daylight lamps," but the difficulties in securing a permanent and trustworthy screen are considerable. One method consists in selecting and superimposing suitable blue and green glasses, but it is generally recognised that to imitate the spectrum of natural light with precision a gelatine screen must be included. A method that has recently been described by R. B. Hussey,[2] in the United States, is to mount the coloured glasses side by side and to place underneath a diffusing glass screen, which serves to mix the components into an approximate white light. A similar device has been used by C. H. Sharp and P. S. Millar in an emergency in order to secure an approximate result at a florists' exhibition.[2] Ives and Luckiesh have concentrated their efforts on the invention of a form of screen which can be applied with a tungsten incandescent lamp, and thus conveniently used on an ordinary lighting circuit. They found it necessary to use both cobalt blue and signal green glasses and a special gelatine filter, and appear to have obtained very successful results.

The most recent achievement in this directon is that of Dr. Kenneth Mees, described before a meeting of the Illuminating Engineering Society in London this year. By a combination of gelatines, involving the use of a newly discovered blue dye, he states that a very perfect resemblance to daylight is secured, and that the results are remarkably permanent. The absorption of light is naturally considerable (amounting to about 85 per cent.), but for the special work for which this lamp is intended such a loss in efficiency is not of very great consequence in comparison with the advantage of being able to extend the hours of work after daylight has ceased.

It is not suggested that lamps of this kind would come into general use as a substitute for artificial illuminants of the ordinary kind. Indeed, the impression is that people rather prefer the more golden hue of artificial light in the evening. This hue has become mentally associated with comfort, and possibly it serves to carry out the sequence of tone from daylight to the warmer tones of sunset. The idea is rather to use these artificial daylight units for special purposes. For example, it would doubtless be of value in a drapers' establishment to have a small recess illuminated in this way, so that customers, in choosing materials, would be able to compare their colours under this light with their appearance by the ordinary artificial illuminants.

There is one question that has an important bearing on these problems, namely, the difficulty in deciding on a standard white light. The researches of Dr. Nichols at Cornell University have shown that the spectrum of daylight varies considerably with different climatic conditions and at different altitudes. In a town especially, where periodical fogs give the transmitted light a more ruddy character, this is so. But in the country it appears that throughout the greater part of the day the quality of light from a white sky does not vary very greatly, and delicate colour-work would usually be done under these conditions.

[2] Trans. Amer. Illum. Engin. Soc., February, 1912.

THE DUNDEE MEETING OF THE BRITISH ASSOCIATION.

THE following is a list of the American, colonial and foreign guests who up to the present date have accepted invitations to attend the forthcoming meeting of the British Association at Dundee. It will be seen that the number is unusually large, and indicates a gathering of scientific men from abroad far beyond anything that has taken place at recent meetings of the Association.

Prof. Aganassief, St. Petersburg; Prof. Allardice, Leland Stanford; Prof. Frank Allen, Winnipeg; Prof. Raoul Anthony, Paris; Prof. Leon Asher, Bern; Dr. Baglioni, Rome; Prof. Ch. Barrois, Lille; Dr. Becker, Brussels; Prof. J. J. Borgmann, St. Petersburg; Prof. Dr. Botazzi, Naples; Dr. Burgli, Bern; Prof. Burton-Opitz, New York; Prof. Irvine Cameron, Toronto; Prof. D. H. Campbell, California; Prof. C. Chilton, Christchurch, New Zealand; Prof. Archibald Clark, Winnipeg; Prof. Franz Doflein, Freiburg; Dr. J. Drugmann, Brussels; Prof. Fano, Florence; Dr. G. W. Fields, Boston, Mass.; Prof. J. C. Fields, Toronto; Miss Alice Fletcher, Cambridge, Mass.; Prof. Dr. Max v. Frey, Würzburg; Dr. A. Gérardin, Nancy; Prof. A. Gerschun, St. Petersburg; Prof. E. Gley, Paris; Dr. Gotham, Berlin; Prof. Dr. Gottlieb, Heidelberg; M. Yves Guyot, Paris; Prof. F. Haber, Karlsruhe; Dr. W. H. Hale, New York; Prof. Hamburger, Groningen; Prof. Paul Hanus, Cambridge, Mass.; Prof. Emil Haug, Paris; Mr. C. Hedley, Sydney; Prof. Paul Heger, Brussels; Prof. S. E. Henschen, Stockholm; Prof. Dr. A. F. Holleman, Amsterdam; Mr. Hans Holzwarth, Mannheim; Prof. Hubrecht, Utrecht; Prof. Ida Hyde, Kansas; Prof. Ch. Julin, Liège; Prof. H. Jungersen, Copenhagen; Prof. H. Kayser, Bonn; Prof. F. Keibel, Freiburg; Prof. A. E. Kennelly, Cambridge, Mass.; Prof. Dr. A. Kossel, Heidelberg; Prof. Kölpin-Ravn, Copenhagen; Dr. Kramp, Copenhagen; Prof. Kronecker, Bern; Prof. Kuliabko, Tomsk; Prof. F. Lindemann, Munich; Prof. Lindmann, Stockholm; Dr. Otto Lipman, Berlin; Prof. Dr. Loewi, Graz; Dr. F. Löhnis, Leipzig; Prof. Maurice Lugeon, Lausanne; Prof. A. B. Macallum, F.R.S., Toronto; Prof. J. J. R. Macleod, Cleveland, Ohio; Prof. J. C. McLennan, Toronto; Prof. F. Mall, Baltimore; Prof. Gustav Mann, New Orleans; Prof. S. J. Meltzer, New York; Dr. Hans Meyer, Vienna; Prof. R. A. Millikan, U.S.A.; Prof. E. C. Moore, Yale; Mr. T. Mortensen, Copenhagen; Baron F. Nopsca, Hungary; Dr. C. H. Ostenfeld, Copenhagen; M. Paul Otlet, Brussels; Prof. Øyen, Christiania; Dr. Ove Paulsen, Copenhagen; Prof. C. A. Pekelharing, Utrecht; Dr. C. G. J. Petersen, Copenhagen; Prof. Maurice Philippson, Brussels; Prof. B. Osgood Pierce, Harvard; Prof. F. H. Pike, New York; Dr. A. Pütter, Bonn; Dr. Redeke, Helder; Dr. Reusch, Christiania; Prof. L. Rhümbler, Hann-Münden; Dr. Sahli, Bern; Prof. J. Schmidt, Copenhagen; Prof. J. W. Spencer, Washington; Dr. von Sustschinsky, Munich; Dr. Emil Tietze, Vienna; Dr. Th. Tschernyschew, St. Petersburg; Prof. Max Verworn, Bonn; Prof. Swale Vincent, Winnipeg;

Prof. Jules Walsch, Poitiers; and Prof. Webster, Worcester, Mass.

The University of St. Andrews will confer, on September 6, the honorary degree of LL.D. on the following guests of the association:—Prof. Charles Barrois, professor of geology in the University of Lille, the *doyen* of French geologists, and author of many well-known publications on the igneous and metamorphic rocks of Brittany; Prof. Fano, professor of physiology in the University of Florence, and editor of the *Archivio di Fisiologia*; Prof. E. Gley, professor of physiology in the Collège de France, and one of the editors of the *Journal de Physiologie et de Pathologie générale*; M. Yves Guyot, of Paris, the well-known writer on political and economic science, editor of the *Journal des Économistes*; Prof. H. J. Hamburger, professor of physiology in the University of Gröningen, distinguished for his researches on osmotic phenomena in relation to physiology, and for his studies of chemotaxis, phagocytosis, and absorption; Prof. Paul Heger, emeritus professor of physiology in the University of Brussels; Prof. Charles Julin, professor of zoology in the University of Liège, who is especially known for his many important investigations into the anatomy and embryology of the Ascidians; Prof. H. Jungersen, professor of zoology in the University of Copenhagen, and director of the Museum of Zoology, a leading authority on the comparative anatomy and classification of fishes; Prof. H. Kayser, professor of physics in the University of Bonn, the eminent authority on spectroscopy; Prof. A. Kossel, professor of physiology in the University of Heidelberg, and editor of the "Handbuch der Physiologischen Chemie"; Prof. Franz Keibel, professor of comparative embryology in the University of Freiburg; Prof. F. Lindemann, of Munich, the distinguished mathematician and philosopher; Prof. S. J. Meltzer, professor of physiology and pharmacology in the Rockefeller Institute, New York, and president of the American Physiological Society; Prof. Hans Meyer, professor of pharmacology in the University of Vienna, well known for his many writings on experimental pharmacology, and especially on the theory of narcosis; Dr. C. G. J. Petersen, of Copenhagen, a leading authority in all matters connected with the economic treatment and scientific study of fishery questions; Prof. Max Verworn, of Bonn, editor of the "Handbuch für Allgemeine Physiologie," and celebrated for his very numerous writings, both experimental and philosophical, on physiological and psychological subjects.

NOTES.

We regret to have to record the death of Prof. Forel, which, according to a Reuter message, took place at Morges on August 7, at seventy-one years of age.

We regret to notice the announcement of the death, at the age of fifty-nine years, of M. Lucien Lévy, president of the Mathematical Society of France in 1911.

The death is announced, at the age of eighty-three years, of Dr. T. L. Rogers, who, in 1883, was president of the psychological section of the meeting at Liverpool of the British Medical Association, and also was one of the promoters of the work of organising the London School of Tropical Medicine.

We notice with regret the announcement of the death, on August 7, in Tenerife, of Mr. R. H. M. Bosanquet, F.R.S., at seventy-one years of age. Mr. Bosanquet was elected a fellow of the Royal Society in 1890 for his work in various departments of physics—chiefly acoustics, light, and magnetism.

At the annual meeting of the German Geological Society, held at Greifswald on August 8, a Palæontological Society was founded. The organ of the new society, the *Palaeontologische Zeitschrift*, will be published by the house of Gebrüder Borntraeger, Berlin.

We learn from the *Revue Scientifique* that the late M. Osmond, the metallurgist, whose death was announced recently (see NATURE, July 4), bequeathed 4000*l.* to the Société de Secours des Amis der Sciences and 4000*l.* to the Société d'Encouragement pour l'industrie nationale.

An exhibition (which will remain open for twelve months) of appliances, fittings, materials, and products relating to sanatoria, tuberculosis dispensaries, and the treatment of tuberculosis will be opened on August 26 at the offices of the Society of Medical Officers of Health, 1 Upper Montague Street, Russell Square, W.C.

A Bill for the control of messages by wireless telegraphy has been passed by the United States House of Representatives, and is now to go to the President. The measure prescribes heavy penalties for interference with messages on the high seas, gives the Government control over inter-State wireless communication, and authorises the President to commandeer wireless stations in time of war.

A Reuter message from Constantinople states that an earthquake shock, lasting at least ten seconds, was felt there at 3.35 a.m. on August 9. The earthquake appears to have been more severely felt on the southern shores of the Sea of Marmora than in Constantinople. The centre of the disturbance seems to have been the region of the Dardanelles. It is reported that there is scarcely a building at Gallipoli or Tchanak which is undamaged, and that many people have been killed or injured.

The Departmental Committee on Boats and Davits appointed by the President of the Board of Trade to report as to the most efficient method of stowing, launching, and propelling ships' boats, will be glad if inventors and others who desire to submit inventions or schemes for their consideration will do so by October 1, 1912.

The seventy-third exhibition of the Royal Cornwall Polytechnic Society will be held at the Polytechnic Hall, Falmouth, Cornwall, on August 27–31 inclusive. Medals and prizes are offered in various departments, including fine arts, photography, mechanics, electrical appliances, ornamental art, natural history, mineralogy and chemistry, &c. Entries may be sent up to August 20. All communications should be addressed to Mr. E. W. Newton, secretary of the society, Camborne, Cornwall.

By the death, on July 16, of Alfred Fouillée, in his seventy-fifth year, a psychologist of much originality and independence of judgment passed

from us. Subsequent psychological investigation has been influenced in no small measure by the point of view which Fouillée worked out in his principal work, published in 1893, "La Psychologie des idées-forces"—the view, namely, that mental evolution proceeds by the interplay of ultimate or primordial *idées-forces*. An *idée-force*, as he conceived it, was a process at once sensory, emotional, and appetitive; the force inherent in all states of consciousness had, so he maintained, its essential ground in the inseparable union of discernment, which was the source of intelligence, and preference, which was the source of will. He emphasised the intimate connection of sensation with motor and appetitive factors, and used this principle as a key to some of the leading problems of psychology. His treatment of feeling-tone, of memory and its relation to conation and movement, of the perception of time, and of the growth of volition, is particularly penetrative and suggestive. Fouillée applied the conception of *idées-forces* to the philosophy of history and of law, and to the solution of ethical and sociological questions; and also made it the basis of a metaphysical monism, according to which mechanical movements are regarded as inseparable from ideas.

In part ii., vol. i., of *The Journal of Roman Studies* Prof. F. Haverfield contributes a valuable paper on Roman London. He remarks on Sir L. Gomme's recent work, "The Making of London," that "although it appears under the authority of a University Press," he is unable to accept many statements contained in it, such as the reference to various Celtic dwellings, to the *territorium* and *pomerium* of Roman London, and the derivation of the name Londinium. He thus sums up his conclusions regarding an original Celtic city:—"Either there was no pre-Roman London, or it was a small and undeveloped settlement, which may have been on the south bank of the Thames." Again, he dismisses the suggestion made by other writers that the Roman roads did not enter London and leave it again, but ran across to the south of it. The life of London, he believes, began very quickly after the Roman conquest; its first phase was an unwalled town situated in the eastern part of what we now call the City, and by A.D. 61 it had become important. But we know little of it, the plan of its streets, or its public buildings. It doubtless fell with other Roman cities in some unrecorded attack in the early fifth century, and lay waste for a hundred years or more.

The Eugenics Review is issued quarterly by the Eugenics Education Society; it contains a record of their proceedings and a general guide to their publications and to events which might be of interest to students of the subject. Among the contents of the July number is much that would appeal to a wider public. We would direct special attention to Mr. Cyril Burt's paper on the inheritance of mental characters. Mr. Burt's training has been that of physiologist and experimental psychologist, and, approaching the subject in the latter capacity, he has furnished from his own researches evidence which escapes some of the objections made to that previously brought forward. Among the objections referred to are these: that native ability has been judged either by measuring faculties which depend, at any rate partly, and according to some schools, wholly, on education, or by considering professional success which is due largely to family influence and opportunity; thus the resemblance between the performances of different members of a family may be due to causes other than heredity. The experimental psychologist has devised tests of qualities which "do not depend to an appreciable degree on acquired skill and knowledge," and has thus measured mental capacity directly and not by estimating mental contents. The evidence of heredity obtained by these means is not as yet very complete; it is presented by the author in the paper under review in a frank and unassuming manner, and considered in conjunction with the results obtained previously by statistical methods or by reasoning from known mental characters of different races.

We have received from Mr. B. G. Teubner, of Leipzig, the first part of the *Zentralblatt für Zoologie, allgemeine und experimentelle Biologie*, published by his firm. This periodical is an amalgamation of the *Zoologisches Zentralblatt* and the *Zentralblatt für allgemeine und experimentelle Biologie*. It contains classified reviews and abstracts of current biological and zoological literature, and will doubtless prove almost indispensable to working zoologists and biologists. The multiplication of biological journals has been so rapid of late years that we cannot but welcome a diminution in their number by such an amalgamation as this.

Mr. H. W. Kew has favoured us with a copy of a paper from the Zoological Society's Proceedings of the current year on the pairing of false-scorpions of the subgenera Chelifer and Chernes. In both the male is destitute of an intromittent organ, and fertilisation is effected by the two sexes facing one another in walking posture, when the male grasps with one or both hands (according to the subgenus) the corresponding organs or organ of the female. The male next extrudes a spermatophore, which stands erect or obliquely on the surface supporting the creatures, and then retires backwards while the female advances until the spermatophore comes below her genital aperture, into which it is immediately received.

According to the first part of vol. xii. of *The Museums Journal*, the Museums Association is in a flourishing condition, both as regards finance and membership. Discounting certain extraordinary expenditure, the balance-sheet shows a surplus, while the list of members has increased by six during the past year. In a lecture reported in the same issue, Dr. W. E. Hoyle gives some useful hints on museums, from the point of view of both the curator and the visitor. He specially insists on the limitation of scope in the exhibits, and of the prime importance of illustrating local subjects, particularly the history and rise of culture.

To vol. ii., pt. 4, of the Journal of the East Africa and Uganda Natural History Society Mr. R. J. Cuninghame contributes an account of Mr. Le Petit's

experiences of the "water-elephant" of the Congo lakes derived from the explorer himself. Although many naturalists regard the "water-elephant" as nothing more than the dwarf Congo elephant, Mr. Cuninghame accepts the view that it represents an altogether distinct type. A very similar account was received from Mr. Le Petit about a year ago by the writer of the present note, who, in consequence of a communication from Paris, did not consider it desirable that it should be published. In the same issue Mr. G. Williams records that a few years ago he saw at early dawn on the Uasingishu a large and apparently unknown animal which he compares to a bear—a comparison borne out by the Nandi, who assert that they are well acquainted with the creature, for which they have a name. Mr. Williams, who is confident that it is neither an ant-bear nor a baboon, adds that the animal has recently been seen again, and that he has heard of one which was burnt in a hut by natives, and of the skin of a second in the Kabras district, although he did not succeed in seeing it.

MR. CHUNG YU WANG, of Wuchow, author of the work on antimony in Griffin's Metallurgical Series, has drawn up a "Bibliography of the Mineral Wealth and Geology of China" (C. Griffin and Co., Ltd., 1912, price 3*s*. net.) The references are divided under the headings of coal, iron, gold and silver, minerals in general, mining and metallurgy in general, geology, petrology, and palæontology; hence the work will be useful to geologists, as well as to those intent on developing the resources of the Chinese Empire. On p. 32, the author remarks that the best book on the mineral wealth of China is one of which he gives the name in Chinese characters, published, with an atlas, in 1907. Perhaps we may look forward to a translation at no distant date.

THE current Annual Report of the Board of Scientific Advice for India, recently received, contains an account of the investigational work done by the various scientific departments during the year 1910–11, and also the programme mapped out for 1911–12. The departments concerned are those of applied chemistry, astronomy, botany, forestry, geodesy, geology, veterinary science, and zoology. One of the chief investigations now being carried on is in reference to the improvement of the cotton crop; to this a large amount of attention is being devoted by the agricultural staff. Simple selection is not considered likely to be of much service in obtaining the required type of plant, but practical results are expected from hybridisation. The methods adopted, and the ideas underlying the work, are of more than local interest; an account of them has been published in *The Journal of Genetics*, and an abstract in the Proceedings of the Royal Society. Among other researches in progress may be mentioned one upon the production of new wheats of high quality, which are giving very promising results; also one having for its object the improvement of the saltpetre industry by modifying the refining processes. The report shows that much solid, useful work is being accomplished.

IN a paper published in 1911 at Helsingfors, entitled "Tid vattnen i Östersjön och Finska Viken," with a short German summary, Mr. Rolf Witting discusses the tides of the Baltic Sea and of the Gulf of Finland. The tides of these seas are small, and have but little importance for sailors, so that the interest of this paper is purely scientific. Mr. Witting used Sir George Darwin's apparatus for making the tidal reductions, and he gives the tidal constants for Kronstadt, Helsingfors, Reval, Hangö, Landsort, Libau, Karlskrona, Ratan, Draghällan, Björn, and Ytter-grund. He also makes use of Dr. Crone's reductions for eight Danish ports, and others by Dr. Schweydar for eight German ones. This considerable amount of material is ably discussed by the author. Perhaps the most remarkable result is that while at the Danish end the semi-diurnal tides are predominant, in the Baltic the tide becomes almost purely diurnal. He explains this by showing that the Baltic ports are near nodes of the semi-diurnal oscillation of the sea. The author also discusses seiches, according to the principles of Chrystal, and finds a period for the longitudinal seiche of about eighteen hours. The transversal seiches differ much at various transverse sections, having periods which lie between three and seven hours. The paper appears to be thorough and scientific, and is thus a valuable monograph on the subject.

OWING to the large amount of cartilage in which they are embedded, it is practically impossible to exhibit the true relations to one another of the bones of the cetacean carpus in macerated skeletons. Some months ago, when a shoal of black-fish was stranded at Mount's Bay, the paddles of a specimen were procured for the Natural History Museum, and, by dissecting away the integuments and muscles from one side of each, moulds were obtained of the bones and cartilages, from which plaster casts were afterwards taken. These casts, coloured to nature, are now exhibited in the Whale Room. During the present summer a taxidermist from the museum was despatched to the Shetlands for the purpose of obtaining flippers of the larger fin-whales; these have been treated in the same manner, the cast of one of the specimens being already completed and coloured. This new mode of exhibiting the structure of the paddle cannot be surpassed.

WE have received a copy of a report by Mr. Merritt Cary on a biological survey of Colorado, forming No. 33 of "The North American Fauna," which was published in August, 1911. An excellent coloured map exhibits the complex life-zones, which show that Colorado, like other areas with varied climatic and physiographical conditions, possesses a correspondingly large and varied fauna and flora. The main features brought out by the survey are: first, the division of the State into three topographic regions, namely the eastern plains, the central system of the Rocky Mountains, and the rugged area of alternating plateaus and valleys on the western slope; and, secondly, the subdivision of each of these regions by diverse physical and climatic conditions into small and irregular faunal and floral areas. Lists of some of the characteristic animals and plants of the various zones are given, as well as a complete list of the mammals of the country.

THE Weekly Weather Report issued by the Meteorological Office, which contains a summary of the temperature, rainfall, and duration of bright sunshine for the several districts of the United Kingdom, shows that the mean temperature for the first eight weeks of summer is generally slightly in excess of the average. The rainfall is also in excess of the normal, the greatest excess being 4·31 in. in the south of Ireland and 3·64 in. in the north-east of England, whilst the north of Scotland is the only district with a deficiency. The duration of bright sunshine for the first two months of summer is everywhere deficient, and in the north-eastern districts the deficiency is very large.

THE Greenwich observations for July give the mean temperature 65°, the mean day readings being 75°, and the mean night readings 55°. This is rather more than 1° in excess of the average, the minima being slightly more in excess of the average than the maxima. The maxima, or day temperatures, ranged from 90° on July 12 to 58° on July 19, and the night minima from 63° to 48°. There were ten days during the month with the shade temperature above 80°, whilst in the corresponding month last year there were nineteen days above 80°. There were three days with the thermometer in the sun's rays at 150°, and in July last year there were eight days above 150°. Rain fell on eleven days, yielding 1·25 in., which is rather more than one-half the average amount; the heaviest fall in twenty-four hours was 0·30 in. on July 2. The sun was shining for 164 hours, which is 72 hours fewer than the average, and is less than one-half of the duration of sunshine in July last year.

DR. W. E. BRITTAN contributes to *The Popular Science Monthly* for July an article on the house-fly and certain other insects which spread diseases. Such insects may be divided into two classes: mechanical carriers, including the house-fly, and essential hosts, such as the mosquito. Rats and fleas are also considered, and the author describes the remedial measures required for checking both types of pests.

THE July number of *The Co-Partnership Journal* of the South Metropolitan Gas Company contains an illustration of the upper surface of the reflector of a street gas lamp which is completely filled by no fewer than four nests of titmice, each with two or more eggs. The structure forcibly recalls a collector's cabinet of nests, and the occurrence is probably altogether unprecedented.

THE June number of *Terrestrial Magnetism and Atmospheric Electricity* contains five tables of magnetic declinations, determined by the *Carnegie* at several hundred positions in the Atlantic during her voyages from New York to Porto Rico, Para, Rio, Buenos Ayres, and Cape Town, in 1910–11. The corrections to the declinations as recorded in the British, German, and United States charts of the Atlantic are also given, and it may be noted that these corrections generally exceed 0·5°, and often exceed 2°.

DR. J. R. ASHWORTH announces, in a letter which appears in *The Electrician* for August 2, that he finds the constant P of Frölich's equation for the magnetisation of iron is inversely proportional to the absolute temperature up to 700° C. If H is the magnetising field and I the fraction the magnetisation produced is of the maximum magnetisation, Frölich's equation runs $H=PI/(1-I)$, and is only intended to apply to cases in which hysteresis is suppressed. As P is the value of the magnetising field at which the magnetisation reaches half its maximum value, Dr. Ashworth's result is more conveniently expressed by the statement that the field for half the maximum magnetisation is inversely as the absolute temperature of the specimen.

PROF. P. C. RÂY has added to his success in preparing ammonium nitrite in tangible form a further accomplishment in determining the vapour density of this very fugitive salt. The salt was vaporised in a Hofmann tube at temperatures ranging from 66° to 100°, and had an average density of 33·5 as compared with the value 32 calculated for the NH_4NO_2. During the heating a large part of the salt was decomposed according to the equations

$$NH_4NO_2 \rightarrow N_2+2H_2O \text{ and}$$
$$3NH_4NO_2 \rightarrow NH_4NO_3+2NO+2NH_3+H_2O,$$

but this effect was measured and allowed for. The experiments are described in full in the July issue of the Chemical Society's Journal.

The Builder for August 9 contains an article dealing with the recent celluloid fire at Moor Lane, E.C., the inquiry into which has now been finished. The following are some of the suggestions made for handling celluloid, which ought to rank second only to absolutely explosive materials and petrol. Storage of the material in bulk should not be permitted in work-rooms; new buildings for stores or workshops should be of fire-resisting materials; the timber parts of old buildings should be plastered; celluloid would be best dealt with in buildings remote from towns; ample gangways should be arranged in workshops; and waste and cuttings of celluloid should be cleared away frequently from the floor. Our contemporary deprecates any panic legislation, but would like to see the duty of examining and pronouncing upon plans of such factories in London placed in the hands of men possessing wide general experience of building and surveying matters, as well as having knowledge of fire and its behaviour under varying conditions.

OUR ASTRONOMICAL COLUMN.

PHOTOGRAPHIC OBSERVATIONS OF COMET 1911*c* (BROOKS).—Ten excellent photographs of comet 1911*c* are reproduced, and, with many others, described by Prof. Barnard in No. 1, vol. xxxvi of the *Astrophysical Journal*. Prof. Barnard directs attention to the lack of details and variation in the tail of this comet up till about the middle of October, 1911; although it was a fairly bright object visually, it was very weak photographically, being essentially different from Morehouse's comet in this respect. But later the comet became exceedingly active, and Prof. Barnard's photographs show some most interesting changes in the structure of the tail, which, on his smaller-scale plates, extends to a distance of 17°. A remarkable reduction in the size of the head on the comet's approach to

perihelion was also shown, the actual diameters on September 18 and October 28 respectively being 1,200,000 kms. and 510,000 kms. A similar increase in the breadth of the "neck" between the head and the tail was also conspicuous. On the former date the head was 54′ in diameter, while the neck was only 6′, but as the comet approached the sun this disparity disappeared, the increased rush of matter from the head, consequent upon the greatly increased light-pressure, probably accounting for the phenomenon.

OBSERVATIONS OF JUPITER.—The observations of Jupiter made, during the present opposition, at the Juvisy Observatory are described and illustrated by M. Quénisset in the August number of *L'Astronomie*. Among other remarkable changes taken place since last year, it is noted that the great northern equatorial band is much feebler, more irregular, and less definite than in 1910 and 1911, while the north temperate band is, at present, much darker and broader than before; it also appears to be nearer the North Pole. The acceleration of the Great Red Spot has been so marked that in the middle of July it passed the central meridian 1h. 40m. before the zero meridian of system ii. The observations indicate a displacement of 22° per annum, equivalent to 25,500 kms. on the planet's surface, or about twice the earth's diameter. Another important feature, the south tropical spot, is darker and more defined than last year, but is not so extended. As it passes the central meridian an hour after the zero meridian of system ii., it is unlikely that the interesting conjunction of these two great spots will be observable during the present opposition.

Observations made during June at the French Astronomical Society's observatory show that the southern disturbance has, since June, 1911, preserved its speed of 7° per month, but later observations indicate an acceleration which will make the new speed 15° per month.

A NEW SUPPLEMENT TO THE ASTRONOMISCHE NACHRICHTEN.—A supplement, No. 1 of the *Literarisches Beiblatt zu den Astronomischen Nachrichten*, July, 1912, Band 192, appears with No. 4593 of the journal. Its object is to notice briefly numerous papers appearing in other current astronomical journals, to publish short notices of new astronomical books, and, in general, to keep its readers *au courant* with what is taking place in astronomical science. The output of new knowledge in astronomy is now so enormous that it has been found impossible to deal with these references and notices in the parent journal.

THE VARIATION OF LATITUDE.—In the latitude variation carefully observed at the International Latitude stations during the past twelve years, there is a term, the Kimura term, as yet unexplained. This is discussed by Dr. F. E. Ross in No. 4593 of the *Astronomische Nachrichten*, and it is suggested that the effect represented by the term is a physical one caused by a progressive change of the zenith point throughout the night at a rate varying with the season. The matter is undoubtedly a very complicated one, in which a secular refraction starting at sundown and depending upon the progressive approach of the mean equivalent isobaric surfaces to the ground is concerned. Dr. Ross suggests the installation of two special latitude stations on the equator, 180° apart and at high altitudes (*e.g.*, Quito and near the west coast of Sumatra) for the further elucidation of the matter.

THE ORBITS OF COMETS.—Commenting on a suggestion made by Prof. Kobold that the orbits of all the hyperbolic comets, if properly corrected for the perturbations of the known planets, would be found to be parabolic, Prof. W. Pickering points out that the hyperbolic orbits appear to be fairly sharply differentiated from the parabolic by the fact that their aphelia tend to collect near one great circle of the sphere, while those of the parabolic collect near another great circle, which intersects the first at an angle of 74°. Thus 73 per cent. of the hyperbolic orbits lie within a zone comprising only 34 per cent. of the total area of the sphere, while 68 per cent. of the well-determined parabolic orbits, 31 in all, lie within the other of the two zones. The inclination of the "hyperbolic" zone to the ecliptic is 86·0°, and the longitude of its node is 93·4° (*Astronomische Nachrichten*, No. 4593).

THE MINERAL RESOURCES AND DEVELOPMENTS IN THE UNITED STATES.[1]

THE mineral industry of the United States reached its greatest prosperity in the year 1907. In the following year it shared the depression which affected American trade; but in 1909 there was a rapid recovery, and the statistics of the mineral production give impressive testimony to American wealth and resources. The output of coal was 460,000,000 short tons, which is 37·53 per cent. of the total for the world; the British output is second in size, and is a quarter of the total. The supremacy of the United States in copper production is still more marked, its yield being more than 58 per cent. of the total, and in spite of the commercial panic the output for 1908 and 1909 showed a steady increase above that of 1907. In spite of the low price of copper, a still larger yield is expected for 1911, when some large low-grade mines in Arizona began their contributions to the supply.

The two volumes on the mineral resources are crowded with figures which indicate that the reserves of the essential minerals are increasing even more than the demands upon them, as lower grade materials can be used and fresh stores are discovered. Thus the yield from the alluvial gold deposits of California is increasing, owing to the use of dredges, which recovered gold worth 7,382,950 dollars in 1909, in comparison with values of 5,065,437 dollars and 6,536,189 dollars in 1907 and 1908 respectively. The deep gold mines of California also increased their output, and Nevada has raised its gold yield by 60 per cent. Even in regard to the two minerals which are probably the most readily exhausted, natural gas and oil, the yields show continued increase. The annual value of the natural gas produced in the United States rose from 215,000 dollars in 1882 to more than twenty-two million dollars in 1888; it then fell year by year to thirteen millions in 1896; but ever since it has shown a steady rise to its record of 63,206,941 dollars in 1909. Pennsylvania, with 9,313 wells, is still the State producing the largest quantity of natural gas; the greatest increase in 1909 was in Ohio; only a few States with small or insignificant outputs, such as Missouri and Colorado, have been less productive. The statistics of oil production show that California is now the most prolific oil State, and has a yield nearly twice as great as the maximum of Pennsylvania.

The most important of the American metallic ores

[1] "Mineral Resources of the United States. Calendar Year 1909." Part i., "Metals." Pp. 617+1 plate. Part ii., "Non-metals." Pp. 942. (Washington, Department of the Interior, U.S. Geological Survey, 1911.)

Bulletin No. 451, "Reconnaissance of the Ore Deposits in Northern Yuma County, Arizona." By Howland Bancroft. Pp. 130+8 plates.

Bulletin No. 454, "Coal Oil and Gas of the Foxburg Quadrangle, Pennsylvania." By Eugene Wesley Shaw and Malcolm J. Munn. Pp. 85+10 plates.

Bulletin No. 455, "Copper Deposits of the Appalachian States." By Walter Harvey Weed. Pp. 166+5 plates.

Bulletin No. 456, "Oil and Gas Fields of the Carnegie Quadrangle, Pennsylvania." By Malcolm J. Munn. Pp. 92+5 plates.

Bulletin No. 480, "Mineral Resources of Alaska. Report on Progress of Investigations in 1910." By Alfred H. Brooks and others. Pp. 333+13 plates. (Washington, 1911.)

are those of iron, and the Lake Superior region is still the mainstay of the American industry. The Mesabi district has now the largest output of the five mining fields near Lake Superior, and yields 54·3 per cent. of the total for the United States.

The five new bulletins on American economic geology deal with problems as varied as the subject is vast. Mr. Munn brings forward fresh evidence in support of his views on the inapplicability of the anticlinal theory of subterranean oil storage to the Pennsylvanian oil fields. His memoir on the Foxburg and Carnegie districts shows that the folds are not the main agency in determining the distribution of the oil. Thus near Carnegie the oil sands, which are really sandstones, occur in many levels in the Devonian and Carboniferous systems; the beds are gently folded, and if the oil collected along the folds the successive oil sands should be most productive along the same lines; but their chief supplies come from different localities. The anticlinal theory is still less tenable for the Foxburg district, as the oil-bearing beds are there nearly horizontal. The oil occurs in pools, the distribution of which is shown on a most interesting map. Mr. Munn attributes the collection of the oil in these patches to the pressure of descending water, which slowly percolates through the less permeable beds; it thus forces the oil downward, and then laterally into the most porous beds, where the movement of water due to capillary attraction is least powerful.

Mr. Weed has compiled a valuable survey of the copper ores of the Atlantic coast States. Students of copper ores will read with interest his account of the famous copper mines of Ducktown, and also his convincing arguments that the ores in the Triassic sandstones were derived from the associated basic lavas and sills known as the New Jersey "traps."

The bulletin on Alaska (No. 480) includes fifteen reports by various authors on the coal, water supply, and ore deposits. The most generally interesting report is a general summary by Mr. Brooks of the results of thirteen years' surveys of the Alaskan metalliferous lodes. The mineral output of Alaska is still increasing, though there has been a set-back to the development of the coalfields, the yield of which has fallen to half, to the great detriment of commercial progress in the territory. The Alaskan railways are paying for imported coal from three to four times the price for which they should obtain better local material. The closing of most of the coal mines appears to be due to the legislation forced on the western mining States by the anxious eastern States, owing to the agitation for the conservation of natural resources. Closing the mines is certainly the most effective method of conserving the mineral reserves of a country, though it may be equally effective in securing their ultimate waste. J. W. G.

THE NUTRITION OF FARM ANIMALS.

IN spite of the enormous importance of the live-stock industry in Great Britain, very little work has been done on the nutrition of farm animals, nor have physiologists drawn upon the accumulated knowledge of practical feeders to anything like the extent warranted by the interest of the subject. This last fault will, it is hoped, be remedied at the forthcoming meeting of the British Association, when physiologists and practical feeders will both attend at the Agricultural Section for a discussion on the problems involved. With the extension of the Agricultural School at Cambridge we may hope also for a considerable increase in our knowledge of animal nutrition.

For some time past nutrition studies have been going on at the Wisconsin Experiment Station, the results of which are published in the research bulletins of that institution. Messrs. Hart, McCollum, Steenbock, and Humphrey have recently (Bull. No. 17) issued an account of experiments carried on for four years with heifers, showing that rations possess important physiological values not measurable by present chemical methods. Animals fed on rations chemically alike (*i.e.* containing equal amounts of fat, protein, &c.), but derived from different sources, behaved very differently. This result has already been obtained elsewhere, but the further conclusions of the authors are rather remarkable. Maize was the best nutrient, oats came next, and wheat last. When a mixture of all three was used, the animals responded less vigorously than to the maize or oat rations alone, but better than to the wheat ration. Certain other effects were noted also; the urine of the wheat-fed animals was acid to litmus, that of the others was neutral or alkaline. It is difficult to account for these observations if further experiment shows them to be well founded; on other grounds it might have been expected that the mixture would have given the best result.

In another paper (Bull. No. 21), McCollum and Steenbock show that rather different results are obtained with the pig. Wheat, oats, and maize did not show such wide differences in chemical value as were expected from the chemical differences in the proteins. It is known, however, that the pig has a remarkable power of effecting the most unexpected changes during the course of its metabolism, transforming into pork an astonishing variety of substances. Marked increases in body protein were obtained when casein was fed as the only protein; zein, however, failed to increase the body protein, although the animal utilised nitrogen from this source for repair of the losses due to tissue metabolism. The authors conclude that the repair processes are of different character from the processes of growth, and do not involve the destruction and re-synthesis of an entire protein molecule.

Recent issues of the Journal of the Board of Agriculture have contained a series of papers by Dr. Crowther, which summarise admirably our present knowledge of the scientific and economic principles involved in animal feeding. It is clearly shown that no one set of considerations determines the value of a particular ration, and in the present state of our knowledge the recommendations of the man of science can only be taken as the starting point from which to begin feeding trials. Even the best methods of calculating rations are shown to be only roughly approximate.

RECENT WEATHER.

ONE of the many interesting vagaries of the recent weather, with its midday temperatures from 20° to 30° lower than for the corresponding period last year, has been the persistently higher temperatures over Scandinavia than in other parts of western Europe. Averaging the maximum shade readings at several representative stations reporting to the Meteorological Office, this abnormal result is shown to have prevailed, so far, throughout August. For the first twelve days of the month the average maximum temperature at Haparanda, at the head of the Gulf of Bothnia, only just outside the Arctic Circle, is 76·8°. The mean for the same period at Nice is 79·1°; but Lisbon is only 73·7°, or lower than Haparanda by 3·1°. At Bodö, within the Arctic Circle, the mean of the highest day readings was 67·9°. At Biarritz the mean of the maxima was only 69·8°, Paris 67·6°, Brussels 67·5°, London 64·5°, Jersey 63·3°, Liverpool 60·3°. The difference is even more intensified taking the mean of the maxima, or

day readings, for the week ending August 12. Haparanda is now found to have by far the highest mean, being 80·0°; the next highest is Nice with 77·6°, followed by 75·8° at Lisbon, 73·5° at Bodö, 68·0° at Biarritz, 66·3° at Paris, 65·6° at Brussels, 63·3° in London, 62·9° at Jersey, and 60·0° at Liverpool, the latter being for the whole week 20° lower than Haparanda. The most marked difference probably occurred on August 10, when at Haparanda the maximum temperature was 86° and at Bodö 79°, whilst at Nice it was only 75°, Lisbon 73°, no other representative station having a temperature as high as 70°, and at Jersey and in London the highest mid-day reading was 63°, and at Liverpool 59°.

The summary of the weather for the first ten weeks of the summer, issued by the Meteorological Office, shows an excess of rain over the entire kingdom, except in the north of Scotland, where the deficiency only amounts to 0·1 in. The excess is greatest in the south-west of England, where it amounts to 5·26 in., the aggregate measurement being 11·35 in. In the south of Ireland the excess is 5·01 in., and in the Channel Islands, the north-east of England, and in the Midland counties it exceeds 4 in. The number of rainy days is also generally largely in excess of the average. The duration of bright sunshine so far this summer is everywhere largely deficient, especially in the eastern districts; in the east of Scotland the duration of sunshine is only one-half of the normal.

ADVANCE OF THE SOUTH-WEST MONSOON OF 1912 OVER INDIA.

IN an interesting article in *The Popular Science Monthly* (vol. lxxviii.) on "The Meteorology of the Future," Prof. Cleveland Abbe stated that: "In India the prediction of great droughts has long been held to be one of the most important questions that can be attacked by the weather bureau of that country, and eminent men have worked upon it for twenty years past." The failure of the monsoon rains and the consequent failure of crops will cause famine over very extensive districts, while a timely and successful forecast, or "inference," of the probable rainfall during the season in question (June to early October) may effect an immense saving to the Government.

The Director-General of Observatories, in a "Memorandum on the meteorological conditions prevailing before the advance of the south-west monsoon," dated June 8, again points out that the monsoon rainfall is affected by previous conditions over various parts of the earth, and he has elsewhere explained that there is a relation of an inverse character between barometric pressure in South America and in the Indian Ocean, the barometer being usually higher than the average in one region when lower in the other, and abundant monsoon rainfall is, as a rule, preceded by high pressure in South America and low pressure in the Indian Ocean.

The memorandum contains a list of recent data which appear to be of importance, and of the inferences drawn therefrom. It is admitted that there is a large uncertainty in the present methods of forecasting, and that it is only when the indications are strongly marked that reliance can be placed on them. In the present year such conditions do not obtain, but a careful consideration of the various features has nevertheless led to the following conclusions being drawn:—(1) It appears likely that monsoon rainfall, which is already overdue on the Konkan coast (Bombay) will be materially later than usual in establishing itself over the country. (2) The rainfall of the first half of the period is likely to be less abundant and less steady than usual, particularly in north-west India. (3) There appears to be no reason for anticipating that the total monsoon rainfall of India as a whole will be in large excess or large defect. (4) An unusual amount of irregularity in the distribution of rainfall appears likely.

PREHISTORIC TIME MEASUREMENT IN BRITAIN.

THE current volume of Transactions of the North Staffordshire Field Club contains a paper by Dr. McAldowie on prehistoric time measurement. It is based on two years' astronomical study of megalithic monuments which have been uncovered in long barrows in Staffordshire and Gloucestershire. It treats first of the orientation of these to sunset at the equinoxes and solstices, and at the early part of November and February, and of May and August, the former being the astronomical, the latter the religious, or agricultural, year of prehistoric times. The chief object of the communication, however, is to direct

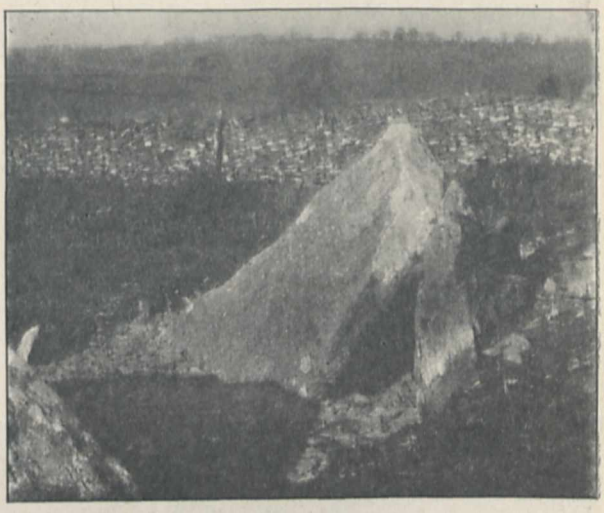


FIG. 1.—Twelve o'clock in November and February marked on the south-east end of the leaning stone.

attention to the shadows cast by these stones on these various dates.

At the south-east corner of the chamber in the Bridestones, in North Staffordshire, which is oriented to sunrise at the equinoxes, the shadow of a tall upright strikes the edge of a recumbent stone at its base when the sun is on the meridian at the summer solstice. At Notgrove, on the Cotteswolds, there is a similar arrangement of megaliths in the middle of a long barrow, the chamber being oriented to the November sunrise. The meridional shadows strike the south and the north edges of the dial stone respectively at the equinoxes and the beginning of November.

The chief portion of the paper deals with a dolmen situated in a long barrow at Camp, near the author's residence, where he had spent many days at all seasons of the year. This dolmen is composed of a north, a south, an east, and a west stone, all firmly embedded in the solid rock, and occupying a somewhat quadrilateral space. A leaning-stone crosses near the middle of this space in a diagonal manner, forming, by its union with the east stone, a sacred "creep-way." The dolmen marks the solstices and

equinoxes at sunrise, noon, and sunset, but the most interesting feature is the fact that solar hours for two degrees west longitude are indicated by shadows touching various prominent points or edges of the stones at the beginning of November and February, and at the winter solstice and the equinoxes. The remains of the barrow prevent the sun's rays from striking on the dolmen when the sun is low on the eastern

FIG. 2.—Twelve o'clock at the equinoxes marked on the south-east corner of the north stone.

or western sky, but the author has been able to obtain photographic records of the shadows of twenty-two out of twenty-seven possible hours of sunshine at the dates mentioned. The south stone acts only as a style, the north stone only as a dial, while the east and diagonal stones fulfil both purposes. The probability is that the megaliths were sacred gnomon

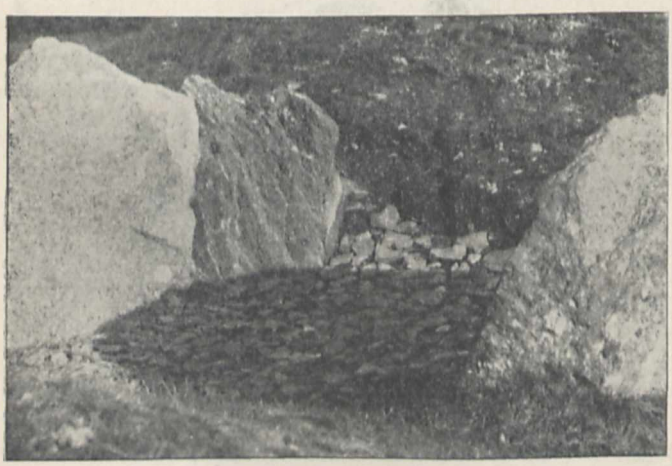


FIG. 3.—One o'clock in November and February marked on the south end of the east stone.

stones worshipped by certain of the ruling races of prehistoric times, and used as a means of registering the passing time chronicled by the sun. The dolmen, therefore, appears to have been a sacred instrument constructed to show mean solar hours, *horae equinoctiales* (used by the ancients for astronomical purposes), at certain critical periods of the year. It must, moreover, have been in use before the barrow was erected. The author has also found solar hours indicated by shadows on the uncovered stones in the long barrows at Notgrove and Belas Knap, although he has not been able to obtain a regular series owing to their imperfect condition. Perhaps, ages after time-measuring dolmens had been in use, some change of cult was introduced into this country, either by the pre-barrow race themselves, or, more probably, by alien invaders, and certain of those ancient temple observatories used as foundations for barrows. The practice of taking over sacred places and temples was a universal one amongst ancient races.

SIR WILLIAM HERSCHEL.[1]

DURING the last twenty years there has been a great revival of statistical investigations as to the distribution and motions of the so-called fixed stars. Kapteyn of Gröningen is the leader of those who are renewing the attempt to obtain in this way some idea as to the construction of the universe. Earlier astronomers had, of course, done something in this direction, but the work of William Herschel so far transcends that of all others that it would be fair to describe him as the originator of this class of investigation. It may be of interest to mention that a complete edition of his works is now in course of publication, under the direction of a joint committee of the Royal and Astronomical Societies.

The interest of Herschel's writings, and the simple charm of his style—written, it is to be remembered, in a language which was not his from birth—have led me on to read about the man as well as about his scientific work. Throughout his life's work his name is inseparable from that of his sister Caroline, and I hope it may prove of interest to you to hear of what they were, as well as of what they did. They were born at Hanover, he in 1738, she in 1750, the children of a bandsman of the Hanoverian Guards. At the age of fifteen Herschel was already a member of the Guards' band. In 1757 the regiment, which had been in England for about a year, served in Germany during the Seven Years' War, and William seems to have suffered from the hardships of the campaign. His parents, seeing that he had not the strength for a soldier's life, determined to remove him from the regiment. The removal may be described more bluntly as desertion, for we learn that when he had passed the last sentinel at Herrenhausen, he took off his uniform, and his luggage was secretly sent after him to Hamburg. At any rate, fortunately for science, he escaped, and in 1757 or 1758 made his way to England.

It would perhaps be impossible to follow him throughout his wanderings, but we know that he was at one time instructor of the band of the Durham Militia, and afterwards that he gained his living as a musician in Leeds, Halifax, Pontefract, and Doncaster. In 1764 he even ventured back to Hanover for a short time, and thus saw his favourite sister again.

During her early years Caroline seems to have been practically the household drudge or general servant, and whatever she learnt was by stealth or in the scanty intervals snatched from her household duties, for her mother thoroughly disapproved of education for a girl.

When we reflect on the difficulties under which both brother and sister laboured, and then consider how much they were able to accomplish, we might

[1] A discourse delivered at the Royal Institution on April 26 by Sir George H. Darwin, K.C.B., F.R.S.

be tempted to underrate the value of educational advantages. Concerning education, Bishop Creighton once said in my hearing, "It is surprising how little harm we do notwithstanding all the pains we take." Paraphrasing the remark, although spoiling the epigram, I would say, "It is surprising how little harm the lack of opportunity does to a great genius."

In 1766 William took a position as organist at Bath, then at the height of fashion. The orchestra at the Pump Rooms and at the theatre at Bath was then one of the best in the kingdom, and Elizabeth Linley, daughter of the director of the orchestra, was the prima donna of the concerts. When in 1771 she became engaged to Charles Sheridan, Herschel thought that the expected vacancy would make an opening for his sister at Bath, and suggested that she should join him. And, in fact, after a time such a vacancy did occur, for Elizabeth Linley, after flirting with Charles Sheridan, jilted him, and eloped with and married the celebrated Richard Brinsley Sheridan.

Caroline was very anxious to accede to her brother's suggestion, but the rest of the family would not for a time hear of it. At length, however, in 1772, Herschel came to Hanover and carried off his sister with the mother's reluctant consent. Even from boyhood his intense love of astronomy had been manifest, and it is interesting to note that in passing through London on their way from Harwich to Bath, when they went out to see the town, the only sights which attracted their attention were the opticians' shops.

On Mr. Linley's retirement from the orchestra at Bath, Herschel became the director and the leading music-master in the town, and he thus obtained an established position. Although Caroline sang a little in public, her aspiration to become the prima donna of Bath was not fulfilled. But she was kept busy enough at first in the cares of housekeeping, with endless wrangling with a succession of incompetent slaveys, and then she gradually became more and more her brother's astronomical assistant.

In the midst of Herschel's busy musical life he devoted every spare moment to astronomy, and when his negotiations for the purchase of a small reflecting telescope failed—and they were all small in those days—he set to work to make mirrors for himself.

One room in the house was kept tidy for pupils, and the rest of the house, including the bedrooms, was a litter of lathes and polishing apparatus. He made reflecting telescopes not only for his own use, but also for sale, for the purpose of providing funds to enable him to continue his researches. His industry must have been superhuman, for later in his life he records that he had made more than 400 mirrors for Newtonian telescopes, besides others of the Gregorian type. These mirrors ranged in diameter from a few inches to 4 ft., in the case of the great 40-ft. telescope. I should say that mirrors are not specified by the diameter of the reflecting surface, but by the focal length. Thus, whatever may be the diameter of the reflecting surface, a 20-ft. telescope means that the mirror is approximately portion of a sphere of 40 ft. in radius, and this will give a focal length of 20 ft. You must, in fact, double the focal length of a telescope to find the radius of the sphere of which it forms a small part.

In order to learn anything of the making of reflectors it is necessary to go to original memoirs[2] on the subject, and even of them there are not many. I feel, therefore, that I shall not be speaking on a topic known to many of the audience if I make a digression on a singularly fascinating art. Mirrors are now made of glass with a reflecting surface of chemically deposited silver; formerly they were made of speculum metal, an alloy of copper and tin. Of whatever substance the mirror is made the process of working it to the required form is much the same. The most complete account of the process of which I know is contained in a paper by Prof. G. W. Ritchey in vol. xxxiv. (1904) of the Smithsonian Contributions to Knowledge. He there gives a full description of the great reflector of the Yerkes Observatory. The process only differs from that employed by Herschel in that he worked by hand, whereas machinery is now required to manipulate the heavy weight of the tools. The Yerkes mirror is formed of a glass disk 5 ft. in diameter, and it weighs a ton; the grinding tools are also very heavy.

I must pass over the preliminary operations whereby the rough disk of St. Gobain glass was reduced to a true cylindrical form, smooth on both faces and round at the edge. Nor will I describe the grinding of a shallow depression on one of the faces by means of a leaden tool and coarse emery powder.

It will be well to begin by an account of the manufacture of the tools wherewith the finer grinding and polishing is effected, and then I shall pass on to a short description of the way they are used.

Two blocks of iron are cast with the desired radius of curvature, the one being concave and the other convex. The castings are then turned so that the concavity and convexity fit together as nearly as may be. For the large mirror these blocks are a little more than 2 ft. 6 in. in diameter, but for small ones they are made of the same diameter as the mirror to be ground. The two are then ground together for a long time with emery powder and water until every part of one surface fits truly to every part of the other. They must then both be portions of a sphere of the same radius, because the sphere is the only surface in which a universal fit is possible. The concave iron is very precious, because it furnishes the standard for regrinding the convex grinding tools when they have become worn by use. In order to make a plane mirror, three surfaces are ground two and two, for if A fits B and C, and B fits C all over each surface they must all be true planes. However, I shall only speak of the figuring of concave mirrors.

The roughly hollowed glass disk is now laid on several layers of Brussels carpet centrally on a massive horizontal turn-table. The convex iron tool just described is suspended by a universal joint from a lever, and it is counterpoised so that only a portion of the weight of the tool will rest on the glass when it is in use. A complicated system of cranks and levers is so arranged that the tool can be driven by machinery to describe loops or curves of any arbitrarily chosen size over the glass, and as these loops are described by the tool the turn-table turns round slowly. In this way every part of the tool is brought into contact with every part of the glass disk in a systematic way. When working near the edge a large part of the tool projects beyond the edge of the glass.

Emery powder and water are supplied in a way I need not describe, and the tool is lowered gently on to the glass. The motive power is then applied, and the grinding is continued for many hours until the preliminary rough depression has been hollowed to nearly the desired shape—namely, that of the standard concave iron.

For finer grinding a change of procedure is now adopted, and very finely powdered emery is used. Another convex tool is formed, by grinding with the standard concavity; the working face of the tool is, however, now cut up into small squares by a criss-

[2] Sir Howard Grubb's lecture at the R.I. in 1887 is one of these, vol. xi., p. 413. Lord Rosse's papers are amongst the most important.

cross of narrow and shallow channels. Such channels are found to be necessary in order to secure an even distribution of the emery and water all over the surface. The grooved tool is now used for many hours, and the surface is tested at frequent intervals with a spherometer. The work ceases when it is no longer possible to detect errors of curvature in this way.

The next stage is polishing. The thickness of the layer of glass worn off in polishing is to be estimated in ten-thousandths of an inch, and can scarcely be detected even with the finest spherometer. For polishing the iron tool is discarded and the work is carried on by hand. As lightness is essential, the tool is built up by a stiff lattice-work of wood with a continuous wooden working face. It is obvious that however carefully the face may be turned it cannot be made sufficiently true, and the requisite accuracy is obtained by means of the plastic properties of rosin or pitch. A number of squares of rosin about a quarter of an inch thick and an inch square are made, and these are glued in rows on the convex face of the wooden tool, with a narrow space intervening between each rosin square and its neighbours. The tool is then warmed slightly so as to soften the rosin a little, and it is then pressed lightly on to the glass disk. By means of this "warm-pressing" a nearly perfect fit is attained.

Each of the rosin squares is then painted with hot melted wax. This is done because wax is harder than rosin and affords a better working face. Finally, when the tool is quite cold, the surface of the glass is painted all over with very finely powdered rouge and water, and the tool is placed gently on the glass with some additional weight resting on it. It is left thus for several hours, but is moved slightly every ten minutes to ensure an even distribution of the rouge and water. By means of this "cold-pressing" a perfect fit is secured of the wax-coated rosin squares with the glass face. Cold-pressing has to be repeated every day before the work begins.

The polishing is now carried on in much the same way as the grinding, but by hand instead of by machine power. The turn-table can be made to tilt so as to bring the glass to stand vertically, instead of horizontally, and the disk is frequently tilted up so as to submit the surface to optical tests. These latter tests are far more searching than those with a spherometer, and enable the observer to detect an error in the radius of curvature of portion of the reflector of a hundredth of an inch. To correct such an error it will be necessary to remove a layer of glass of $\frac{1}{500000}$th of an inch!

The most refined optical test is by the observation of the image of a brilliant light issuing from a pinhole close to the intended centre of the spherical surface. The observer examines the image of the pinhole with a microscopic eyepiece placed as close as possible to the pinhole. He then causes a straight-edge close in front of the eyepiece to move slowly across the reflected beam of light, either from left to right or from right to left, so as to eclipse the light. Previously to the eclipse the whole of the glass seems to be a uniform blaze of light, and if the curvature is perfect the light which enters the observer's eye comes from all parts of the disk, and the surface is seen to darken equably all over. But if the surface is imperfect the light from some part is eclipsed sooner than that from others, and the disk seems to possess considerable hills and valleys illuminated, as it were, by a setting sun.

The interpretation of these apparent hills and valleys shows where further local polishing with a small tool is requisite. Sir Howard Grubb says that if he suspects a hollow, he holds his hand near the surface for a minute or two; if a hill is suspected, he washes the region with an evaporating wash. The warmth in the one case and the cooling in the other tend to rectify, and indeed over-rectify, the errors.

When success is finally attained, after all we have only a spherical surface, and it becomes necessary to obtain a parabolic form. This last stage is done by further tests of the kind described, with a diaphragm placed over the mirror which only permits the observer to see the light reflected from chosen zones of the mirror. The time at my disposal will not allow me to describe this in further detail, or to tell you how there is always found to be one definite diameter of the glass along which its weight must be supported. I must pass by, too, the system of counterpoised levels used for supporting the back of the glass, and the method by which silver is chemically deposited on its surface. Meagre although this sketch has been, it will have served to show you how beautiful are the processes employed, and I would ask you to realise that at first Herschel was a mere amateur, and had to discover everything for himself.

As I have said, Herschel had to do all his polishing by hand, and he found when once the final stage had begun, it was necessary that it should never stop even for a moment. Caroline relates how she was kept busy in attending on her brother when polishing: "Since by way of keeping him alive I was constantly obliged to feed him by putting the victuals by bits into his mouth. This was once the case, when in order to finish a 7-ft. mirror, he had not taken his hand from it for sixteen hours together."

The making of the mirror is, however, but a small part of the difficulty of making a telescope, for it involves high engineering skill to provide a solid stand, an observing platform, the graduated circles in right ascension and declination for setting the telescope and the clock, whereby it is made to follow the stars in their daily motion. The great size of Herschel's mirrors and the weight of the long tube introduced mechanical difficulties which were at that time entirely new.

A dozen years after his establishment at Bath, Herschel began to be well known in the world of science, and many of the most illustrious astronomers came to see him. In 1781 he was elected to the Royal Society, and in the same year he discovered the planet Uranus, and called it by the now almost forgotten name of Georgium Sidus, in honour of George III. The magnitude of the discovery may be estimated by the fact that only the five principal planets, familiar to all men for centuries, were then known; and the asteroids or minor planets had not yet been discovered by Herschel himself. His fame from this and his other discoveries led to a command from the King to take his 7-ft. telescope to Windsor, and there he was requested to act as celestial showman to the King, the Queen, and the Princesses. The expedition put him to much expense, and he was kept hanging about Windsor for months, but at length the King offered him the post of Private Royal Astronomer, with the modest salary of 200*l.* a year.

Herschel's friend, Sir William Watson, said that never had a monarch bought honour so cheap, and Caroline pours scorn on the King's meanness; but I think this was scarcely fair. It must have been well known that Herschel had deserted from the Hanoverian Guards, and while the King might consent to forget this, it was a strong measure to take the deserter into his service. At a later date, moreover, when the King was informed by Sir Joseph Banks of Herschel's financial difficulties, he granted him 2000*l.*, afterwards increased to 4000*l.*, for the construction of the great 40-ft. telescope, with the condition that

he should retain it for his own use. To this was added a further 200*l.* a year for maintenance, and a pension of 50*l.* a year to Caroline Herschel. And besides, he was allowed to make specula for sale, and half the observatories of Europe were so furnished by him at prices which were then thought considerable.

At any rate Herschel jumped at the offer, which, by relieving him from his musical slavery, allowed him to follow the wish of his life. The Herschels then came to the neighbourhood of Windsor, and after several removals they finally settled at Slough. The change was delightful for him, since he now had space for his telescopes and workshops, but the difficulties of housekeeping in a rambling and dilapidated house rendered the change somewhat less agreeable to his sister.

The closeness to Windsor was perhaps a necessity of the case, but it had its disadvantages, since he was frequently summoned to take his telescope to Windsor, or large parties from the Castle would visit him at his house in order to see the wonders of the heavens. When his time had been wasted in this way he would make up for the loss by redoubled labour.

The fury, as I may call it, with which they worked may be gathered from Caroline's journal, and the work was not free from danger, because in his eagerness Herschel would not always delay his observations until the telescope was properly fixed. To stand in the dark on a platform without a railing, when your attention is distracted from your position, cannot be very safe, and they both met with a good many accidents which might easily have proved fatal.

The incessant work, together with the interruptions by the visitors from the Castle, began at length to tell on Herschel's health. His sister notes that on October 14, 1806, after working all day, he was out from sunset until past midnight surrounded by fifty or sixty persons, without food or proper clothing, and that he never seemed to recover completely from this great strain on his strength.

But I have passed by an event of importance in the lives of both brother and sister, for in 1783 he married Mrs. Pitt, a lady of singularly amiable and gentle character. To the sister, however, the marriage was a great blow, for, although she continued to be his secretary and assistant, she moved into neighbouring lodgings, and was no longer so closely associated with him as theretofore. Mrs. John Herschel writes: "It is not to be supposed that a nature so strong and a heart so affectionate should accept the new state of things without much and bitter suffering," and tradition confirms this belief. All her notes and memoranda relating to a period of fifteen years from the time of the marriage were destroyed by her when, as we may presume, her calmer judgment showed her that the record of her heartburning would be painful to the surviving members of the family. At any rate, she was on affectionate terms with her sister-in-law throughout all the later years of her life, and the brilliant career of her nephew, the celebrated Sir John Herschel, and correspondence with him, afforded the leading interest of her old age.

Although Herschel lived until 1822, and accomplished an enormous amount of work up to the end of his life, yet his health seems to have declined from about the time I have noted. On his death Caroline felt that her life, too, was practically ended, and she returned to Hanover. Ever afterwards she used to cry, "Why did I leave happy England?" and it is incomprehensible that she should not have returned to the place where all her real interests lay.

Although she felt the death of her brother as practically the end of her life, she was always full of jokes and fun. In a letter to her nephew, she told him that her father used to punish her, a grown woman, by depriving her of her pudding if she did not guess rightly the angle of the piece she had helped herself to. Dr. Groskopf writes of her when she was eighty-nine years of age, "Well! what do you say of such a person being able to put her foot behind her back and scratch her ear with it, in imitation of a dog, when she was in one of her merry moods." She only died in 1847, having very nearly completed her ninety-eighth year.

Herschel himself must have been a man of singular charm, as is testified to by Dr. Burney and his daughter, Mdme. d'Arblay. That he possessed an incredible amount of patience is proved by the fact of his submitting to the reading aloud of the whole of a portentous, and fortunately unpublished, poem in many cantos by Dr. Burney, entitled "A Poetical History of Astronomy." It appears that Herschel had had an interview with Napoleon in Paris in 1802, and the poet Campbell asked him whether he had been struck by Napoleon's knowledge. "No," said Herschel, "the First Consul surprised me by his versatility, but in science he seemed to know little more than any well-educated gentleman, and of astronomy much less, for example, than our King. His general air was something like affecting to know more than he did know." He was struck, too, by Napoleon's hypocrisy in observing "how all these glorious views gave proofs of Almighty Wisdom."

And now having endeavoured to show what kind of people Caroline and her brother were, I must turn to what they did. Herschel's discoveries were so numerous that I am compelled to make a selection. I shall, therefore, only attempt to sketch his endeavour to understand the general construction of the stellar universe, and to speak of his work on double stars.

(*To be continued.*)

BUDGETS OF CERTAIN UNIVERSITIES AND UNIVERSITY COLLEGES.

THE reports for the year 1910–11 from those universities and university colleges in Great Britain which are in receipt of grants from the Board of Education have now been issued as Blue-books (Cd. 6245 and 6246).

It will be remembered that the following English universities participate in the annual grant made by Parliament for university colleges:—Birmingham, Bristol, Durham (Armstrong College), Leeds, Liverpool, Manchester, Sheffield, London (including University College, King's College, Bedford College, School of Economics, and East London College), and also the University Colleges at Nottingham, Reading, and Southampton. The University of Wales includes the University Colleges of Aberystwyth, Bangor, and Cardiff.

The reports also deal with certain other constituent colleges of universities in receipt of aid under "The Statement of Grants available from the Board of Education in Aid of Technological and Professional Work in Universities in England and Wales." These institutions are twelve in number, nine being medical schools attached to hospitals in London. They are all schools of the University of London. One, the Newcastle College of Medicine, is a constituent college of the University of Durham, while the two remaining, namely, Manchester Municipal School of Technology and the Bristol Merchant Venturers' College, make provision for the faculties of technology and engineering, respectively, in the universities to which they are attached.

The tabular matter which is contained in the volumes gives full information as to the income and expenditure of the institutions concerned. To make a comparison with the reports of previous years easily possible, the data concerning the medical schools and other colleges receiving grants from the Board of Education in aid of technological and professional work, as explained above, are printed in italics in the tables and not included in the reports.

The following summaries of income and expenditure have been drawn up from the tables, and serve to bring out the resources of the institutions of higher education participating in the Treasury grant, and the way the available funds are expended.

UNIVERSITIES AND UNIVERSITY COLLEGES, 1910–11.

(1) ENGLAND.

(*a*) *Income.*

	Amount £	Percentage of Total
Fees	174,379	31·7
Endowments	80,973	14·7
Donations and Subscriptions	24,287	4·4
Annual Grants from Local Authorities	85,598	15·6
Annual Grants from Exchequer	156,637	28·5
Other Income	28,126	5·1
Total	£550,000	100·0

(*b*) *Expenditure.*

	Amount £	Percentage of Total
Administration	60,182	10·8
Provision and Alteration of Buildings	2,419	0·4
Maintenance	62,389	11·1
Educational Expenses	373,985	66·8
Superannuation	11,959	2·1
Scholarships, etc., from Sources other than Trust Funds	9,877	1·8
Other Expenses	39,054	7·0
Total	£559,865	100·0

(2) WALES.

(*a*) *Income.*

	Amount £	Percentage of Total
Fees	16,547	25·9
Endowments	4,486	7·0
Donations and Subscriptions	2,813	4·4
Annual Grants from Local Authorities	4,508	7·1
Annual Grants from Exchequer	34,498	54·0
Other Income	1,011	1·6
Total	£63,893	100·0

(*b*) *Expenditure.*

	Amount £	Percentage of Total
Administration	7,948	12·5
Provision and Alteration of Buildings	—	—
Maintenance	3,705	5·8
Educational Expenses	45,852	71·8
Superannuation	1,946	3·0
Scholarships, &c., from sources other than Trust Funds	970	1·5
Other Expenses	3,466	5·4
Total	£63,887	100·0

The committee appointed last summer to advise the Board of Education as to the distribution of Exchequer grants available for university education in England and Wales directed attention to the importance of substantial endowments and the wide divergence that exists in this respect between different institutions. This divergence is brought out by the figures given in the table from which the above summaries were made; thus, while Manchester receives nearly 30 per cent. of its income from endowment, King's College receives only about 1 per cent. Manchester and Liverpool together have nearly half the total income from the endowments of the universities and university colleges in England which participate in the Exchequer grant. In considering the contribution made by local authorities, it is to be remembered that the London County Council contributes 10,000*l.* to the University of London, besides the various sums paid to the schools of the University. 300*l.* of the amount is taken for the administrative expenses of the University, and the remainder is apportioned equally between the four faculties of arts, pure science, engineering, and economics, and is devoted towards the maintenance of certain professorships, readerships, and lectureships in these faculties. The city of Manchester, in addition to its contribution to the University, spends a large sum annually on the Municipal School of Technology. The figures do not include any part of the additional 50,000*l.* voted for the financial year 1911–12, since none of this increase was distributed until after the end of the period under review in the reports. In addition, the University of London received 8000*l.*, the University of Durham 2000*l.*, and the University of Wales 5500*l.*, in aid of administrative expenditure, which must otherwise have been met by the constituent colleges from other sources.

The receipts from fees in England amounted to rather less than 32 per cent. of the total income, a decline of 1 per cent. compared with last year. The amount received from endowment was about the same as last year, namely, 15 per cent.; on the other hand, the receipts from local authorities have increased by 1 per cent. to 15·6. The total receipts of all kinds from the Exchequer remain about stationary at 28·5 per cent. In Wales, the income from fees increased slightly to 26 per cent.; a further growth is likely to be shown in future returns by reason of the substantial increase that has been made in the fees charged to all students entering Welsh colleges in 1911 or later years. The percentage of the income derived from endowments and from local authorities is slightly greater than last year, while the receipts from the Exchequer remain about stationary at 54 per cent.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

MANCHESTER.—By the will of Mr. John Hall the sum of 40,000*l.* is left in reversion to the University. During the life of two nieces or the survivor of them, Mr. Hall's residuary estate is to be accumulated at compound interest, and on the decease of the survivor the sum of 20,000*l.* is to be devoted to the founding of a Samuel Hall professorship in chemistry, and 15,000*l.* to that of a Samuel Hall professorship in philosophy, it being directed that the holder of this professorship shall deliver once in each year a free public lecture on the study of philosophy past and present, to be called the "Hall Oration on Philosophy." This lecture is to be given in Owens College, Manchester, and is to be of a popular character and suitable to a general audience. 2500*l.* has been left for not less than two Samuel Hall scholarships in chemistry; and 2500*l.* for not more than two Samuel Hall scholarships in

philosophy. The ultimate residue of the property is left to the Victoria University, Manchester, for John Hall scholarships in such scientific subjects and subject to such terms and conditions as the council of the University with the consent of Mr. Hall's trustees may approve.

PROF. W. M. BAYLISS, F.R.S., has been appointed university professor of general physiology in University College, London.

MR. A. CROMPTON, a research assistant at the Pasteur Institute, Paris, has been appointed a member of the staff of the Imperial Cancer Research Fund.

THE appointment of Dr. A. W. Mackintosh as Regius professor of medicine in the University of Aberdeen, in the place of Prof. D. W. Finlay, resigned, has been approved by the King.

MR. F. J. KEAN, lecturer in the department of civil engineering in the University of Leeds, has been appointed lecturer in machine designing and experimental engineering at McGill University, Montreal.

MR. F. J. LEWIS, demonstrator in botany and lecturer in geographical botany in the University of Liverpool, has been appointed professor of biology in the University of Alberta, Edmonton, Alberta, Canada.

IT has been decided to hold a Summer School of Geography in Yorkshire in August, 1913. The school is being promoted by the Universities of Durham, Leeds, and Sheffield, in co-operation with the County and County Borough Education Committees of Yorkshire. Further particulars will be announced later.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, July 29.—M. F. Guyon in the chair.—Jean **Escard**: An experimental contribution to the study of the formation of the lunar craters. Viscous substances, such as bitumen, resin, or mixtures of both, are heated after addition of a small quantity of water. The steam issuing from the pasty mass gives rise to well-marked crater-formed openings; a photographic reproduction of such an experiment is given.—André **Brochet**: The polarisation of electrodes. A study of the lines of equal potential in an electrolyte with bipolar electrodes.—A. **Berthaud**: An elementary demonstration of the law of mass action.—Eugène **Wourtzel**: The synthesis of nitrosyl chloride and the atomic weight of chlorine. A known weight of pure chlorine is treated with a slight excess of nitric oxide, the nitrosyl chloride formed is solidified at a low temperature, and the excess of nitric oxide removed. Five determinations of the ratio of Cl : NO are given, with a mean value of 1·18167, leading to an atomic weight of 35·460 for chlorine if O = 16, H = 1·00762, Ag = 107·88, and N = 14·008.—Mlle. Cécile **Spielrein**: The equilibrium of lithium sulphate and the alkaline sulphates in presence of their mixed solution.—Luigi **Norsa**: The electrical properties of the copper-zinc alloys. Measurements of the electrical conductivity, its temperature coefficient, and the thermo-electric power (against lead) of twenty-five alloys of copper and zinc. Diagrams of the results are shown, and those show discontinuities corresponding to the compositions CuZn, $CuZn_2$, and $CuZn_8$.—Wladmir **Smirnoff**: The thermal expansion of the alloys of aluminium and zinc.—Pierre **Jolibois**: The formula of organo-magnesium compounds and of magnesium hydride. The author adduces evidence in favour of the formula, MgR_2MgI_2, for the organo-magnesium compounds.—P. **Lemoult**: Leucobases and colouring matters derived from diphenylethylene; the oxidation by lead peroxide of the tetra-methyl-cyclohexylidene base.—E. **Doumer**: The treatment of arterial hypertension by electrification of the abdomen and the renal region.—Albert **Berthelot** and D. M. **Bertrand**: Contribution to the study of the toxic properties of β-imidoazoethylamine. This compound has proved to be much less toxic to the ape than to the guinea-pig, rabbit, or cat.—H. **Busquet** and M. **Tiffeneau**: The rôle of caffeine in the cardiac action of coffee. Caffeine is the principal agent of the cardiac action of coffee.—E. **Fauré-Frémiet**: Degenerative parthenogenesis in *Ascaris megalocephala*.—J. **Bridré** and A. **Boquet**: Anticlavelous vaccination with sensitised virus. The titration of the vaccine.—A. T. **Salimbeni**: The action of certain ethers of glycerol on the tubercle bacillus. A study of the action of mono-, di-, and tri-chlorohydrin upon the tubercle bacillus.—Ph. **Négris**: The age of the crystalline formations of the Peloponnesus.—G. **Massol**: The radio-activity of the mineral waters of Usson. The dissolved gases of the Usson springs consist almost entirely of nitrogen and the rare gases; they are radio-active, and their radio-activity is due to the radium emanation.—Prince B. **Galitzine**: The determination of the depth of an earthquake focus and of the velocity of propagation of seismic waves in the superficial layers of the earth's crust.—F. de Montessus de **Ballore**: The periods of Brückner and destructive earthquakes. There would appear to be no relation between the Brückner cycles and the number of earthquakes.

August 4.—M. F. Guyon in the chair.—Paul **Sabatier** and M. **Murat**: The preparation of the four dicyclohexylpropanes. These hydrocarbons have been prepared by the action of hydrogen in the presence of reduced nickel upon either the diphenylpropanes or the diphenylpropenes. Details are given of the intermediate compounds prepared, and of the physical and chemical properties of the dicyclohexylpropanes.—Paul **Suchar**: Invariant curves by a reciprocal transformation.—A. **Guillet**: The realisation of a uniform circular movement by a periodic synchronising action. The synchronisation is effected electrically, the ultimate control being a heavy pendulum.—C. **Dauzère**: The changes undergone by cellular vortices when the temperature is raised.—F. **Schwers**: Remarks on a note by P. T. H. Muller and Mlle. V. Guerdjikoff on the refraction and magnetic rotation of mixtures. These authors found that the magnetic rotation of binary mixtures was a linear function of the concentration, but that, for the index of refraction, the curve showed a marked discontinuity. The second conclusion is adversely criticised.—Daniel **Berthelot** and Henri **Gaudechon**: The photolysis of the sugars ketonic by sunlight and by ultra-violet light. Ketoses containing three, four, six, and seven atoms of carbon were used in the experiments. With sunlight, carbon monoxide was given off in all cases, the rapidity of gas evolution decreasing as the atomic weight of the sugar increased. With ultra-violet light, the reaction remained fundamentally the same, but was complicated by secondary reactions.—Marc **Landau**: The application of luminous energy to the study of some questions of chemical analysis. Prolonged exposure to ultra-violet light completely polymerises ethylene; methane, ethane, and hydrogen undergo no change under the same conditions, and these facts can be applied in the analysis of gaseous mixtures.—F. **Jadin**

and A. **Astruc**: Some quantitative determinations of manganese in plants. All the plants examined were found to contain manganese in small amounts.—C. **Gerber** and P. **Flourens**: The ferment in the latex of *Calotropis procera*. This proteolytic ferment resembles that obtained from belladonna and the diastase from decapod Crustacea.—H. **Jumelle** and H. Perrier **de la Bathe**. A new genus of palm in Madagascar.—A. **Guilliermond**: The mode of formation of the pigment in the root of the carrot.—Mme. and M. Victor **Henri**: The action of ultra-violet rays upon the organism.—Lucien **Vallery**: Study of the coagulation of albumen by heat and its precipitation by potassium iodomercurate. An attempt to base a quantitative method for the determination of albumen in serum and urine upon the precipitate formed with the double iodide of mercury and potassium.

NEW SOUTH WALES.

Linnean Society, June 26.—Mr. W. S. Dun in the chair.—Dr. S. J. **Johnston**: Some trematodes from Australian frogs. Sixteen species of frogs were examined for trematodes, in numbers ranging from a few in the case of rare species to hundreds in the case of common frogs. Ten species of these frogs yielded trematodes, of which fifteen species are described as new. These were examined alive, mounted in normal saline solution, stained and mounted as whole mounts, and by means of sections. The new species are:—(1) *Polystomum bulliense*, from the bladder of *Hyla phyllochroa*; (2) *Diplodiscus megalochrus*, from the rectum of *H. aurea* and *Limnodynastes peronii*; (3) *Diplodiscus microchus*, from the rectum of *H. ewingii* and *L. tasmaniensis*; (4) *Dolichosaccus trypherus*, gen. nov., sp. n., from the duodenum of *H. aurea* and *L. peronii*; (5) *Dolichosaccus ischyrus*, from the intestine of *H. caerula* and *L. dorsalis*; (6) *Dolichosaccus diamesus*, from the stomach of *H. freycineti*; (7) *Brachysaccus anartius*, gen. nov., sp. n., from the intestine and rectum of *H. aurea* and *L. peronii*; (8) *B. symmetrus*, from the rectum of *H. caerula*; (9) *Pneumonoeces australis*, from the lungs of *H. aurea* and *L. peronii*; (10) *Gorgodera australiensis*, from the bladder of *H. aurea* and *L. peronii*; (11) *Mesocoelium mesembrinus*, from the duodenum of *H. coerulea*; (12) *M. oligoon*, from the intestine of *H. citropus*; (13) *M. megaloon*, from the duodenum of *H. ewingii*; (14) *Pleurogenes freycineti*, from the duodenum of *H. freycineti*; (15) *Pleurogenes solus*, from the intestine of *H. aurea*.—Dr. V. F. **Brotherus** and Rev. W. W. **Watts**: The mosses of the Yarrangobilly Caves District, N.S.W. Ten new species are described; and, of the other species enumerated, many are new to New South Wales. The principal feature of the collection is the evidence it supplies of affinity to the Tasmanian flora, and to that of the Australian Alps.—Rev. W. W. **Watts**: The sphagna of Australia and Tasmania.

CAPE TOWN.

Royal Society of South Africa, May 15.—Mr. L. Péringuey, president, in the chair.—T. **Stewart**: The rainfall on Table Mountain for thirty years.—Prof. A. **Young**: Tidal phenomena in wells near Cradock.

BOOKS RECEIVED.

An Essay on Hasheesh, including Observations and Experiments. By V. Robinson. Pp. 83. (New York: "Medical Review of Reviews.") 50 cents.

Das Klima. By Dr. E. Alt. Pp. 136. (Leipzig: P. Reclam, jun.) 1.50 marks.

A First Book of General Geography. By B. C. Wallis. Pp. viii+151. (London: Macmillan and Co., Ltd.) 1*s*. 6*d*.

Our Cavalry. By Major-General M. F. Rimington. Pp. xii+224. (London: Macmillan and Co., Ltd.) 5*s*. net.

The Standard of Value. By Sir D. Barbour. Pp. xvi+242. (London: Macmillan and Co., Ltd.) 6*s*. net.

Der energetische Imperativ. By W. Ostwald. Erste Reihe. Pp. iv+544. (Leipzig: Akademische Verlagsgesellschaft m.b.H.) 9.60 marks.

The Evolution of the Vertebrates and their Kin. By Prof. W. Patten. Pp. xxi+486. (London: J. and A. Churchill.) 21*s*. net.

Intermediate Physics. By Prof. W. Watson. Pp. xv+564. (London: Longmans and Co.) 6*s*. net.

Physiography for High Schools. By A. L. Arey, F. L. Bryant, W. W. Clendenin, and W. T. Morrey. Pp. vi+449. (Boston, New York, and Chicago: D. C. Heath and Co.; London: G. G. Harrap and Co.) 4*s*. 6*d*.

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