THURSDAY, FEBRUARY 15, 1906.

## BIOLOGICAL HERESIES.

*The Nature and Origin of Living Matter.* By Dr. H. Charlton Bastian, F.R.S. Pp. 344; with 245 illustrations from photomicrographs. (London: T. Fisher Unwin, 1905.) Price 12*s.* 6*d.* net.

DR. H. CHARLTON BASTIAN re-expounds his well known biological heresies with a vigour and industry worthy of a better cause. The first heresy is that "*archebiosis*" is a present occurrence, that is, that living organisms may here and now arise from non-living materials. What seems to most biologists so difficult to conceive with any concreteness, that their evolutionist faith is strained a little to believe it may have occurred *once* long ago, may be seen occurring any day in this veteran experimenter's laboratory. What Pasteur looked out for in vain for a score of years has been revealed to Bastian's persistent patience. The second heresy is that "*heterogenesis*" is not infrequent, that is, that a living creature may give rise to alien offspring, to organisms quite different from itself, it may be belonging to a different class altogether. Against the fact of the persistence or continuity of hereditary resemblance we are accustomed to balance the fact of variation; but now we are asked to make room for what is more than the most convinced believer in mutations or transilience ever dreamed of, namely, such facts of heterogenesis as the production of infusorians from a rotifer's egg. Our convictions as to the specific plasmic architecture of different forms of life, our difficulty in imagining how chlorophyll corpuscles can become a swarm of sun-animalcules, must be corrected, like other prejudices, by facing the facts. To ignore these is the worst form of *ignorantia elenchi* of which scientific students can be guilty. If nature's method includes the hop, step, and leap phenomena, which this book describes at great length, what can excuse the blindness of those who persist that evolution is like a snail's continuous crawl?

To see what Dr. Bastian interprets as archebiosis, we are recommended to take an infusion of turnip or fresh beef, to filter this through two layers of the finest Swedish paper, to let a drop fall on a cleaned microscope slip, to put a cover-glass on, to remove excess of fluid with blotting-paper, to allow one or more air-bubbles to remain in the film, to seal up with melted paraffin wax, to fix upon a clear space free from particles near an air-bubble, to incubate at blood-heat for two or three hours, and to await events. The expected happens—multitudes of living particles appear. How can we account for their origin? Three hypotheses present themselves, (*a*) that they have arisen through the reproductive multiplication of one or more germs that had escaped observation in the film; (*b*) that they have developed from a multitude of diffusely disseminated *invisible* germs; or (*c*) that they have been produced *de novo* in the fluid by a process of archebiosis. The author argues that the third interpretation is the true one. One of the arguments is based on the uniformity of nature:—

"To assume, as the great majority of Evolutionists do, that Archebiosis, or the natural origin of living matter, took place once only in the remote past and that it has not been repeated, or if repeated in past times, that it no longer goes on, is to look upon this process as a kind of natural miracle, and to postulate a break in continuity which ought only to be possible in the face of overwhelming evidence of its reality. This latter is, however, as I contend, altogether absent to anything like an adequate extent."

This kind of argument applied to other great events in evolution has the advantage of fostering an expectant attitude. Nature may be repeating herself oftener than we think.

Many of us have made flask experiments with super-heated organic fluids, which remained sterile for years without any hint of archebiosis; but, of course, these experiments only prove that living organisms do not arise under these severe conditions. We must give archebiosis a chance, and unluckily that chance usually means either an open door to infection or imperfect sterilisation. But the surer work we make with sterilisation, the greater likelihood is there of our destroying what Dr. Bastian calls the *germinality of the fluids*. When organisms do *not* appear in the sterilised medium the sceptical experimenter says "Biogenesis is confirmed," whereas he ought to say "Unluckily, I have destroyed the germinality of good archebiotic material." When organisms *do* appear in the sterilised medium the sceptical experimenter says "What an ass I am!" but if he were not so slow of heart to believe, he should say "Archebiosis for ever."

As to the original archebiosis in free nature, the author makes the suggestion that nitrate of ammonia (or nitrite?), which is formed in the atmosphere in thunderstorms and brought down by the thunder shower, may have played an important part in the mixture of ingredients in which protoplasm was first synthesised.

Dr. Bastian's patient experiments on heterogenesis raise, as it seems to us, some interesting questions concerning the variability of minute organisms, the phases in the life-history of many forms which are very inadequately known, the occurrence of "latent germs" in the interior of healthy fruits and animal organs, and so on. But we are too bigoted to believe that diatoms can be produced by the transformation of the cells of an unrelated alga, that anabena or actinophrys or amœbæ can arise from chlorophyll corpuscles, that the eggs of a fly may be transformed into infusorians, or that several different kinds of ciliata may arise from the eggs of one and the same rotifer. While all this is incredible to us because it is magical and unmeaning—incongruous with our experience of nature's workings—the difficulty is to interpret what Dr. Bastian saw and photographed. We venture the suggestion that in some of the egg-experiments he may have been on the track of ovivorous parasites such as are known to infest the eggs of some aquatic insects.

While we must stand aloof from Dr. Bastian's heresies, we cannot but admire his dogged support of what seems to us a lost cause. It is something to stand *unus contra mundum* with no loss of courage or of good humour. We also sympathise with some of the positions which the author maintains in the introductory part of his book, *e.g.* as to the innate or intrinsic variability of living matter, and as to the importance of discontinuous variations or mutations. There is also much vigorous criticism of Weismann's last volume, "The Evolution Theory," and a defence of Spencer's concept of "physiological units" as against Weismann's "determinants." But when, in regard to the transmission of modifications, Dr. Bastian says that "Weismann frankly admits the whole point in dispute—namely, that *acquired characters can be, and are, frequently inherited,*" we must express our surprise at what seems to us an extraordinary misunderstanding. J. A. T.

## *A STANDARD TREATISE ON PHYSICS.*

*Lehrbuch der Physik.* By O. D. Chwolson. Vol. iii. Translated into German by E. Berg. Pp. xi+988; illustrated. (Brunswick: Vieweg und Sohn, 1905.) Price 16 marks.

*Traité de Physique.* By O. D. Chwolson. Translated from the Russian and German editions into French by E. Davaux, with Notes on Theoretical Physics by MM. E. and F. Cosserat. Vol. i., part i., pp. xiii+407; vol. ii., part i., pp. vii+202. (Paris: A Hermann, 1906.) Price 16 francs and 6 francs respectively.

THE first two volumes of this important translation from Russian into German have already been noticed in these columns. The present volume embraces the science of heat, including thermodynamics. The treatment throughout is most admirable both for accuracy and lucidity, and the treatise may be expected to become generally known in this more accessible shape. Each chapter is followed by copious references to original sources of information; these are divided into sections numbered according to the parts of the text to which they relate; they constitute a valuable summary of the most important memoirs, especially as they include quite recent work as well as the earlier work which formed the foundation of the science of heat. The illustrations are excellently done.

Besides the phenomena which are usually described in a treatise on physics (thermometry, expansion, thermal capacity, laws of cooling, conductivity, general thermodynamics, and equations of state), chapters are to be found here on thermochemical investigations and the theory of solutions, including the phase rule. These are not in any way skimped. An outline of everything that is worth knowing seems to be included. The matter is not served up in a haphazard manner; but the relative value of different investigations is well brought out by the amounts of space which are devoted to them. The book is a happy mixture of theory and practice. For example, while a delightfully clear explanation is given of the meaning of the various partial differential coefficients which arise in theoretical thermodynamics, there is also given one of the very few existing correct accounts of the implication of the Joule-Thomson experiment.

The methods of Planck are followed in connection with thermodynamics. The play of entropy in irreversible transformations is made very clear; a student, by its perusal, could hardly fail to get nearer to a true conception of the nature of such processes.

The results of an investigation are not merely summed up in a formula; in most cases a table of experimental data upon which the formula is based is also provided. This, of course, is as it should be, for it puts the reader at once in touch with the actual experiment, and differentiates the volume from a mere collection of physical tables.

Altogether, we do not hesitate to say that the three volumes form as satisfactory a treatise on the part of physics to which they relate as we have ever met with. They are to be followed by a fourth volume on electricity and magnetism.

In the translation into French both the Russian and German editions are made use of, while additional notes on theoretical physics are added by MM. E. and F. Cosserat, the former of whom is a professor in the University of Toulouse. This also will appear in four volumes; the present instalment consists of parts of the first two. The additional notes will be kept quite distinct from the main text. One such note (consisting of 37 pages) now appears on the dynamics of a particle and of a rigid body. This is an attempt to re-state the principles of mechanics in such a way as to remove the difficulties pointed out by M. Poincaré in the application of mechanical principles to natural phenomena. These difficulties arise, according to Poincaré, from a too faithful application to all phenomena of the theory of the astronomical universe. The system of mechanics expounded is in general based on energetics, but a wider form than usual is given to this principle. It is impossible to criticise the theory presented until the remaining notes bearing on it have appeared.

With regard to the French edition in general we are very well pleased, and we look forward to its completion, for there are many to whom it will prove more welcome than its German equivalent. The treatise bids fair to prove itself the leading text-book of physics for general use.

## *CLIMBS IN WESTERN CANADA.*

*In the Heart of the Canadian Rockies.* By James Outram. Pp. 466; with maps and 46 illustrations. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1905.) Price 12*s.* 6*d.* net.

IN the "Apology" with which this volume is prefaced, the author tells how he went to the mountains during a part of three summers to recuperate from mental overstrain, and states that he has been hampered by the same disability in preparing his book. Nevertheless, he has succeeded in producing a useful piece of work, which brings together an account of all that has been accomplished in the

Canadian Rockies by himself and by other kindred spirits.

Though essentially and avowedly a mountain-climber's book, it incidentally places before the reader much information regarding the physical geography of an imperfectly known region that is full of interest. The author's sympathy in the natural beauty of this magnificent country is expressed simply and moderately, and his descriptions therefore, though not particularly vivid, ring true. The aim and effort of his toilsome journeyings was ever to reach the mountain-tops—preferably the tops hitherto untrodden—and all other considerations were subordinate to this desire. How difficult often was the attainment, and yet how great was his success, is faithfully chronicled in these pages. Along the main chain of the Rockies—those huge stratified wedges left by Nature's Quarriers to show how much has been excavated—from Mount Columbia (12,500 feet) in the north to Mount Lefroy (11,290 feet) in the south, and also on the crests of the Ottertail Range outstanding to the west—Mr. Outram and his Swiss guides have scored their innocent conquests and have brought back increased knowledge of forests, glaciers, snow-fields, and craggy peaks.

By conveniently interweaving in his narrative full extracts from the records of other explorers, the author enables us to recognise the salient features of this wilderness of mountains, and in so doing to increase our sense of enjoyment in them. For, as the author has noted, it is curious how, when confronted by some wide and novel prospect, we instinctively search for some feature already known, upon which our new perceptions may form themselves; and great is the relief to our confused senses as soon as a recognisable point is found. In mountain scenery, lack of familiarity usually implies also lack of that knowledge of distances and heights which is an essential ingredient to the full impressiveness of the prospect: for it is not the low-angled picture in the eye, but the interpretation of it, that stirs emotion. The ancients did not know their mountains well enough to appreciate them.

For the same reason it is essential that mountains should have names; but it seems deplorable that almost all the peaks of the Canadian Rockies should have had meaningless personal names attached to them. Better the most tongue-twisting native term or the most bizarre appellation of the backwoodsman! Yet it must be admitted that we agree with the author in desiring something less cumbrous than "The West Branch of the North Fork of the North Saskatchewan" as the name for a stream!

The book is well illustrated by reproductions from photographs of many of the mountains and other striking features in the scenery of the region. But photographs of this kind, and still more the process-illustrations prepared from them, yield only a feeble image, useful perhaps as a reminiscence to anyone who has experienced the scene, but always unsatisfying.

By an evident oversight, no scale is attached to the two maps interleaved in the text, though these are not on the same scale as the folder at the end of the volume. And is it by accident or design that the seven-line quotation of Sir Edwin Arnold's verse which is given at the beginning of the first chapter of the book is repeated, with a slight variation, at the end of the last chapter? G. W. L.

## SCIENCE AND ART OF CARPENTRY.

*A Manual of Carpentry and Joinery.* By J. W. Riley. Pp. viii+500. (London: Macmillan and Co., Ltd., 1905.) Price 6*s.* net.

THIS is a handy little volume on a well-worn subject, about which there are many works extant, but it contains a good deal of useful information for the student in one of the noblest of the crafts. It was Lord Avebury who compared wood to metal, and dwelt on the higher qualities of the former material as a field for the perpetuation of the more enduring forms of art.

The present manual, besides dealing with the various operations of the carpenter, starts with the consideration of geometry, mensuration, and mechanics as a necessary preliminary for his education if he would work with benefit to himself and his employers. The qualities of various kinds of timber, its structure and growth, method of conversion, defects, and preservation are explained. Chapters on plane and solid geometry and mensuration in relation to carpentry follow, and these are probably the best chapters in the book, because of their importance to the student in their relation to the craft.

The chapter on tools is well illustrated—saws, planes, chisels, gouges and centre bits being shown. The inclusion of wood-working machinery is an innovation which will be welcomed because of the increasing importance of machinery in these days. This chapter is also well illustrated with woodcuts of sufficiently large size to render them useful and explanatory. In fact, although some might say that machines are hardly a part of a student's education, we think the author is right in including them, and it certainly is a novel feature in a text-book for elementary students. Joints and fastenings in floors, roofs and beams, dovetails of various forms used in joinery, and keying and clamping are then described.

The various kinds of wooden floors, the method of "trimming" round fireplaces, and the joints of different kinds between floor boards are also dealt with. We should like to have seen a condemnation of the usual system of constructing floors with a hollow space between floor boards and plaster ceiling, forming a series of continuous dustbins for the collection of filth of all kinds. Many architects frequently omit the plaster ceiling altogether.

The usual types of wooden roofs and trusses and the method of finding bevels for rafters at different inclinations, the different kinds of partitions, scaffolding, jib cranes, shoring of buildings, are all parts of the craft which Mr. Riley has carefully explained with illustrations. The chapter on the mechanics of carpentry and the theory of the parallelogram of

forces, the use of a polar diagram and its application to weighted beams are clearly set out.

Door and panelled framing, revolving vestibule doors, hinges and locks, and the different varieties of windows, sash or casement are explained and illustrated. We cannot understand why writers on the subject are always content to show window frames "in reveal" when they appear to so much better advantage only slightly set back from the face of the wall, as in "Queen Anne" and "Georgian" architecture, and as carried out by so many of the best architects of to-day.

There are also chapters on roof lights and conservatories, staircase work and handrailing, and workshop practice, together with summaries and questions from papers set at the City and Guilds examinations in the subject.

## OUR BOOK SHELF.

*Die Explosivstoffe mit besonderer Berucksichtigung der neuren Patente die Schiessbaumwolle (Nitrocellulosen).* By Dr. Richard Escales. Pp. viii+308. (Leipzig: Veit and Co.) Price 10 marks.

THIS is the second volume of a series of special works on explosives. Although the first volume on "Gunpowder and Similar Mixtures" was issued as recently as 1904, it has been found necessary to prepare a new edition, and doubtless the first edition of the volume under consideration will soon be exhausted. The whole series when completed should form a valuable reference work on all subjects relating to explosives.

The book is thoroughly up to date, and reference will hardly be in vain for any information either as to details of manufacture or the more purely scientific questions relating to nitrocellulose or closely allied bodies. The testing of guncottons to determine their stability and the influence of methods of preparation on this have received a great deal of attention during the last three or four years, since it is generally recognised that the older stability tests are often unsatisfactory when taken alone. The author has collected and arranged in excellent form all possible information on this important matter up to quite a recent date.

Special reference is made to new patents, and this information will be of great service to those engaged in the manufacture of this important class of bodies.

J. S. S. B.

*Lehrbuch der technischen Physik.* By Prof. Hans Lorenz. Zweiter Band, Technische Warmelehre. Pp. ix+544. (Munchen: R. Oldenbourg, 1904.)

THE first volume of this text-book, dealing with the mechanics of solids, appeared some three years ago. It was to have been followed by a volume on hydromechanics, but this has been delayed to include later developments, and its place has been taken by the present volume on heat, which was originally intended to come third in the series. The general scope of the book is similar to that of the first volume. It is not a "technical" handbook as we understand it. There are no descriptions or figures of machines, or even of instruments for measurement. There are no details of experimental methods, nor any mention of precautions necessary for securing accurate results. The whole work is as purely theoretical as any Cambridge mathematical text-book; but the theory is limited to such parts of the subject as have practical applications, with a few numerical tables introduced here and there for the comparison of the equations with experimental results. Such a book might be written by anyone of sufficient mathematical ability without any practical knowledge of the subject, and might be thoroughly assimilated by the student without imparting to him any power of applying the theory to a practical case. One cannot help feeling that, in a subject where so much depends on experiment, and for the technical student who wishes to learn how to apply his knowledge, the utility of the book would be greatly enhanced by a judicious admixture of practice with the theory.

From the purely theoretical standpoint there are many details which are open to criticism. Empirical and theoretical formulæ are in places so interwoven that the student would find it very difficult to disentangle the theory from the consequences of some purely empirical assumption. Though one would certainly hesitate to recommend the book to the technical student wishing to learn how to apply the theory, it might provide him with a useful kind of mental discipline, and prove a good antidote to the more common kind of technical treatise in which experimental results are reduced to a series of purely empirical and often theoretically inconsistent formulæ.

H. L. C.

*The Making of East Yorkshire: a Chapter in Local Geography.* By T. Sheppard. Pp. x+29; 4 plates. (London: Brown and Son, 1906.) Price 1*s*.

THE teachers of Yorkshire are blessed by nature with an environment of abounding interest; added to this they have, what is equally to their advantage, a goodly supply of able exponents of nature's beauties, amongst whom the author of this brochure takes a worthy place.

Mr. Sheppard gives a clear account of the geological vicissitudes through which east Yorkshire has passed from Liassic to recent times. He has naturally selected the salient points, but a word or two about the conditions which governed the deposition of some of the argillaceous deposits would have resulted in a better balanced story. The imaginative reader who attempts to visualise the statement at the foot of p. 20 will be presented with an awesome and none too truthful picture—but this is quite a small matter.

Every teacher in east Yorkshire should possess a copy of the pamphlet; and it would be an excellent thing if our other counties could each be supplied with a similar sketch of their geological history.

J. A. H.

*Jahrbuch der Chemie.* Edited by Richard Meyer. Pp. xii+589. (Brunswick: Vieweg und Sohn, 1905.) Price 16*s*.

WE have previously had occasion to commend Meyer's "Jahrbuch" to English readers, and the new volume compares favourably with its predecessors.

That lucidity in some of the abstracts is sacrificed to brevity naturally follows from the vast amount of information which is compressed into a limited space; after all, one valuable feature of a year-book is the completeness of its references. It has been previously observed that the "Jahrbuch" has a distinctly German bias, which, perhaps, cannot be entirely repressed, but scarcely excuses the omission in the present volume of references to certain foreign memoirs of the first importance.

An apology for its late appearance accompanies the volume, and we are led to infer that the delay may have been occasioned in some measure by the regrettable loss of Dr. Bodländer from the staff of contributors, whose place, it may be added, on the section of physical chemistry is now taken by Dr. A. Coehn.

J. B. C.

*Elements of Applied Microscopy.* By Charles-Edward Amory Winslow. Pp. xii + 183. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1905.) Price 6*s.* 6*d.* net.

THIS little book is planned on novel lines, and contains a good deal of information in a small compass. As it is primarily intended for class use, practical details are briefly dealt with, and more space is thus available for descriptions of the various objects which the microscopist is intended to study. The first three chapters deal with the theory, construction, and manipulation of the microscope, and the preparation and mounting of objects. Next, micrometry and the camera lucida are described, and the subsequent chapters are devoted to the microscopy of starches, of foods and drugs and their adulterants, the examination of textile fibres and of paper, forensic microscopy, microchemistry, and petrography and metallography. Sufficient information is given to stimulate the student's powers of observation and desire for further knowledge. The chapter on the microscopy of paper is a particularly good one. Altogether the book should usefully fulfil the object for which it has been written.

*Auslese aus meiner Unterrichts- und Vorlesungspraxis.* By Dr. H. Schubert. Zweiter Band. Pp. 218. (Leipzig: Göschen, 1905.) Price 4 marks.

THIS is a very entertaining instalment of Prof. Schubert's lectures. The first section deals with triangles having rational sides and areas, pyramids with rational edges and volumes, and similar subjects. Tables and formulæ are given which will be useful to those who wish to set neat numerical exercises in trigonometry and mensuration. Section ii. is devoted to continued fractions, the Pellian equation, expression of an integer (when possible) as the sum of two squares, and so on. Section iii. is on the elementary calculation of logarithms, and forms a supplement to a similar chapter in the first volume.

## 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.*]

### Secondary Röntgen Rays and Atomic Weight.

IN papers on secondary Röntgen radiation and polarised Röntgen radiation I have shown that all the phenomena of secondary radiation (as indicated by an electroscope placed several centimetres from the radiator) may, from substances of low atomic weight, be accounted for by considering the corpuscles or electrons constituting the atoms, to be accelerated in the direction of electric displacement in each primary Röntgen pulse as it passes through such substances, and that the interaction between the corpuscles affects only to a small extent the character of the secondary radiation proceeding from the substance. In light atoms there is almost complete independence of motion of the corpuscles within the limits of disturbance produced by all primary beams experimented upon.

It was also shown (NATURE, March 9, 1905) that this independence of motion disappears in heavier atoms in which there may be conceived to be a more intimate relation between the corpuscles, inter-corpuscular forces being brought into play which have the effect of widening the secondary pulses and producing accelerations in the corpuscles in directions other than those of electric displacement in the primary pulse. Until recently I have been unable to make experiments on a sufficient number of elements of higher atomic weight to arrive at any law connecting the penetrating power of the secondary radiation with the atomic weight of the radiator. Recent investigation has, however, shown that beyond the region of atomic weights in which the character of secondary radiation is almost independent of the nature of the radiator, the absorbability of the radiation is a periodic function of the atomic weight, the periodicity agreeing so far as these experiments have gone with the periodicity in chemical properties.

A detailed account of these results will be published shortly.

They, however, afford striking evidence of a connection between chemical properties and distribution of corpuscles in the atom, such as Prof. J. J. Thomson suggests in his conception of the constitution of the atom; for the character of the secondary radiation set up by a given primary can only, according to the theory which has been shown to account for all the phenomena I have hitherto observed, be affected by the relation between the radiating corpuscle and its neighbours.

The results also suggest a method of determining atomic weights by interpolation, for a small variation in atomic weight is usually accompanied by a very considerable change in absorbability of the secondary radiation, and though in these experiments great accuracy has not been essential, it appears that in many regions a variation of atomic weight by much less than 1 would be indicated.

The experiments are being continued.

CHARLES G. BARKLA.

University of Liverpool, February 9.

### The Falkland Island Fox.

IN a review in the current number of NATURE of Mr. Renshaw's "Some Mammalian Types," reference is made to the "Antarctic wolf of the Falkland Islands exterminated by the sheep farmers in self defence." Might I be permitted to add a word on this subject in correction of an erroneous impression current among many naturalists with regard to this animal? During a visit to the Falkland Islands in 1903, and again in 1904, I made careful inquiries with regard to the native wolf or fox. The oldest sheep farmers in the islands, men who remembered when the fox was still plentiful, insisted that it was quite a mistake to credit it with attacking sheep; this never occurred, and the reason that the farmers waged war against the foxes was because the sheep, apparently mistaking them for dogs, especially at night, in their terror ran into the bogs and swamps which abound in the islands and were consequently lost. None of the farmers whose experience went back to the time of these foxes had any memory of sheep being killed or even mauled by them. In making this correction, I must say that I have not seen Mr. Renshaw's book, and consequently do not know what reason he attributes for the extermination of the fox.

R. N. RUDMOSE-BROWN.

Scottish National Antarctic Expedition, Edinburgh, February 10.

### Chinese Names of Colours.

ON the interesting observation on Chinese names of colours of Mr. H. Crook, in NATURE (January 11), I would add this little information. Prof. Giles in his great dictionary gives (No. 4845) 雪青 as "a very light violet colour"; Wells Williams (p. 820) as "a purple colour." Mr. de Zelinski and Clémence Royer, in an interesting note "Sur les noms des couleurs en japonais" ("Congrès internat. des Orientalistes, Compte rendu de la 1ère session, Paris, 1873, vol. i., pp. 83–87), give another example, in Japanese, of the same kind.

浅葱 (*asagi*), literally "*a light yellow*," signifies, following Prof. de Rosny, "*bleu de ciel*"! Mr. Hepburn, in his Japanese dictionary, fifth edition, Tokyo, 1894, renders the same expression by "*a light green or pale colour.*"

Analogous oddities can also be found in European languages, as the French "*azur cendré*," or "*une rose* (the flower) *jaune*," &c.

GIOVANNI VACCA.

Firenze, Via Ricasoli 49, Italy.

## NOTES ON SOME CORNISH CIRCLES.

### *The Merry Maidens, Lat. 50° 4′ N.*

NE of the best preserved circles that I know of is near Penzance. It is called the Merry Maidens [1] (Dawns-Maen), and is thus described by Lukis [2] (p. 1):—

"This very perfect Circle, which is 75 feet 8 inches in diameter, stands in a cultivated field which slopes gently to the south.

"It consists of 19 granite stones placed at tolerably regular distances from each other, but there is a gap on the east side, where another stone was most probably once erected.

"Many of the stones are rectangular in plan at the ground level, vary from 3 feet 3 inches to 4 feet in height, and are separated by a space of from 10 to 12 feet. There is a somewhat shorter interval between four of the stones on the south side.

"In the vicinity of this monument are two monoliths called the Pipers; another called Goon-Rith; a holed stone (not long ago there were two others); and several [5] Cairns."

Photo. by Lady Lockyer.

FIG. 1.—The Merry Maidens (looking East).

Lukis thus describes "the Pipers":—

"Two rude stone pillars of granite stand erect, 317 feet apart, and about 400 yards to the north-east of the Circle of Dawns-Maen. No. 1 is 15 feet high, 4 feet 6 inches in breadth, and has an average thickness of 22 inches, and is 2 feet 9 inches out of the perpendicular. The stone is of a laminated nature, and a thin fragment has flaked off from the upper part. No. 2 is 13 feet 6 inches high, and is much split perpendicularly. At the ground level its plan in section is nearly a square of about 3 feet."

Goon-Rith is next described:—"No 3 is naturally of a rectangular form in plan, and is 10 feet 6 inches in height. The land on which it stands is called Goon-Rith, or Red Downs. The upper part of the stone is of irregular shape."

Borlase, in his "History of Cornwall" (1769), only mentions the circle, but W. C. Borlase in his "Nænia Cornubiæ" (1872) gives a very rough plan including the stones before mentioned and several barrows, some of which have been ploughed up.

At varying distances from the circle and in widely different azimuths are other standing stones, ancient crosses and holed stones, while some of the barrows can still be traced.

The descriptions of the locality given by Borlase and Lukis, however, do not exhaust the points of interest. Edmonds [1] writes as follows:—

"A cave still perfect . . . is on an eminence in the tenement of Boleit (Boleigh) in St. Buryan, and about a furlong south-west of the village of Trewoofe (Trove). It is called the 'Fowgow,' and consists of a trench 6 feet deep and 36 long, faced on each side with unhewn and uncemented stones, across which, to serve as a roof, long stone posts or slabs are laid covered with thick turf planted with furze. The breadth of the cave is about 5 feet. On its north-west side, near the south-west end, a narrow passage leads into a branch cave of considerable extent, constructed in the same manner. At the south-west end is an entrance by a descending path; but this, as well as the cave itself, is so well concealed by the furze that the whole looks like an ordinary furze break without any way into it. The direction of the line of this cave is about north-east and south-west, which line, if continued towards the south-west, would pass close to the two ancient pillars called the Pipers, and the Druidical temple of Dawns Myin, all within half of a mile."

This fougou is situated on a hill on the other side of the Lamorna Valley, near the village of Castallack, and the site of the Roundago shown in the 1-inch ordnance map.

Borlase [2] says that many similar caves were to be seen "in these parts" in his time, and others had been destroyed by converting the stones to other uses.

There is evidence that the circle conditions at the Merry Maidens were once similar to those at Stenness, Stanton Drew, the Hurlers, Tregaseal, and Botallack, that is that there was more than one, the numbers running from 2 to 7. Mr. Horton Bolitho, without whose aid in local investigations this paper in all probability would never have been written, in one of his visits came across "the oldest inhabitant," who remembered a second circle. He said, "It was covered with furze and never shown to antiquarians"; ultimately the field in which it stood was

[1] I may here remark that "9 maidens" is very common as a name for a circle in Cornwall. It is a short title for 19 maidens. Lukis implies that Dawns-Maen once consisted of 20 stones. If all the circles followed suit it would be interesting to note if the present number of 19 is always associated with a gap on the eastern sides. The "pipers" are, of course, the musicians who keep the maidens merry, as does the "blind fiddler" at Boscowen-un Circle.

[2] "Prehistoric Stone Monuments, Cornwall."

[1] "The Land's End District," p. 46. [2] "Antiquities," p. 274.

ploughed up and the stones removed. It is to prevent a similar fate happening to the "Merry Maidens" themselves that Lord Falmouth will not allow the field in which they stand to be ploughed, and all antiquarians certainly owe him a debt of gratitude for this and other proofs of his interest in antiquities. Mr. Bolitho carefully marked the site thus indicated on a copy of the 25-inch map. I shall subsequently show that the circle which formerly existed here, like the others named, was located on an important sight-line.

Mr. Horton Bolitho was good enough to make a careful examination of the barrows A and B of Borlase.[1] In A (S. 69° W.) he found a long stone still lying in the barrow, suggesting that the barrow had been built round it, and that the apex of the barrow formed a new alignment. In B there is either another recumbent long stone or the capstone of a dolmen. This suggests work for the local antiquarians.

I should state that there may be some doubt about barrow A, for there are two not far from each other with approximate azimuths S. 69° W. and S. 64° W. The destruction of these and other barrows was probably the accompaniment of the reclamation of waste lands and the consequent interference with antiquities which in Cornwall has mostly taken place since 1800.

But it did not begin then, nor has it been confined to barrows. Dr. Borlase in his parochial memoranda under date September 29, 1752, describes a monolith 20 feet above ground, and planted 4 feet in it, the "Men Peru" (stone of sorrow) in the parish of Constantine. A farmer acknowledged that he had cut it up, and had made twenty gate-posts out of it.

My wife and I visited the Merry Maidens at Easter, 1905, for the purpose of making a reconnaissance. Mr. Horton Bolitho and Mr. Cornish were good enough to accompany us.

On my return to London I began work on the 25-inch Ordnance map, and subsequently Colonel R. C. Hellard, R.E., director of the Ordnance Survey, was kind enough to send me the true azimuths of the Pipers. In October, 1905, Mr. Horton Bolitho and Captain Henderson, whose help at the Hurlers I have already had an opportunity of acknowledging, made a much more complete survey of the adjacent standing stones and barrows.

In this survey they not only made use of the 25-inch map, but of the old plan given by W. C. Borlase dating from about 1870. Although the outstanding stones shown by Borlase remain, some of the barrows indicated by him have disappeared.

In January, 1906, my wife and I paid other visits to the monuments, and Mr. Horton Bolitho was again good enough to accompany us. Thanks to him permission had been obtained to break an opening in the high wall-boundary which prevented any view along the "Pipers" sight-line. I may here add that unfortunately in Cornwall the field boundaries often consist of high stone walls topped by furze, so that the outstanding stones once visible from the circles can now no longer be seen from them; another trouble is that from this cause the angular height of the sky-line along the alignment cannot be measured in many cases.

I will now proceed to refer to the chief sight-lines seriatim. The first is that connecting the circle which still exists with the site of the ancient one. On this line exactly I found four points, a barrow (L) which Borlase had missed (further from the circle than his barrow A), the site, the present circle, and the fougou; azimuth from centre of circle N. 64° E. and S. 64° W. This is the May year line found at Stonehenge, Stenness, the Hurlers and Stanton Drew.

In connection with this there is another sight-line which must not be passed over; from the circle the bearing of the church of St. Burian is about N. 64° W.; like the fougou it is situated on a hill, and near it are ancient crosses which I suspect were menhirs first and crosses afterwards.[1] However this may be, we see in this azimuth of 64° three times repeated that the May and August sunrises and sunsets and the February and November sunsets were provided for.

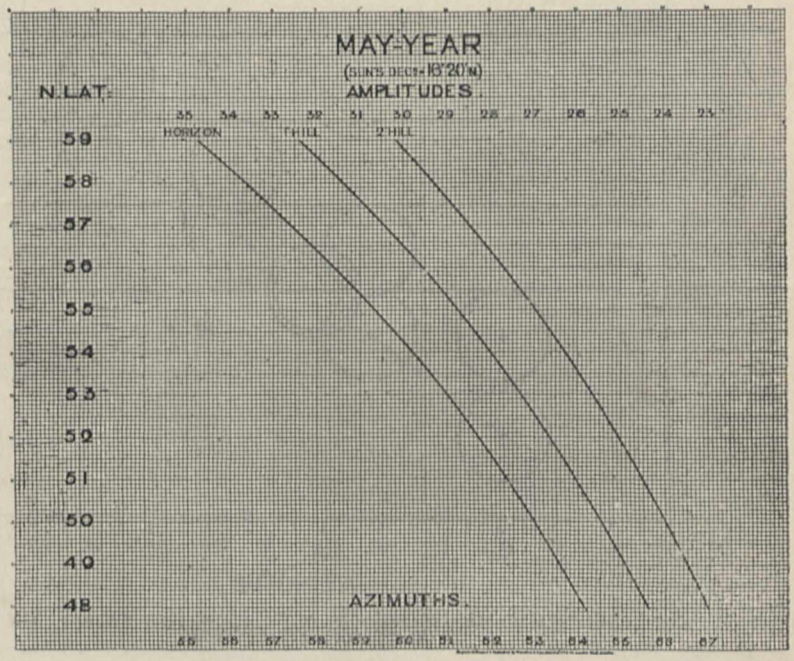



FIG. 2.—The place of the May sunrise in British latitudes.

With regard to the other sight-lines I will begin with that of the Pipers as it is quite obviously connected with the eastern circle only; the stones could not have been seen from the other on account of rising ground. The barrow shown in this direction by Borlase has now entirely disappeared, and the earth has evidently been spread over the surrounding field; its surface is therefore higher than formerly, so that when the opening was made in the wall the top of the nearest piper could not be seen from the centre of the circle; an elevation of about 2 feet from the

[1] "Nænia," p. 214.

[1] In A.D. 658 a council assembled at Nantes decreed:—"As in remote places and in woodlands there stand certain stones which the people often worship, and at which vows are made, and to which oblations are presented—we decree that they be all cast down and concealed in such a place that their worshippers may not be able to find them."

"Now the carrying out of their order was left to the country parsons, and partly because they had themselves been brought up to respect these stones, and partly because the execution of the decree would have brought down a storm upon their heads, they contented themselves with putting a cross on top of the stones."—"Book of Brittany," by Baring-Gould, p. 20.

ground level was necessary. Walking straight from the circle to the first piper, the second piper was exactly in a line, though at a much lower level. This showed that the ordnance values were not quite accurate, which was not to be wondered at as no direct observation had been possible. I therefore adopted the mean of the ordnance values as the true azimuth :—

| | | | |
|---|---|---|---|
| Piper 1.—N. | 37° | 58′ | 36″ E. |
| Piper 2.— | 38 | 52 | 36 |
| Mean ... ... | 38 | 25 | 36 |

The sky-line from the centre of the circle was defined by the site of the vanished barrow, angular elevation 20′, and it is highly probable that the function of the barrow when built was to provide a new sight-line when the star-rise place was no longer exactly pointed out by the piper line.

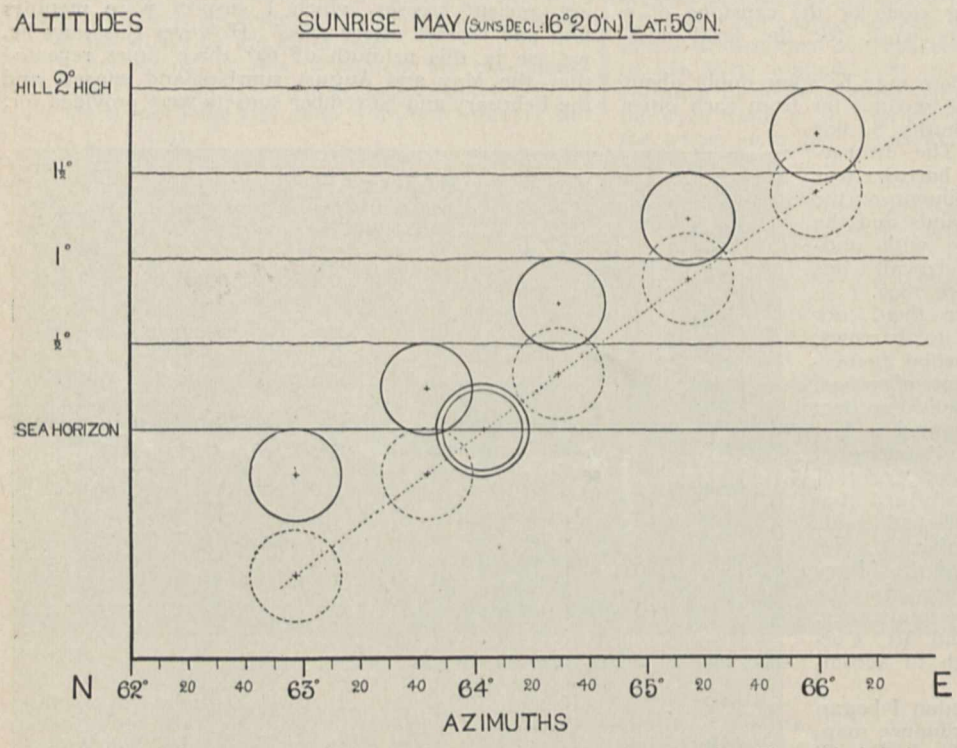



FIG. 3.—Showing the influence of the height of the sky-line on the apparent place of sunrise. The double circle shows the tabular place of sun's centre.

With these data the star in question was Capella, dec. 29° 58′ N., heralding the February sunrise, 2160 B.C.

I next come to the famous menhir Goon-Rith. The conditions are as follows :—from the circle Az. S. 81° 35′ W. Altitude of sky-line 34′.

Concerning this alignment from the circle, it may be stated that it cuts across many ancient stones, including one resembling a rock basin or laver, and another either a holed stone or the socket of a stone cross. I suspect also the presence in old days of a holy well attached to the circle, for there is a pool of water in a depression which is shown in the 25-inch map.

I regard it as quite possible that we are here in presence of the remains of a cursus, an old *via sacra*, for processions between the circle and the monolith.

I have not been able to find any astronomical use for this stone from the circle or from the site of the old one, but if we suppose it to have been used like the Barnstone at Stenness for observations *over* the circle its use at once becomes obvious.

From the azimuth given, the declination of the star was 5° 24′ N. Now this was the position of the Pleiades B.C. 1960, when they would have warned the rising of the May sun.

So that it is possible that the erection of the Pipers and of Goon-Rith took place at about the same time, and represent the first operations.

The next alignment has an azimuth of S. 69° W.; from the circle, it would be the same within a degree from the site of the one which has disappeared, altitude of sky-line 18′; this line is to a stone cross on rising ground, doubtless a re-dressing of an old menhir, and on the line nearer the circle are the remains of a barrow.

With these data the star in question was Antares, dec. S. 13° 18′, heralding the May sunrise 1310 B.C.

There is another stone cross defining a line az. N. 11° 45′ E. from the circle, altitude of sky-line about the same as along the piper azimuth; an intervening house prevents measurement. These values give us N. dec. 38° 46′, referring to Arcturus warning the August sunrise in 1640 B.C.

The three alignments already referred to, then, give us the warning stars for three out of the four quarter days of the May year, the astronomical conditions of which in Cornwall are shown in the accompanying diagrams.

NORMAN LOCKYER.

## THE SERUM THERAPY OF PLAGUE.

THE discovery of diphtheria antitoxin and the excellent results obtained with it in practice, which in the Metropolitan Asylums Board hospitals has resulted in a reduction in the case-mortality from about 29 to 11 per cent., raised hopes that a panacea had at last been found for all microbic diseases. But it must be confessed that expectations have not been realised, and as regards other therapeutic sera none has proved nearly so efficacious as the diphtheria serum.

Several reasons may be given for this. The antitoxic sera, *i.e.* therapeutic sera prepared by the injection of bacterial toxins, are much more potent than anti-microbic sera, and possess antidotal properties proportional to their strength. But unfortunately most micro-organisms do not produce an extra-cellular toxin, like the diphtheria bacillus does; the toxic substances are more or less intimately associated with the bacterial cells, as in staphylococcic and streptococcic (septic) infections, typhoid, plague, &c. Now

the anti-microbic sera seem to neutralise through the interaction of two substances, one present in the serum, the other a constituent of the patient's body and limited in amount, so that when the whole of the latter has taken part in the neutralisation, no additional amount of the therapeutic serum produces a further neutralisation.

Again, an anti-streptococcic serum prepared with streptococcus A, though active against A, does not necessarily neutralise another streptococcus B. In diphtheria also, a local and visible lesion generally enables a diagnosis to be made, and serum treatment to be applied, before any great amount of tissue damage has been done, whereas in tetanus, for which a very potent antitoxin has also been prepared, it is the results of tissue damage which lead to a diagnosis. No therapeutic serum can, of course, *repair* tissue damage, and if this has proceeded beyond a certain degree the condition becomes incompatible with life. It is noteworthy that even in diphtheria, if treatment be delayed beyond the third day, antitoxic treatment produces results little better than treatment without antitoxin, tissue damage having proceeded to too great an extent during the interval.

The fearful prevalence of plague in India during the last few years, which has caused the death of hundreds of thousands of the inhabitants of that great Empire, has naturally directed attention to the serum therapy of this disease, since no ordinary form of treatment has any particularly beneficial effect, and the Government of India has therefore been well advised to devote one of its scientific memoirs [1] to the subject, under the editorship of Lieut.-Col. Bannerman, M.D., I.M.S., who has had much experience of plague. Various forms of anti-plague serum were the subjects of trial, the Roux-Yersin, Lustig, Haffkine, Terni, and Brazil, the details of the preparation of which are given, and tables of the results obtained. Col. Bannerman concludes from a study of the circumstances and of the case-mortality of the various series of cases treated with the different sera that (1) the Roux-Yersin serum did not affect the case-mortality in the slightest degree, (2) in three out of the four trials made with Lustig's serum the case-mortality of the serum cases was higher than among those receiving ordinary treatment, (3) with Haffkine's serum there is no certain evidence of its efficiency, (4) with Terni's serum there is a difference of 0·91 per cent. only in favour of the serum-treated cases, and (5) with Brazil's serum, though there is a difference of 2·85 per cent. in favour of the serum-treated cases, it is problematical if this can definitely be ascribed to the serum.

As regards case-mortality, therefore, these trials do not suggest that serum therapy in plague is of much, if of any, value, but clinically there is an amelioration in the symptoms, and the cases when treated with serum live for a longer period than without it. We might add that the series of cases treated with Terni's and with Brazil's serum (110 and 70 respectively) are too small to warrant any definite conclusions. Bannerman from these results considers that it will be necessary to commence anew the study of the serum therapy of plague, and with this we cordially agree. At the same time we cannot help thinking that it would be desirable to make a much more extended use than has been done of the intravenous method of administration of the serum.

R. T. HEWLETT.

[1] *Scientific Memoirs of the Government of India*, No. 20, 1905. Serum Therapy of Plague in India. Reports by Mr. W. M. Haffkine, C.I.E., and various Officers of the Plague Research Laboratory, Bombay. Edited with an Introduction by Lieut.-Col. Bannerman, M.D., B.Sc., I.M.S., Director, Plague Research Laboratory, Bombay.

## *SEA COAST PROTECTION.*

A CONFERENCE of local authorities having districts situated on the seaboard of England was held in London on February 6 on the subject of the defence of the coasts against erosion by the sea, and the national responsibility in regard to the matter. This conference was convened by the chairman of the Herne Bay District Council. The matter had been taken up by the sea-side towns on the east coast in 1903, and a deputation was then appointed to wait on Mr. Balfour, but nothing came of this. The conference recently held consisted chiefly of representatives of towns on the south coast, and a resolution was adopted "That representatives of this conference be appointed to approach the Prime Minister and President of the Board of Trade, to request the Government to introduce into Parliament a Bill declaratory of the aforementioned principles and defining ways and means whereby some relief towards, or allowance in respect of, the cost and maintenance of protective works might be contributed by the Government." The report of the meeting that appeared in the public journals does not say what "the aforementioned principles" consist of.

The members who attended this conference consisted almost entirely of representatives of sea-side towns, where promenades and similar works have been constructed for the purpose of enhancing the attractions of these places.

The *Engineer*, in an article on this conference, points out that to protect efficiently long stretches of purely agricultural land, the sea margin of which consists of friable and easily eroded material exposed to the inroads of the sea, would (as shown in the book on "The Sea Coast," published by Messrs. Longmans and Co.) involve a capital and maintenance expenditure out of proportion to the advantages secured, the value of the land preserved during the life of the protective works not being equal to one-third of the outlay required for protecting it.

In the case of sea-side resorts or other localities where the coast-line is of considerable value, the *Engineer* points out that while the preservation of the littoral is an absolute necessity, the benefits to be derived by protection are almost wholly local, and the owners of agricultural land not worth the cost of protection would have a perfectly legitimate grievance if Imperial funds were spent for the benefit of their wealthier neighbours. It may also be added that all inland towns would have an equal right to protest against contributing towards money spent on these sea-side towns, where promenades and other works have been constructed to attract visitors, and thereby have enormously increased the value of the property of those whose land is adjacent.

There was one part of the subject of coast erosion alluded to at the meeting which might with more reason be pressed on the attention of the Government, that is, the prevention of the removal of sand and shingle from the beach, which now forms a natural protection to the shore. As the law now stands, the Board of Trade, on being applied to, will order a local inquiry where complaint is made of injury done by such removal, and if as the result of such inquiry it is shown that such removal is injurious, the Board can, under its statutory powers, issue an order forbidding any further removal. The cost of these inquiries, however, is considerable.

In some cases the Government itself is the offender, shingle being taken for making concrete for its coast works. In many cases the local authorities, who are now asking for State relief, have been the worst offenders in this respect, by placing their sea walls so

as to shut in the natural shingle banks behind the walls or using the material from them for their works.

The Government might justly be asked to obtain such an alteration in the existing law as would make any removal unlawful unless it could be shown that such removal would not in any way be injurious to adjacent property, and making it the duty of the coastguards to report where any removal of shingle or sand is taking place.

## NOTES.

THE present year will witness the fiftieth anniversary of the foundation of a great branch of chemical industry which, perhaps more than any other discovery in applied chemistry, has reacted upon the science itself to its lasting benefit. Half a century ago the first artificial colouring matter obtained from a coal-tar product was discovered and manufactured by William Henry Perkin under the trade name of "Mauve." The subsequent development of the coal-tar colour industry has been one continuous series of triumphs, and the colossal scale on which organic compounds of great complexity are now manufactured, often in a state approaching chemical purity, cannot but strike the future historian of scientific industry as one of the most marvellous achievements of applied organic chemistry of the present age. The marvel is enhanced when it is borne in mind that the whole of this industrial development, which has been made possible by the intervention of pure science at every stage, has taken place during the last half-century. The founder of the industry, Dr. Perkin, is happily still with us in full vigour, and a movement is now being organised to celebrate the jubilee of the discovery and to do honour to the discoverer. Preliminary meetings have been held under the auspices of the Chemical Society and a provisional committee formed, which committee has prepared a scheme for submission to a public meeting for adoption at the Mansion House on February 26 at 3 p.m., when the Lord Mayor has consented to take the chair. That the importance of the movement is being appreciated in this country is shown by the fact that, in addition to all the leading chemists and manufacturing chemists, the committee already comprises the names of Lords Halsbury, Rayleigh, Alverstone, and Avebury, the Right Hons. R. B. Haldane, A. J. Balfour, and Joseph Chamberlain, and representatives of the universities, Royal Society, the City companies, &c. The appreciation, moreover, is not limited to Perkin's own countrymen, and it is known that when the scheme has been formally adopted at the Mansion House meeting on February 26 other countries, and especially Germany, the present headquarters of the industry, will participate in the movement. Those who are interested in the scheme are invited to attend the meeting. The secretary to the committee is Prof. A. G. Green, of Leeds University, from whom particulars can be obtained.

A PORTRAIT of Dr. H. C. Sorby, F.R.S., subscribed for privately, and presented by the subscribers to the University of Sheffield, in commemoration of Dr. Sorby's scientific work and labours as one of the founders of the university, was unveiled on Monday, in the presence of a large assembly of leading citizens and other admirers of his devotion to scientific research and to the cause of higher education in Sheffield. Alderman Franklin, as president of the university council, opened the proceedings, and the portrait was unveiled by the Lady Mayoress. Mr. Simeon Snell and Prof. W. M. Hicks, F.R.S., who organised the movement for the presentation, in asking the University to accept the portrait, referred to Dr. Sorby's long association with Sheffield—he might, in fact, be regarded as the Dalton or the Priestley of Sheffield—and to his sixty years of active work for the advancement of science and the extension of natural knowledge. The state of Dr. Sorby's bodily health prevented him from being present at the ceremony, but he expressed his appreciation of the honour in a letter to Alderman Franklin. The portrait is a replica of one painted by Mrs. M. L. Waller, and now hanging in the rooms of the Sheffield Literary and Philosophical Society.

THE gold medal of the Royal Astronomical Society has this year been awarded to Prof. W. W. Campbell, of the Lick Observatory, for his spectroscopic researches on the motions of stars in the line of sight. The medal was presented at the eighty-sixth anniversary meeting of the society on February 9, when the American Ambassador, Mr. Whitelaw Reid, received the medal on behalf of Prof. Campbell, who was unable to be present. Mr. Whitelaw Reid, in accepting the medal on Prof. Campbell's behalf, said he would certainly value the decoration as highly as a soldier or statesman would value one sent him by a Sovereign. The United States is proud of every advance in art or science made by her sons—prouder of these than of triumphs in trade or in war—and it will be gratified that this high recognition for service to one of the noblest of sciences came from a land to which they are so closely related.—It may be remarked that this is the third consecutive year that this medal has been awarded to an American astronomer. In fact, Mr. Choate, the late American Ambassador, in receiving the medal for Prof. Lewis Boss last year, remarked that it seemed quite one of the annual duties of the Ambassador to proceed to the rooms of the Royal Astronomical Society to receive the gold medal. Out of the list of the last thirteen medallists, no less than seven hail from the United States.

ACTIVE steps are being taken at York to ensure the success of the meeting of the British Association to be held there next August. Last Saturday, at a large and distinguished assembly, over which the Lord Mayor of York presided, the arrangements in connection with the forthcoming visit were advanced a further stage. A reception committee representative of the city and county was elected, and it was resolved to raise a fund of not less than 2500*l.* for the necessary expenses of the meeting. In an appropriate speech, the Lord Mayor moved "That this meeting agrees cordially to welcome the British Association to York this year from August 1–8, and in doing so attaches special interest to the fact that the Association began its existence in York seventy-five years ago." The Dean of York seconded this resolution (which was carried unanimously); and in supporting it Dr. Tempest Anderson referred to local connections with the association, the first officials of which included some of the leading members of the Yorkshire Philosophical Society. The local reception committee appointed on Saturday is an unusually strong one: the president is the Lord Archbishop of York; chairman, the Lord Mayor (Mr. R. H. V. Wragge); vice-chairman, Dr. Tempest Anderson; treasurer, Sir J. Sykes Rymer; and secretaries, Mr. R. Percy Dale and Mr. C. E. Elmhirst. Pro-Chancellor A. G. Lupton (University of Leeds) and Prof. W. M. Hicks (University of Sheffield) both spoke at the meeting, and expressed the desire of their universities to assist in making the forthcoming meeting of the association a success.

SIR WILLIAM CROOKES has been elected a corresponding member of the physical section of the Paris Academy of Sciences in succession to the late M. Bichat.

THE second congress of the German Röntgen Society will be held at Berlin on April 1–2, under the presidency of Prof. Eberlein.

THE largest steel ingot ever made was cast at Manchester on February 1. It weighed no less than 120 tons, and was cast on the Whitworth system of fluid compression. The 120 tons of molten steel were subjected to a pressure of 12,000 tons in order to make the ingot homogeneous and sound throughout.

IN order to lessen the smoke and soot nuisance in the town of Helsingfors, the municipal authorities have appointed an engineer, Mr. Ed. Cedercreutz, first to examine and test the boiler and furnace installations in the town, and then to propose suitable means for diminishing the above mentioned source of annoyance.

IN honour of the late Prof. Edouard Grimaux, who by reason of his numerous chemical researches, and particularly his contributions on the atomic theory, has taken a high place among French men of science, it is proposed to erect some form of memorial in his native town of Rochefort-sur-Mer. Contributions to the memorial fund are to be addressed to the Mayor of Rochefort, M. E. Marianelli.

THE Society of German Portland Cement Manufacturers will hold its twenty-ninth general meeting in Berlin on February 16–17. On the agenda list are the following papers, amongst others:—Report from the society's laboratory, Dr. Framm, of Karlshorst; report of the sea-water commission, Dr. Eng. Rudolf Dyckerhoff, of Amöneburg; report of the committee for examining the change of volume and the time of binding of Portland cement, Dr. Müller, of Rüdersdorf; hydraulic binding appliances, Dr. Goslich, of Züllchow; rotating furnaces, Dr. Michaëlis, sen., of Berlin; the acidity of water and its removal, Mr. H. Wehner, of Kissingen.

ON January 28, at Stensjöholm, near Ryssby, in Sweden, the agricultural chemist Prof. Alexander Müller died in his seventy-eighth year. A native-born German, Müller received his early education in Chemnitz and Freiburg, and at the University of Leipzig. In 1851 he was appointed lecturer in chemistry at the Trade School in Chemnitz; from there, in 1856, he was appointed director of the agricultural experimental section of the Landbruks Academy in Stockholm, and consulting agricultural adviser for Sweden and Norway. In this capacity Müller displayed great ingenuity in conducting numerous practical experimental investigations for the welfare of Scandinavian agriculture. The earliest of his published researches dealt chiefly with dairy methods, hygienic questions, and the proper working of various soils. In later years he occupied himself mainly with questions relating to the cleansing of towns, and, indeed, published a number of papers on this subject.

BY the death on January 13, at the early age of forty-six, of Prof. A. S. Popow, physical science in general, and Russian science in particular, has lost one of the pioneer band of physicists in the field of wireless telegraphy. After studying at the St. Petersburg University from 1877 to 1883, Prof. Popow was appointed first an assistant, and later professor of physics in the Mining School for Officers at Kronstadt, whilst he also delivered lectures at the Technical High School for the Russian Marine from 1890 to 1901. His zeal for work was extraordinary; although he devoted himself strenuously to experimental work in different branches of electrotechnics, he also found time to superintend the electrical station at Nijni Novgorod, whither he betook himself each summer. His work in 1895 was particularly rich in results, for in the summer of that year he succeeded in signalling over long distances by means of electromagnetic waves, and also invented an apparatus for graphically indicating and recording storms, which in 1896 was introduced into the meteorological observatory of the St. Petersburg Forest Academy, whilst the Parisian firm of Dacretoit constructed a receiving station for wireless telegraphy according to Popow's plans, which have been taken as a model for the installation throughout the Russian Marine. In 1905 Popow was appointed professor of physics at the electrochemical institute in St. Petersburg, and on September 28, 1905, on the declaration of the academic freedom of Russian universities, he was elected director of the institute. Popow's intellectual gifts, his attachment to scientific research, and geniality of intercourse at all times, secured for him the warmest sympathy and respect from both colleagues and students.

IN reply to the request made by Prof. S. P. Thompson in last week's NATURE (p. 340) for the dates of birth and death of William Nicol, the inventor of the Nicol prism, two correspondents state that Nicol was born about 1768 and died in 1851 at Edinburgh, where he was a teacher of physics. (See the "Century Cyclopedia of Names" published by the *Times*, p. 737.)

IT is announced by *Science* that there is a movement being started to present to the City of Philadelphia a statue of Dr. Joseph Leidy. Dr. Leidy, who was born in that city in 1823, and died there in 1891, added much to its scientific eminence, and as president of the Academy of Natural Sciences, professor of human and comparative anatomy and zoology in the University of Pennsylvania, and president of the Wagner Free Institute of Science, accomplished much for these institutions.

THE Cairo correspondent of the *Times* states that Mr. T. Barron, the geological surveyor to the Anglo-Sudan Administration, died on January 31 at El Koweit. While in the Survey Department of the Public Works Ministry in Cairo, Mr. Barron rendered excellent services in revising the geology of the country between Cairo and Suez. In 1904 Mr. Barron's services were lent to the Sudan Government, and part of the work with which he was then entrusted included the investigation of the lignite deposits of Tchelga, in north-west Abyssinia. He eventually joined the Sudan service.

DR. C. G. SELIGMANN, Hunterian professor for 1906, delivered the first of his three lectures on Monday in the theatre of the Royal College of Surgeons, and took as his subject the "Physical Anthropology and Ethnology of British New Guinea." After directing attention to the general features of New Guinea, Dr. Seligmann proceeded to classify the natives of British New Guinea into four main stocks, Papuo-Melanesian in the south-east, Motuan around Port Moresby, Eastern Papuan in the hinterland or mountainous region, and West Papuan in the large western area, much of which is still unknown. The lecturer pointed out that there were linguistic and other resemblances between his Papuo-Melanesian stock and the island Melanesians, particularly those of the Solomon Islands. There is an area of brachycephaly on the west

of the Papuan Gulf for which it is very difficult to account; members of this stock seem to form part of the population south of the Fly River. The average stature rises in proceeding from the centre of the Gulf eastwards. There is no reason to suspect Australian influence, even in the Torres Straits Islands.—The lectures are open to the public; the second was given yesterday, and the concluding one will be delivered to-morrow (Friday) at five o'clock.

PROF. S. H. REYNOLDS, University College, Bristol, informs us that the rock fall at Cheddar on the night of Sunday, February 4, is not a matter of any very great moment, though much has been made of it in the papers. The point at which it took place is a quarry on the northern or dip slope side of the gorge, which here follows the strike of the rocks. The fallen rock detached itself from the quarry face along the bend of a master joint,

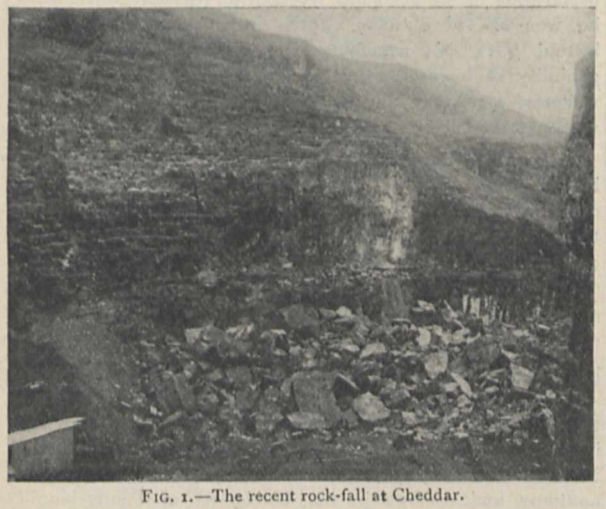


FIG. 1.—The recent rock-fall at Cheddar.

and estimates of its amount vary from 70,000 tons to 500,000 tons; but an experienced quarry owner has assured Prof. Reynolds that 20,000 tons is about the amount of the fall. Though this may seem a very large amount, the fall is entirely confined to the face of the quarry, and the general features and beauty of the gorge are absolutely unaffected by it.

IN the annual report on British New Guinea for 1903, Sir F. Winter described a people on the Musa River, named Agaiambo; according to the newspaper reports of the period they are web-footed dwarfs; subsequent information went to show that they had been wiped out by a hostile tribe. The latest report, for 1904–5, shows that this latter item was incorrect, for ten members of the tribe have been measured by Captain Barton, and their photographs sent to Sydney. Unfortunately, much of the latest information is contradictory of the earlier report; the Agaiambo are stated to kneel in their canoes or sit on their heels, and to this circumstance their physical peculiarities are attributed; but Sir F. Winter says that they stand. Moreover, it is difficult to see how sitting on the heel could produce, as alleged, a protrusion of the heel. There is no evidence to show that the tribe is web-footed; they are not dwarfs; the man seen by Sir F. Winter stood as high as an ordinary native; what was peculiar about him was that the lower extremities were badly developed, so that his hips were 3 inches lower than those of the ordinary native. This feature seems to be borne out by the later evidence. There is no reason at present to suppose that they are of different stock from their neighbours; they are said to speak the same language as the Barigi, with whom they barter produce.

IN a paper on library aids to mathematical research, published in the *Proceedings of the Royal Society of Edinburgh*, Dr. Thomas Muir has touched upon a subject of ever-growing importance that has not yet received the systematic attention in this country which it needs. It deals with the requirements of the scientific investigator classed under the two general main categories of books and books about books. The paper is confined to the single subject of mathematics, with reference to Scotland in particular, but, as Dr. Muir remarks, "there can be no doubt, however, that other subjects are in as bad a plight, and that the whole question of library aid is worth serious and prompt attention from all scientific men." Commencing with "books about books," or summaries of existing literature, and excluding the "Bibliotheca Mathematica," which is different in scope, Dr. Muir finds that the mathematician is adequately provided for as regards past literature by Poggendorff's "Handwörterbuch" and the Royal Society catalogues, and as regards current literature by the "Jahrbuch über die Fortschritte," the Amsterdam "Revue semestrelle," and the "International Catalogue of Scientific Literature." But when it comes to the books themselves, the present state of affairs is eminently unsatisfactory. Confining his attention to the sixty-seven serials, mainly mathematical, included in the list published in the "International Catalogue, A" for 1903, Dr. Muir tabulates the state of affairs in the libraries of the University and Royal Society of Edinburgh and the University and Philosophical Society of Glasgow. He finds that only thirty-four of the sixty-seven periodicals are to be found in the combined libraries of southern Scotland, and many sets are incomplete, but that a considerable duplication exists in the libraries in question. Austrian mathematics is unrepresented. An annual expenditure of 100*l.* would suffice to purchase and preserve all the serials on the list, but even without any expenditure whatever the whole object could be attained by cooperation between the several libraries and gradual elimination of the cases of duplication. Dr. Muir considers that mathematical research at present can only be pursued in Scotland with difficulty and uncertainty, and that research in mathematical history is practically an impossibility. What Dr. Muir says regarding Scotland applies with still more force to libraries elsewhere. If he had extended his study, for example, to Wales, he would have found three separate libraries in the three university colleges each with only some 10*l.* or so per annum for purchase and binding of books and periodicals.

THE opening article in the January number of *Himmel und Erde* is devoted to the discussion of the question whether the attributes of organisms can be due to physical causes. In concluding this article, the author, Dr. V. Franz, of Breslau, points out that, although a physical origin of life is highly probable, its demonstration is a matter of almost insuperable difficulty.

IN the January issue of the *Museums Journal*, Mr. J. Minto discusses the relation of provincial museums to national institutions. After pointing out that local museums cannot at the present day grow with the requisite rapidity and properly discharge their educational functions if dependent solely upon donations, the author expresses himself as follows:—"It will take years to do away with

the idea of museums still entertained by many members of committees, as store-houses of curiosities, and to understand that museums must form part of the educational machinery of the nation."

WE reproduce from an article on the Florida Keys, published in the *National Geographic Magazine* for February, an exceedingly interesting photograph of an alligator's nest, showing a large number of eggs, from some of which young alligators have been hatched. In common

FIG. 1.—An alligator's nest, with newly-hatched alligators, in Florida. From the *National Geographic Magazine*.

with the caimans of Central and South America, the Mississippi alligator lays a number of eggs amid brushwood, which are carefully covered over with débris, and guarded during the period of incubation by the parent. In due course the young alligators are hatched, and soon make their way to the water, the nest, at least in the case of some of the Brazilian caimans, being opened by the female parent in order to facilitate the escape of her progeny.

IN an instructive article entitled "Saving California's Fruit Crops," published in the *Century Magazine* for February, the author, Mr. W. S. Harwood, dwells on the important services Mr. Compere has rendered to fruit-growers in America, and thus throughout the world, by his efforts to discover insects which will hold in check some of the most injurious insect fruit-pests. Mr. Compere's idea is that every injurious insect has an enemy in some part of the world, if only it can be found. He discovered, for instance, in Spain, a region where the codling-moth lives, but where the ravages of the worm to which its eggs give birth were slight. Investigation showed that this was due to an ichneumon-fly, by which the pest was kept in check. Naturally it was assumed that what held good for Spain would also be efficient in California, and a number of ichneumon-pupæ were accordingly packed and dispatched to the States. When the flies hatched they at once set to work on the codling-moth caterpillars, with the result that a swarm of young ichneumons has been produced, and it is hoped that in course of time the codling-moth pest may become a thing of the past. Another plan is to send a small tree of the species affected by a particular pest to the country where the enemy lives, whence it is returned to its native home provided with a stock of destroyers.

TO the *American Naturalist* for January Lieut.-Colonel C. D. Durnford contributes an article (also published synchronously in this country in the *Annals and Magazine of Natural History*) on the flight of flying-fishes. In this it is maintained that the ordinary "aëroplane theory" of the flight of these fishes is based on an absolute mechanical impossibility, and that the real explanation is to be found in an intensely rapid vibration of the wing-like pectoral fins—a vibration which is revealed to the eye when the movement slows down as the fish touches the crest of a wave. In another article in the same journal Messrs. Dexler and Freund furnish some interesting information with regard to the mode of life of the dugong, noting also the various methods employed in the capture of these animals in Queensland. It is confirmed that dugongs do not voluntarily leave the water, while it is suggested that they seldom enter brackish, and are incapable of living in fresh water. Much interest attaches to the existence of a slimy coating for the protection of the eye, a similar coating also occurring in whales, although in the latter instance it is of an oily nature, in order to prevent its being too easily washed away by the sea-water.

IN *Macmillan's Magazine* for February, Mr. H. L. Puxley describes the unhygienic conditions which largely obtain in the production and distribution of milk, and suggests the precautions which should be taken to ensure a wholesome milk supply.

MESSRS. SANDERS AND CROWHURST, Shaftesbury Avenue, W., have submitted for our inspection a series of excellent lantern slides, and an album, entitled "Wild Birds at Home," of sixty beautiful reproductions of photographs taken with the "Birdland" camera, which has been made specially for natural history photography. A comparison of these life-like pictures—which are faithful representations of the actual environments of the birds depicted, untouched in any way by engravers—with the woodcuts which comparatively few years ago were the only illustrations available for works on natural history will demonstrate vividly the astonishing advances in pictorial illustration made possible by instruments like the "Birdland" camera in the hands of patient observers. Photographs of this high excellence both encourage and assist the study of animal life.

FIG. 1.—Gannets on the wing. From a photograph taken with the "Birdland" Camera.

THE *Journal of Hygiene* for January (vi., No. 1) contains papers by Prof. Muir and Mr. Browning on anti-immune bodies and complementoids and on the action of comple-

ment as agglutinin, by Mr. MacConkey on a method for hastening the liquefaction of gelatin by the *B. cloaceae*, by Dr. Boycott on the bacteriology of para-typhoid fever, and by Dr. Haldane on a portable apparatus for gas analysis. Dr. Sandilands writes on epidemic diarrhœa and the bacterial content of food, suggesting that flies may be the active agents in conveying this disease, no mention, however, being made of Dr. Nash's previous work in this direction. Prof. Ronald Ross directs attention to the occurrence of flagellated protozoan parasites in the mosquito (*C. fatigans*), which he suggests may invalidate Schaudinn's work on the development of the hæmosporidian *Halteridium danilewskyi* in this insect. Dr. Hamilton Wright also contributes a reply to Dr. Travers's criticism of preventive measures against beri-beri, which appeared in a former number of the Journal.

A SELECT list of works prepared at the Royal Botanic Gardens, Kew, by members of the staff, or in collaboration with them, has just been published as No. 1 of the *Kew Bulletin*, 1905. The list is extensive, as it goes so far back as 1859, when Grisebach's "Flora of the British West Indies" began to appear, and it includes Dr. Watt's "Dictionary of Economic Products of India" and the *Annals of Botany*. It is to be hoped that this number is a precursor to the resuscitation of the Bulletin.

FROM the Department of Agriculture, Nairobi, a leaflet, No. 10, has been issued on the insect and fungoid pests reported during the year 1904–5. The larvæ of a moth, *Spodoptera exempta*, destroyed the vegetation near Nairobi; a ladybird, *Epilachna similis*, is mentioned as doing great damage to maize and wheat; and several beetles and other insects were observed. Amongst fungi, wheat-rust proved fatal to the prospects of the wheat crop, dwarf beans suffered from rust and anthracnose, and the crop of chick-pea, *Cicer arietinum*, was completely destroyed by a *uredo*-fungus.

THE historic quotation connected with Darwin's examination of the primrose might well be repeated with reference to a posthumous paper on the oxlip by the late Prof. Errera, edited by Miss J. Wéry for the *Receuil de l'Institut botanique*, Brussels (vol. vi.). The paper furnishes a good illustration of Prof. Errera's talent for drawing deductions from simple experiments or observations. It was found that although the number of long-styled and short-styled plants was about equal, a bunch of flowers collected at random nearly always contained more of the long-styled, this being due to the slightly larger size of the flowers; the balance is maintained by the direct fertilisation of a larger number of short-styled flowers.

WE have received the report of the Meteorological Service of Canada for the year 1903. At the chief stations observations are taken day and night at equal intervals of time not exceeding four hours; at other stations they are taken three times daily, except in the case of those recording only rainfall and the general state of the weather. For the purpose of weather forecasts the country is divided into ten districts; the general success of fully or partially verified predictions amounted to 86 per cent. The results for the numerous stations are very carefully prepared, and include observations in Newfoundland, Labrador, and Bermuda, together with a chronicle of the chief characteristics of the weather in each month. Maximum shade temperatures of 99° were registered at Alberni, British Columbia, in June, Melfort, N.W. Territories, and St. Alban's, Manitoba, in July; minimum, −67°, at Good Hope, N.W. Territories, in February.

THE *U.S. Monthly Weather Review* for September last contains an account of the Japanese meteorological service in Korea and Manchuria. At the beginning of the Russo-Japanese war, Prof. Wada, who had been connected with the meteorological service of Japan since 1879, was entrusted by the Japanese Government with the organisation of a similar system in Korea and Manchuria, and is now completing the work as chief of that service; up to the present time fourteen stations have been established. A first-class observatory has been established at Chemulpo; the other stations, including Mukden, Fusan, and Port Arthur, are mostly of the second order. All the coast stations issue daily weather predictions, which are made known by means of flags; the central observatory issues storm warnings when an atmospheric disturbance is expected on or near the coasts of Korea and Manchuria, and day and night signals are immediately displayed at all stations.

IN view of the fact that acetylene gas is used in Germany to a very large extent, it is proposed to form a guild of acetylene apparatus owners for the purpose of collecting, arranging, and distributing information on methods of preparation and storing and on the uses of acetylene.

IT has long been known that the province of the Pechora is rich in mineral treasures. Quite recently a party of Russian and Belgian engineers examined the basin of the Ussa, and made rich finds of naphtha and copper ores. In fact, it is stated that the quantity of naphtha to be obtained from surface deposits in the Pechora district exceeds that present in the Caucasus, and is of a better quality, whilst the tonnage of easily workable copper ores is given as many millions. But for the working of these treasure-fields a large sum of money will be required, inasmuch as even the most primitive roads and methods of easy communication are practically unknown; also the population, and consequently the supply of labour, is extremely small. However, it is reported from St. Petersburg that energetic efforts are being made to obtain the necessary capital.

IN the *Lancet* for December 16, 1905, Dr. P. W. Latham describes a new method of directly transforming α-benzoyl-amino-*p*-hydroxycinnamic acid into tyrosine, by heating it with potassium cyanide, which acts as a reducing agent, and subsequently boiling the product with aqueous barium hydroxide. A theory, based on these observations, is advanced as to the method of formation of tyrosine in the animal body.

IN a note published in the *Annalen der Physik* (series 4, vol. xviii., p. 860), Prof. B. Walter recommends the use of a material called "picein," manufactured by the New York-Hamburg Indiarubber Company, as a cement for joining together pieces of physical apparatus; it is preferable to sealing-wax on account of the ease with which it can be worked, and the fact that it does not become brittle. As it is insoluble in water and alcohol, it can be used in contact with solutions prepared with these solvents, for example in absorption cells.

WE have received a reprint of a memoir by Prof. Augusto Righi, published in the *Memorie* of the Royal Academy of Sciences of Bologna (series vi., vol. ii., p. 151), in which full details are given of the method used in ascertaining the connection existing between the atomic weight of an element and the amount of secondary radiation it emits when subjected to the β and γ rays of radium; the results have already been noticed in NATURE (vol. lxxii. p. 350).

IN the *Atti dei Lincei* (series 5, vol. xiv., ii., 207) Prof. A. Righi describes a number of experiments which were made with the purpose of ascertaining the influence of the rays of radium on the resistance of certain solid and liquid dielectrics. A marked increase in the conductivity under the influence of the rays was observed in the case of liquid vaseline and olive oil, but with benzene, petroleum ether, and carbon bisulphide a much smaller effect was found. When solid colophony was subjected to the action of the rays, a change of conductivity could not be detected.

A WORK upon steam turbines, by Messrs. T. Stevens and H. M. Hobart, giving the most recent results in practice and having a concise account of the latest types, will be issued by Messrs. Whittaker and Co. in March.

MESSRS. SWAN SONNENSCHEIN AND CO., LTD., have now published the "Public Schools Year-book" for 1906, being the seventeenth issue of this important annual. Among other useful chapters which the volume contains, in addition to full particulars of 117 public schools, those dealing with engineering, medicine, agriculture, and horticulture as professions are of particular value to parents desiring occupations for their boys.

MR. FRANCIS HODGSON has published the third volume of the second series of the *Proceedings of the London Mathematical Society*. The volume runs to 482 pages, and includes papers read before the society during the period December 8, 1904, to November 9, 1905. As the papers read at meetings of the society are briefly described in our "Societies and Academies" columns, there is no necessity for a detailed statement of the contents of the volume, though it may be added that, in addition to the papers, the volume includes records of the proceedings at meetings and an obituary notice of the late Mr. Robert Tucker by Prof. M. J. M. Hill, F.R.S.

## OUR ASTRONOMICAL COLUMN.

COMET 1905*c* (GIACOBINI).—Herr A. Wedemeyer gives a continuation of his daily ephemeris for comet 1905*c* in No. 4074 of the *Astronomische Nachrichten*. The following is an extract therefrom:—

*Ephemeris 12h. M.T. Berlin.*

| 1906 | α (true) h. m. s. | δ (true) ° ′ | log *r* | log Δ | Brightness |
|---|---|---|---|---|---|
| Feb. 18 | 0 49 32 | −13 26 | 9·9192 | 0·1123 | 2·91 |
| 20 | 1 2 3 | −11 55 | 9·9424 | 0·1237 | 2·48 |
| 22 | 1 13 48 | −10 27 | 9·9640 | 0·1355 | 2·13 |
| 24 | 1 24 45 | − 9 2 | 9·9843 | 0·1477 | 1·83 |
| 26 | 1 35 0 | − 7 41 | 0·0034 | 0·1602 | 1·58 |
| 28 | 1 44 37 | − 6 24 | 0·0214 | 0·1728 | 1·38 |

Brightness at time of discovery = 1·0.

It will be noticed that the comet has rapidly decreased in brightness, and, as its magnitude when discovered was only about 10·0, has become a more difficult object. On February 18 it will set about 2½ hours after sunset in the south-west.

COMET 1906*a* (BROOKS).—Several observations of comet 1906*a* are recorded in No. 4073 of the *Astronomische Nachrichten*, in which also appear a set of elements and an ephemeris calculated by Herr M. Ebell.

The magnitude of the comet on January 28–31 was about 10·0, and Prof. Hartwig, observing with the Bamberg heliometer on the latter date, recorded that the comet was round, had no tail, and had a central nucleus which appeared to be about one magnitude fainter than a 9·3 magnitude star.

The latter part of Herr Ebell's ephemeris is given below:—

*12h. M.T. Berlin.*

| 1906 | α (true) h. m. s. | δ (true) ° ′ | log *r* | log Δ | Brightness |
|---|---|---|---|---|---|
| Feb. 16 | 12 4 44 | +84 35 | 0·1909 | 9·9742 | 0·99 |
| 17 | 10 35 41 | +84 48 | | | |
| 18 | 9 13 22 | +84 15 | 0·1955 | 9·9817 | 0·94 |
| 19 | 8 12 51 | +83 8 | | | |
| 20 | 7 32 10 | +81 43 | 0·2001 | 9·9912 | 0·88 |

Although near to the pole, the comet is not an easy object, owing to its small magnitude, which is now decreasing.

OBSERVATIONS OF EROS.—The results of a number of observations of Eros, made at the Arcetri Observatory between July 26 and August 25, 1905, appear in No. 4073 of the *Astronomische Nachrichten*.

Variations in the magnitude of the asteroid were observed as follows:—July 28, mag. = 11·4; August 7, mag. = 10·9; August 23, mag. = 12·0.

Comets 1905*b* and 1905*c* were also observed at Arcetri, and the results are given in the same journal.

CATALOGUE OF STARS WITHIN TWO DEGREES OF THE NORTH POLE.—Publication No. 2 of the Vassar College Observatory is devoted to a catalogue of 408 stars all of which are within 2° of the North Pole. The coordinates and magnitudes have been determined from eight plates taken by Prof. Donner, of the Helsingfors (Finland) Observatory, by Dr. Caroline E. Furness. A previous publication (No. 1) dealt similarly with the stars situated within 1° of the pole, and to this the present volume forms a sequel. The positions are given for 1888·0, and in cases where the star is common to both, references are given to the B.D.M. and Carrington catalogues. The present work is published by the Carnegie Institution, and forms No. 45 in the publications of that body.

THE FIRE NEAR MOUNT WILSON OBSERVATORY.—Writing to *Popular Astronomy*, No. 2, vol. xiv., Prof. Hale corrects the recent report concerning the forest fire on Mount Lowe, and states that, as the fire did not come within several miles of the Solar Observatory, the observers there were never in any fear that the buildings or instruments might be injured.

THE INCREASING PERIOD OF β LYRÆ.—In an article published in No. 367 of the *Observatory*, Dr. Alex. W. Roberts makes an interesting suggestion concerning the diminishing rate of increase in the period of β Lyræ.

Having discussed a number of previous observations, he has deduced a formula which gives the period of this variable at any date, the epoch being 1900·0. The suggested cause is that in β Lyræ we have a binary in which the component stars are slowly receding from each other under tidal forces, and if this is so it provides direct evidence in support of Prof. Darwin's theory regarding the evolution of planetary and stellar systems.

THE UNITED STATES NAVAL OBSERVATORY.—Rear-Admiral Chester's report of the operations of the United States Naval Observatory for the fiscal year ending June 30, 1905, shows that the staff is again to be congratulated on the amount of work performed. Nearly 950 observations, including 218 of Saturn's satellites, were made with the equatorial, and 9179 observations were made with the meridian instruments; the latter included nearly 4000 observations of Gill's "zodiacal stars" and an equal number of "standard stars."

The A.G. Zone Catalogue of the stars between −13° 50′ and −18° 10′ is nearing completion; all the stars have been observed, and most of the observations have been reduced to 1900·0.

With the photoheliograph, photographs of the sun were obtained on 166 days, and showed spots and faculæ on the solar disc on 162 days. Whilst engaged upon this work, Mr. G. H. Peters made some valuable observations regarding the focal variation due to temperature. A new triple lens of 7½ inches aperture and 65 feet focal length, giving a solar image of about 7 inches diameter, has been procured, and was to be used for solar photography after its employment on the 1905 eclipse expedition to Spain.

The branch observatory at Tutuila, Samoa, was, on the date of the report, rapidly approaching completion.

## RECENT REPORTS OF GEOLOGICAL SURVEYS.[1]

### Cleavage.

THE subject of rock cleavage is one of perennial interest; only a short time ago were Dr. Becker's views noticed in these columns, views founded upon experiment and analysis. Now, Dr. Leith (1) lays before us his reading of the same problems after attacking them by the way of micro-sections and field observations. The author makes the term "rock cleavage" very comprehensive; he recognises among cleavable rocks two broad divisions, which he calls respectively protoclase, or original cleavage rock, and metaclase, or secondary cleavage rock. The former class includes such structures as bedding in sediments and flow structure in lavas; the latter class is considered under the heads "fracture cleavage" and "flow cleavage." Fracture cleavage is conditioned by the existence of incipient or cemented and welded parallel fractures, and is independent of the parallel arrangement of the mineral constituents. Flow cleavage is conditioned solely by a parallel arrangement of the minerals. The one is a phenomenon of the zone of fracture, the other of the zone of flowage in the lithosphere. Fracture cleavage is made to include, wholly or in part, those structures that have been variously described as close-joint-cleavage, false

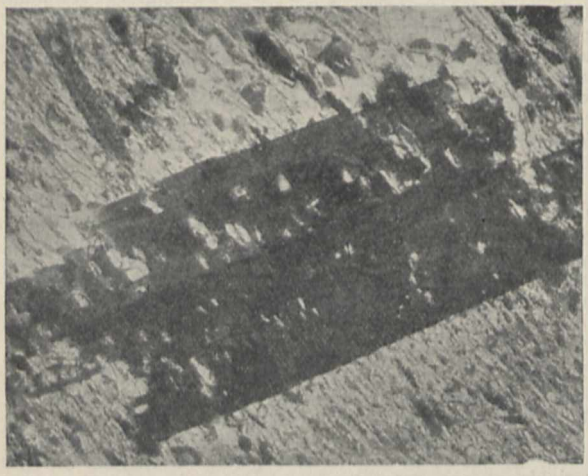


FIG. 1.—Porphyritic constituents developed after rock flowage has ceased. Chloritoid crystal. (Bulletin 239.)

cleavage, strain-slip-cleavage, slip cleavage, ausweichungs cleavage, rift and fissility in part (the term is retained for closely spaced parallel partings). Flow cleavage includes, wholly or in part, the ultimate cleavage of Sorby, "cleavage" of most authors, slaty cleavage, schistosity, and parallel structures in certain gneisses. Flow cleavage is a molecular phenomenon, and the dominating factor in its production is re-crystallisation. Much space is devoted to the study of the behaviour of the more important rock-forming minerals in relation to the direction of the cleavage in rocks, and many thin slices have been examined to determine how far there existed a parallelism between the cleavage of the rock and dimensional and vector properties of given mineral species.

The bulletin is evidently the result of a great deal of work, and contains a clear statement of the author's views; the illustrations are excellent, and it must be read by all interested in the subject, but it cannot be said greatly to advance our knowledge.

### The Geology of Cements.

Several reports have appeared from time to time dealing with the raw cement materials of individual States; in Bulletin No. 243, E. C. Eckel (2) summarises the available information for the United States as a whole. "The object has been to treat the subject from the geological rather than from the technical standpoint, although the technology of the cement manufacture is also discussed with sufficient fulness for the purpose of the report." While mainly a compilation, and bearing the impress of composite authorship, there is in this volume an air of freshness about the facts and of uniformity about their presentation which is doubtless due to the circumstance that Mr. Eckel personally visited every district in which cement is being produced, and examined nearly every plant in operation. Nor were the undeveloped deposits of cement material neglected.

The bulk of the report is devoted to Portland cement materials in the several States; the geological characters and relationships of the limestones, clays, and natural cement rock are clearly explained, abundant analyses are shown, and the peculiar local conditions of transport and fuel, as well as the available markets, are briefly discussed. The cement materials are derived from rocks of the most diverse geological age, ranging from Cambrian up to recent marls and alluvial silts. Short sections are given to the "natural" cement resources and to the Puzzolan cements. We noticed in the section on the grinding of raw materials no reference to the influence of the degree of fineness upon the temperature required for a suitable clinker.

### General Geology.

The average British geologist, if his range of vision is not quite limited by the importance of the exposure in his own back garden, if he can momentarily turn from pebble-picking and the unravelling of zones, may enjoy by following Prof. Russell across central Oregon, a pleasant and profitable, if somewhat tantalising, hour. The region included in this preliminary report (3) comprises the country between the Snake River on the east and the Cascade Range on the west, and thus takes in the extreme northern part of the Great Basin.

The predominant rocks of central Oregon are volcanic; an older series of rhyolites and andesites is succeeded by a younger series of basaltic rocks, which are again followed in the Pauline Lake district by andesitic outbursts. The oldest of the rocks dates from early Tertiary times; the youngest may be only a few centuries old.

The sedimentary rocks are represented by soft clays, sands and volcanic dust of Tertiary age. The most conspicuous elevations in central Oregon are of volcanic origin; many are old worn-down craters and peaks, but young volcanoes, particularly as the Cascades are approached, are exceedingly abundant. "Their cones, so recent in numerous instances that erosion has not yet broken their crater rims, are so numerous that 50 or more may frequently be counted in a single view, while a change of a few miles in the position of the observer brings perhaps as many more within the range of vision."

Many interesting features in the water supply and drainage of the country are described in these pages, but none exceeds in interest the fascinating story of the Deschutes River, about the point where it is joined by its tributary the Crooked River. First we find that the Deschutes in Tertiary times had eroded a great valley twenty to thirty miles wide in parts; then most of this valley was filled to a depth of more than 700 feet by water-borne volcanic dust and lapilli with a little sand and clay; this was followed by a sheet of basalt some 80 feet thick. Displaced in this way from their old courses, the Deschutes and its tributaries cut fresh channels and made canyons in the new material 800 feet deep and about one mile wide, until

[1] (1) Bulletin 239, 1905, "Rock Cleavage." By C. K. Leith.
(2) Bulletin 243, 1905, "Cement Materials and Industry." By E. C. Eckel.
(3) Bulletin 252, 1905, "Preliminary Report on the Geology and Water Resources of Central Oregon." By I. C. Russell.
(4) Bulletin 235, 1904, "A Geological Reconnaissance across the Cascade Range." By G. O. Smith and F. C. Calkins.
(5) Bulletin 242, 1904, "Geology of the Hudson Valley between the Hoosic and the Kinderhook." By T. N. Dale.
(6) Bulletin 254, 1904, "Report of Progress in the Geological Re-survey of the Cripple Creek District, Colorado." By Waldemar Lindgren and F. L. Ransome.
(7) Bulletin 237, 1905, "Petrography and Geology of the Igneous Rocks of the Highwood Mountains, Montana." By L. V. Pirsson.
(8) Twenty-fifth Annual Report of the U.S. Geological Survey, 1903-4.
(9) Indiana, Department of Geology and Natural Resources, Twenty-ninth Annual Report, 1904. By W. S. Blatchley.
(10) Canada: Summary Report of the Geological Survey Department of Canada for the Calendar year 1904 (1905).

once more an outburst of basaltic lava filled up the canyons to a depth of at least 500 feet. Still in their old courses, but displaced from their channels, the streams had again to commence re-excavation. At the present time they have cut through more than 500 feet of the hard basalt without reaching its bottom. The two periods of canyon cutting probably belong to the "Sierran" epoch of Le Conte.

Hot springs, desert conditions, glaciation, and the influence of domestic animals upon river erosion form the subjects of notes. The illustrations are beautiful, and helpful to the text.

FIG. 2.—View of double-crested moraine on south-side of Hayden Glacier, looking west. (Bulletin 252.)

The region about the northern limit of the Cascade Range was traversed by Messrs. G. O. Smith and F. C. Calkins (4) in a rapid reconnaissance. The older rocks encountered are grouped together as pre-Cretaceous, comprising (1) old-looking schists along the Columbia River and lower Okanogan Valley; (2) supposed Carboniferous sediments with volcanics in the more northern part of the Okanogan Valley; (3) strata similar to the last mentioned exposed in the base of the upper Skagit River; (4) some old sediments and a great volcanic mass near Hamilton; and (5) a great assemblage of strata ranging from Palæozoic to Jurassic lying to the west and north of Mt. Baker.

An extensive development of the Cretaceous is indicated from the Hozomeen Range on the west to the Similkameen Range on the east; the name "Pasayten formation" is proposed for this in place of Prof. Russell's term Similkameen. Sandstones and shales predominate; contemporaneous igneous rocks appear to be absent. Tertiary sediments occupy a much smaller area than do the Cretaceous, but volcanic rocks, presumably of this age, are of some importance. Later formations are represented by glacial and river gravels, and by the andesitic lavas of Mt. Baker.

As compared with their immense importance in the southern Cascades, the part played by volcanic rocks in the boundary section appears very subordinate. Plutonic rocks are greatly developed, the prevailing type being a "grano-diorite." The volcanic rocks range from soda-rhyolite, dacite, acid and basic andesites, to basalt. The dyke rocks include a soda-syenite from south of Bighorn Peak, and a diorite (?) in which apatite occurs in broad, irregular plates as one of the last products of crystallisation. The authors conclude that volcanic and plutonic rocks alike may have been derived from a homogeneous magma, low in alkalies, with soda predominating over potash; hence they may belong to the same province as the rocks of the southern Cascades and the Sierra Nevada.

Dr. Dale has written a short account of the stratigraphy of a strip of the Hudson Valley (5) between the Hudson River on the west and the Rensselaer Plateau and the Taconic Range on the east. The difficulties in the way of delimiting the age and relations of the several formations are the rarity and bad preservation of the fossils, the repeated minor overfolding, and the prevalence of Glacial drift. An excellent map accompanies the paper on the scale of 1 inch to the mile; fossil localities and good outcrops are clearly indicated by a system of coloured spots—a plan worthy of imitation.

The formations represented are Lower Cambrian, Beekmantown shale with Dictyonema and Clonagraptus, the Hudson shale and Hudson schist (Ordovician = Trenton), and the Silurian Rensselaer Grit = Oneida, Medina.

Three crustal movements are recognised in the area:—(*a*) at the close of the Lower Cambrian, Upper and Middle Cambrian are missing; (*b*) the Taconic or Green Mountain movement which folded the Ordovician beds; (*c*) a post-Devonian or Carboniferous movement which folded the Silurian Grit of the Rensselaer Plateau. Minor oscillations are indicated by conglomerates which occur in the Lower Cambrian, in the Hudson shale, and in the Rensselaer Grit.

Although only ten years had elapsed since Cross and Penrose made a careful study of the Cripple Creek district, the people of Colorado asked for a re-survey on account of the great development of underground working in the interval; this re-survey has been undertaken by Messrs. Lindgren and Ransome, who have now issued a report of progress (6) in advance of the laboratory examinations.

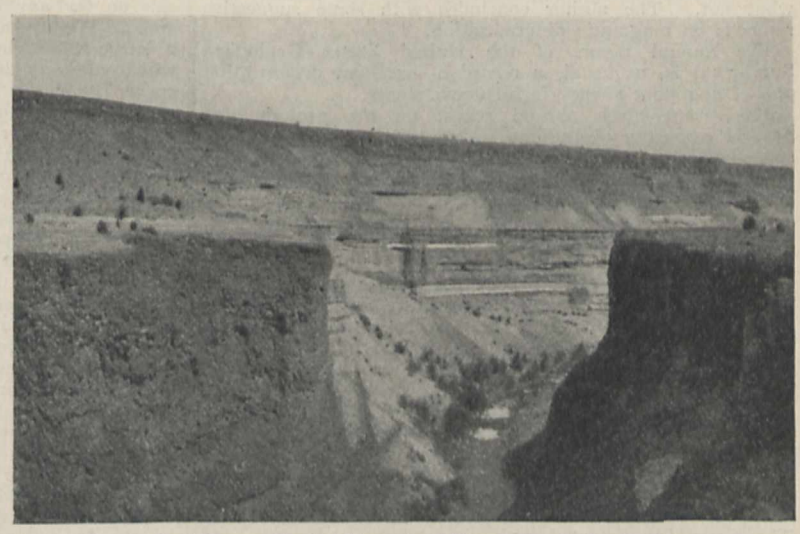


FIG. 3.—View in Opal Canyon, Crooked River, Crook County, showing basalt of inner canyon in contact with stratified beds of outer canyon. (Bulletin 252.)

The oldest rocks in the district are the muscovite and fibrolite schists; these are closely associated with fine-grained granitic gneiss. Both gneiss and schist are cut by a reddish granite. A second type of granite is the coarsely porphyritic Pikes Peak type. As a result of the recent work, the views of Cross upon the rocks erupted

from the Cripple Creek volcanic centre are somewhat modified; the various rock types recognised by him are shown to be linked by intermediate forms; they are clearly all divergent eruptive facies of one general magma, characterised by containing from 9 per cent. to 15 per cent. of potash and soda, the soda being always somewhat higher than the potash; no true andesite is recognised. Most of the ore has come from the central area of phonolitic breccia.

The bulk of the telluride ore-bodies is in fissure veins, either simple or complex, being closely spaced and linked together, constituting what is called a "sheeted zone." The fissures radiate from a point to the north of the area; they are uniformly narrow, therefore the amount of gangue and ore is comparatively small. Quartz, fluorspar, and other minerals usually line the walls of the fissures; the rich tellurides are generally the last minerals to form. The authors consider that the unoxidised ore deposits represent the product of one period of general mineralisation not appreciably modified by any secondary enrichment. The last exhalation of the Cripple Creek volcano seems to be a mixture of nitrogen with about 20 per cent. of carbon dioxide and a small amount of oxygen. The gas increases in quantity with the depth, and in some cases interferes seriously with mining operations.

An interesting description of the petrography of the Highwood Mountains of Montana (7) is given by Prof. Pirsson. This region is occupied by a greatly eroded group of volcanoes which were in activity at some time subsequent to the Lower Cretaceous; several necks (stocks) are exposed, and now stand up as prominent peaks. Highwood Peak, the highest point in the group, is composed of syenite (pulaskose) and monzonite (shoshonose); in East Peak the rock is a basic leucite syenite. The Shonkin stock is shown to consist of Missourite, passing by intermediate stages into shonkinite. The Arnoux stock is important as the source of a new variety, *Fergusite* (fergusose), a rather coarse-grained, pseudo-leucitic augite rock, consisting of orthoclase, nepheline, and diopside; it appears to bear a similar relation to the leucitites that missourite does to the leucite basalts. In describing the petrographic characters of the necks, dykes, and extrusive flows, the new nomenclature is used concurrently with the old, so that the conservative reader need not be dismayed by "Trachyphyro-Highwoodose," "grano-shoshonose," or what not. The author concludes with some suggestive remarks on magmatic differentiation.

The annual report of the United States Geological Survey (8) is, as usual, a record of excellent organisation and of abundant energy in all departments.

The twenty-ninth annual report on the geology and natural resources of Indiana (9) contains a monograph of some 650 pages, by Prof. Blatchley, on the clays and clay industries of the State, the reports of the inspectors of mines and natural gas, a paper on the utilisation of convict labour in making road material, an account of the petroleum industry in Indiana in 1904, and a paper on the insect galls of Indiana.

The section on clays is very much like similar reports with which we are becoming daily more familiar; it is an excellent report of its kind. It describes in detail the clay resources of each county, with geological information and analyses; suggestions are given as to available clays and shales that are as yet unworked, and advice is given as to the best way of dealing with them. The use of bricks for road-making is strongly advocated, and the full specifications for the construction of brick pavements in the city of Terre Haute are given; these may prove of interest to those in this country who favour this type of road—the brick roads in Terre Haute have given great satisfaction. The report is illustrated with photographs and maps, and with full statistics of the various branches of the clay industry.

The paper on insect galls, by Dr. Cook, is little more than a catalogue of the galls known in the State. It is provided with a simple introduction to the subject and a bibliography, and with numerous outline sketches and photographs. It should be appreciated in the State. We are not aware that the papers mentioned above are issued separately; if this is not the case it seems unfortunate, for they appeal to such divergent interests.

The summary report of the Geological Survey of Canada (10) for 1904 indicates considerable activity in all quarters of the Dominion. A striking illustration of the usefulness of the survey lies in the discovery of a coal seam 10 feet thick in a bore-hole 2340 feet deep in Cumberland, Nova Scotia. This bore-hole was sunk through a thick cover of unproductive rocks at the suggestion of Mr. Hugh Fletcher, of the Geological Survey staff, after he had worked out the structural geology of the district.

In the Purcell Range, Dr. Daly records an enormous sill of hornblende-gabbro, 2500 feet thick; this he calls the "Moyie sill," from its occurrence at a point where the Moyie River crosses the international boundary. This great mass of basic rock has been thrust into the pre-Cambrian Kitchener quartzite, with the result that its upper portion, some 200 feet thick, has been converted into an acid biotite-granite by assimilation of the siliceous sediment. This has come about principally through the agency of "gravitational differentiation" following the shattering of the quartzite by the heated contact.

Prospecting for iron by means of the magnetometer (Thalen-Tiberg form), an innovation in Canada, seems to have had good results in Charlotte County, New Brunswick. Dr. Barlow contributes some notes on the occurrence of corundum in the intrusive complex of Robillard Mountain at Craigmont. The corundiferous rocks are of syenitic or gabbroid type; scapolite and nepheline often accompany or replace the prevailing felspars. Some of the syenite contains as much as 34 per cent. of corundum.

J. A. H.

## THE PERIODICITIES OF SUN-SPOTS.[1]

EVERYBODY knows how to interpret the curve by means of which the intensity of radiation of a body is expressed in terms of the wave-length or frequency, and everybody recognises the utility of such a curve. It allows us at once to distinguish between the line spectrum and the spectrum of bands or the continuous spectrum, and brings out regularities which would be difficult to recognise in the original disturbance. In practice we employ the spectroscope to give us the data from which the curve of intensities is constructed. But what the spectroscope can do for a luminous disturbance, calculation can do for any quantity which fluctuates about a mean value. We are able, therefore, to construct in every case a curve which in all respects is analogous to the graph which connects the period and intensity of radiation. This curve I call the periodograph, and refer to the diagram embodying the curve as the periodogram. There is a periodogram of rainfall or barometric change, and these curves would, in my opinion, if constructed for different localities, yield us most important and characteristic information about climate.

During the last three years I have been occupied in calculating the periodogram of sun-spot variability. The results have been communicated to the Royal Society, and the following is a summary of abstracts which are published in the *Proceedings* of that society. The first paper deals with a detailed examination proving that the process I employ furnishes an analysis which is identical with the experimental spectrum analysis supplied by the grating. In the second paper the method is applied to the statistics of sun-spots.

The data used were Wolf and Wolfer's sun-spot numbers, which give us sufficient information from the year 1749 to the present time. I have in addition used, wherever possible, the measurements of areas which for each synodic revolution of the sun have been collected by the Solar Physics Committee of the British Board of Education from the year 1832 onwards, and the areas measured from photographs at the Greenwich Observatory for each day of the year since January 1, 1883.

The whole of the observations were treated collectively, but the complete interval of 150 years was also divided into two nearly equal portions, which were separately examined. At first sight, the results obtained by a com-

[1] Abstract of two papers, entitled, (1) "The Periodogram and its Optical Applications"; (2) "The Periodicity of Sun-spots." Read before the Royal Society on December 7, 1905.

parison of the two intervals of 75 years were exceedingly puzzling. While the observations beginning with about 1826 showed a nearly homogeneous variation of 11·125 years, this period seemed almost entirely absent between 1749 and 1826. Its place was during that interval taken by two important groups of periodicities, one of which had a periodic time of about 9·25 years, while the second had an average period of 13·75 years. The latter period was represented more nearly by what in spectroscopy is called a "band," extending from 13·25 to 14·25 years, but some of this want of definiteness may be due to the deficiency in observational data. For some time I was inclined to draw the conclusion that such periodicities as we observe are comparatively short lived, and replaced by a number of others which in their turn die out. A more detailed investigation, however, convinced me that the periodicities are, as regards the interval of time elapsing between successive maxima, extremely regular, occurring with what may prove to be astronomical accuracy. The key of the solution is, I believe, to be found in the overlapping of a number of periods, all of which are regular as regards time, but vary considerably as regards intensity, so that one or other may for a certain number of years become inactive. Their real existence is proved by the fact that whenever they reappear after a period of inactivity, the phase of the renewed periodic action fits in exactly with the continuation of the old period.

A periodicity of about 4·78 years runs through the whole of the observations. Its amplitude being about one-sixth of that of the eleven-year period is too great to be accounted for by accident. It appears separately in the series of Wolf's numbers, ranging from 1749–1826 and from 1826–1900. It also appears in the series depending on the measurement of areas. The phases of the period as determined from these series are in good agreement, and even while I was inclined to question the permanency of the eleven-year period I never felt any doubt that during the whole length of 150 years this period has been acting. Its time, determined as accurately as possible from the combined records, was 4·81 years, but I believe that if greater weight were given to the more recent and more complete observations the number would be slightly reduced. As regards the main period, which has certainly given its character to the sun-spot statistics during the greater part of the last century, I find the time as determined from the observations since 1826 alone to be 11·125 years. This agrees well with Wolfer's estimate of 11·124, and Newcomb's investigation, which led to 11·13 as the most probable number.

If to the most accurate series of measurements of sun-spot areas which begin in 1832 we apply a process the result of which is the elimination of the chief period, and draw a curve representing what is left, we find decided maxima during the years 1836, 1845, 1853, 1862, and 1870, the intervals being alternately 9 and 8 years, or 8·5 years on the average. The periodogram based on Wolf's numbers for the complete interval 1749–1900 shows a decided maximum of intensity for a periodicity of 8·25 years. Adopting this period provisionally, and disregarding all observations since 1826, we may use Wolf's series previous to that date for the determination of the phase of the period in question, and thus forecast the maxima for the subsequent interval. We thus obtain 1836·3, 1844·7, 1852·9, 1861·2, 1869·4, in almost exact agreement with the above. The slight disagreement of phase would be corrected by assuming the time to have been 8·32 years.

A periodicity of about 13·5 years shows as a maximum of intensity in the periodogram for the complete interval. In connection with it the following facts seem remarkable. There are in Wolf's records three cases of successive maxima having an interval of between 13 and 14 years. They are:—1626·0–1639·5, 1816·4–1829·9, 1870·6–1883·9. Also the interval between 1639·5 and 1816·4 is thirteen times 13·61, and the interval between 1829·9 and 1870·6 is three times 13·57. Thus the maxima all fit in with a period of about 13·6 years, which with varying intensity seems to have run through the whole record of observations.

Not wishing to lay too great a stress on what may prove to be merely a numerical coincidence, I return to the three periods which have been determined with some accuracy. It was only after the periodic times had been independently determined that the following remarkable relationship between the numbers was discovered. Taking frequencies into consideration, we are led to form the reciprocals of the periodic times, and thus find

$$1/11\cdot125 = 0\cdot08989$$
$$1/8\cdot32 = 0\cdot12019.$$

Adding up we find

$$1/4\cdot76 = 0\cdot21008.$$

Hence the sum of the frequencies of two of the periods agrees within the possible errors with the frequency of the third period. But it is also found that the two first numbers are very nearly in the ratio of three to four, so that we may also express the three periodic times as sub-periods of 33·375 years. Thus

$$\tfrac{1}{3} \times 33\cdot375 = 11\cdot125$$
$$\tfrac{1}{4} \times 33\cdot375 = 8\cdot344$$
$$\tfrac{1}{7} \times 33\cdot375 = 4\cdot768.$$

How far this connection is accurate or approximate it is impossible to say at present, but the fact that the three periods which have been traced with a considerable degree of certainty should also bear a remarkably simple relationship to each other is worthy of note.

If we accept a period twice as long as that given above, we might account for other periodicities of which at present the times are only approximately determined; thus $\frac{1}{8} \times 66\cdot75$ would lead us to 13·34, in fair agreement with the period of 13·57 years which has been mentioned above. But the difference is greater than it should be, and at the present I do not wish to put forward the longer.

ARTHUR SCHUSTER.

## *NATURAL HISTORY AND ARCHÆOLOGY OF THE WATERLILIES.*[1]

MR. CONARD has embodied the result of several years' work on the waterlilies in the sumptuous volume before us. The monograph opens with an historical account of the plants as they were known to the ancients, and then deals with the group from a modern botanical point of view.

An interesting part of the memoir deals with the morphology and development of the plants, and the reader will find much that is worth reading therein. It must be confessed, however, that, taken as a whole, this portion occupies a somewhat large number of pages in proportion to the amount of valuable information it contains. The structure of the root is given at some length, but one would have liked to see a comparative treatment given that embraced not only the roots of different species, but also those of an individual plant at various stages of the life-history. Possibly such an investigation might throw light on the nature or origin of the "Liorrhizic" character of the roots in the waterlilies. Mr. Conard gives a good account of the formation of the intercellular spaces and the diaphragms so characteristic of the order, and he mentions an interesting occurrence of stomata on the under surface of the aërial leaves that rise above the level of the water in *Nymphaea odorata* var. *minor*.

The occurrence of stipules is a point of some note, and it may be remarked that their absence from the early leaves of the seedlings detracts from their phylogenetic significance in the group.

A short sketch of the development of the flower is included in the monograph, and we think it might have been considerably extended with no small advantage. The flowers, as is well known, occupy a remarkable position in waterlilies, where they apparently replace a leaf. The author was led to adopt a suggestion made by Caspary as to the morphology of the flower which explains the anomaly and at the same time appears to fit the facts of development. The anterior sepal, which appears first, and often well below the others, is regarded as morphologically representing the bract, whilst the two lateral sepals are

1 "The Waterlilies. A Monograph of the Genus Nymphæa." By Henry S. Conard. Pp. xiii+279. (Published by the Carnegie Institution of Washington, 1905.)

in like manner formed at the expense of the two prophylls. A similar explanation, it may be remarked, has been advanced, also on good grounds, to explain the otherwise anomalous character of the flower and inflorescence in *Adoxa moschatellina*.

The chief part of the work is devoted to the taxonomy of the group and to the description and delineation of the different species. Distribution and hybridisation are briefly considered, and a short chapter on the culture of the waterlilies is added; the work closes with an excellent bibliography.

The illustrations are numerous, and many of them are finely executed in colour, whilst the paper and printing leave nothing to be desired even by the most fastidious bibliophile. The book certainly deserves a place on the shelves of those who are interested in a group more beautiful than most, and perhaps inferior to none, of the plants that are cultivated for the beauty alike of their form and of their colour.

## UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The general board has nominated the following as electors to professorships:—Prof. W. A. Tilden to the professorship of chemistry, Sir W. D. Niven to the Plumian professorship of astronomy, Sir A. Geikie to the professorship of geology, Prof. J. J. Thomson to the Jacksonian professorship of natural philosophy, Sir W. H. Broadbent to the Downing professorship of medicine, Dr. L. Fletcher to the professorship of mineralogy, Prof. Larmor to the professorship of experimental physics, Sir W. H. White to the professorship of mechanism and applied mechanics, Prof. Schäfer to the professorship of physiology, and Dr. J. F. Payne to the professorship of pathology.

Mr. A. R. Brown, of Trinity College, has been elected to the Anthony Wilkin studentship in ethnology and archæology. This is the first election which has been made to this recently founded studentship.

THE Goldsmiths' Company has voted a further sum of 1558*l.*, in addition to its previous endowment of the Goldsmiths' College at New Cross, to defray the expenses of putting the buildings in complete working order.

UNDER the auspices of the Society for the Technical Education of Women, founded a few years ago by Mrs. P. N. Arian, a technical high school for women was opened in St. Petersburg on January 28. The new high school has two faculties, one for engineering and building subjects, and the other for electrochemistry, and provides a four-year course in each, which courses it is intended shall be of the same educational standard as those in the same subjects in the present technical high schools.

WE have received a copy of a well illustrated "Souvenir" of the opening last year of the new engineering and metallurgical laboratories of the University of Sheffield. In view of the illustrated article published in NATURE for July 20, 1905, describing the new buildings at Sheffield, it is unnecessary to do more than direct attention to the excellence and great extent of the provision made in this new university for teaching the higher branches of applied science. It is possible from the numerous well executed pictures in the souvenir to form a good idea of the laboratories and their equipment without a visit to Sheffield.

*Science* announces further munificent gifts to higher education in the United States. Mr. John D. Rockefeller has given 290,000*l.* to the University of Chicago. Of this sum, 200,000*l.* is for the permanent endowment, 70,000*l.* to cover the current expenditures or deficit of the various departments of the University to July 1, 1907, and the remaining 20,000*l.* is to provide a fund, the interest of which is to go to the widow of the late President Harper during her lifetime. By the will of the late Mr. Marshall Field, Chicago receives 1,600,000*l.* for the endowment and maintenance of the Field Columbian Museum. The bequest is on condition that within six years from the death of Mr. Field there shall be provided a satisfactory site for the permanent home of the museum. By the will of the late Mr. W. C. Putnam, the Davenport (Iowa) Academy of Sciences becomes prospectively one of the most richly endowed institutions of its kind in the world. Mr. Putnam left an estate of 140,000*l.* with provisions for limited incomes to relatives, the remainder of the revenues to be paid to the academy, and the entire estate to go to that institution at the death of the surviving brothers and sisters.

UNDER the leadership of Dr. Chiari, a member of the Austrian Government, a petition was recently laid before the Austrian Minister of Education in which the teaching of chemistry in the technical high schools was given the most prominent place. The petition affirmed that the present conditions of the chemical laboratories in the high schools had repeatedly been the subject of severe criticism in technical circles; that neither the space provided, the existing equipment nor the teaching staff was at all adequate to the requirements of modern chemistry. The backwardness of Austrian chemical laboratories could not but most seriously affect the chemical industries; indeed, in no other branch of commerce was a direct and intimate connection with the high schools so absolutely essential. The schools had been neglected, and consequently it was found that instruction in general technical chemistry and the intensive study of those branches of technical chemistry which were particularly suited to Austria had not received that amount of attention which they needed. A scheme involving the erection of a new chemical institute in Vienna was laid before the Government last year. The petitioners desired a speedy settlement of the existing misunderstandings on this subject, as they considered the building of such a chemical institute the first condition to an increased interest in Austrian chemical industries.

A COPY of the address delivered by Sir Alexander R. Binnie at the recent distribution of prizes to students of the Merchant Venturers' Technical College, Bristol, has been received. The address dealt in broad outline with education and with what it in a certain sense implies, the acquisition of knowledge. Answering the question, How do we obtain knowledge? Sir Alexander Binnie said it can only be obtained through those senses with which human beings are endowed. First, knowledge includes sensations directly conveyed, that is, personal knowledge. Then there is knowledge of the world conveyed in books, that is, the teaching of authority; and there is a third, an all important division of knowledge, derived partly through observation, and partly through the mysterious property called mind. Observation and reasoning lead, especially in the line of science, to certainties greater, often more sure and more truthful, than those received through the senses. Later in the address Sir Alexander Binnie urged that in all these matters of education it is necessary to be careful; arrogance and self-conceit are quite out of place. There are limitations to all, but in the study of nature, and the great truths that nature reveals, the human mind is enlarged and its conceptions are elevated. In all the knowledge acquired during the years that human beings are permitted to indulge in that wonderful spectacle which nature presents, a preparation is being undergone, and it is to be hoped an advancement from a lower to a higher grade of mind.

## SOCIETIES AND ACADEMIES.

### LONDON.

**Royal Society**, December 7, 1905.—"The Determination of the Osmotic Pressures of Solutions by the Measurement of their Vapour Pressures." By the Earl of **Berkeley** and E. G. J. **Hartley**. Communicated by W. C. D. Whetham, F.R.S.

The authors find that Ostwald and Walker's "bubbling" method of determining the lowering of the vapour pressure of solutions is unsatisfactory. They therefore use a form of apparatus such that dry air is allowed to pass over the solution, while the latter is continuously stirred, and then over the solvent. By placing two vessels containing

the solution in series, the constancy of weight of the second vessel indicates that the air has been saturated up to the vapour pressure of the solution. The total quantity of vapour given off by the solution and solvent is absorbed by sulphuric acid, and the gain in weight of the latter should equal the loss sustained by the two former. With solutions in water, it is pointed out that, on account of the condensation of solvent in the tube leading to the sulphuric acid, this never quite obtains. The loss of weight of the solution in conjunction with that of the solvent give, however, the data for calculating the osmotic pressure. It is shown that Arrhenius's formula, when applied to concentrated solutions, does not connect the true osmotic pressure with the lowering of vapour pressure; and a more correct relation is deduced from a consideration of the hydrostatic pressures about a column of solution which is closed at the lower end by a semi-permeable membrane, and is partially immersed in the solvent. It is found that the osmotic pressures of cane-sugar solutions when calculated by way of vapour pressures and when observed directly agree to within 5 per cent. of one another over a range of 20 to 110 atmospheres.

January 25.—"Artificial Double Refraction, due to Æolotropic Distribution, with Application to Colloidal Solutions and Magnetic Fields." By Dr. T. H. **Havelock.** Communicated by Prof. J. Larmor, Sec.R.S.

The sections of the paper are summarised as follows:—

(1) The formal investigation of artificial double refraction in colloidal solutions as due to a deformation of the medium consisting of a change in the packing of the colloidal particles.

(2) The possibility that such deformation may be produced by mechanical stress as arising from the possession of a certain amount of rigidity by such solutions.

(3) The analogy between the effects so produced and the double refraction due to a magnetic field.

**Linnean Society,** January 18.—Prof. W. A. Herdman, F.R.S., president, in the chair.—Coloured transparencies from flowers in natural colours: T. E. **Waltham.**—The life-history of *Margaritifera Panasesae*: A. W. **Allen.** The paper was interesting as the result of close observation in the field, though practically all had been observed by other observers in various parts of the world, and of various nationalities.—Some endophytic algæ: A. D. **Cotton.** The observations referred chiefly to *Endoderma viride*, Lagerh., which occurs abundantly in the tissues of *Nitophyllum Hilliae*, Grev., a deep-water alga, only obtainable by dredging. The author also gave the result of his study of *Streblonema intestinum*, Holmes and Batters, based upon Reinsch's preparations in the Kew herbarium.—The organ of Jacobson in Sphenodon: Dr. A. **Broom.**

February 1.—Prof. W. A. Herdman, F.R.S., president, in the chair.—The Percy Sladen Trust Expedition in H.M.S. *Sealark* to the Indian Ocean: J. Stanley **Gardiner.** Accounts of the work and results of the expedition were given by Mr. Gardiner in NATURE of April 13, August 10, October 5, November 9, December 21, 1905, and January 25 of the present year.

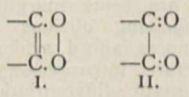
**Anthropological Institute,** January 23.—Prof. W. Gowland, president, in the chair.—Annual meeting.—Annual address: copper and its alloys in antiquity: **President.** Smelting had its origin in the camp fire, from which the first primitive furnace, a hole in the ground, used even now in parts of Japan, naturally evolved. The lumps of copper discovered in "founders' hoards" had clearly been smelted in this way. The hole was first filled with charcoal, over which was placed the ore, then another layer of charcoal, then more ore, and so on; the draught was obtained by the wind or by primitive bellows. The smelted copper was not run off, but, at the moment of solidification, was pulled out of the fire and broken into pieces on a large stone. This system is still practised in Korea, while the implements used by primitive man have their counterpart at the present day in the tools used by the native smelters in some parts of Africa. Turning to the question of bronze, Prof. Gowland stated that in his opinion this was made directly from a copper ore containing tin, long before the two metals were mixed. In Hungary a copper ore containing antimony takes the place of a copper-tin ore, and the implements found there frequently contain antimony in considerable amounts. He defined bronze as an alloy of copper and tin containing not less than 2 per cent. of tin; lead, arsenic, zinc, &c., being present in very small quantities. The president was of opinion that there was no evidence of a true Copper age in Europe, excluding only Cyprus, which was, of course, exceptional. Copper implements were only used by primitive man as adjuncts to stone implements, which were more efficient as weapons, and when found are only copies of stone implements, or when made in the Bronze age take the form of the implements of that period. In its simple form a copper celt could only be made in an open mould, and therefore only flat celts could be made of copper. The opinion often maintained, that the intention of the makers of bronze weapons was to make an implement in the proportion of 9:1, was shown by analysis to be incorrect, as also was the theory that the art of tempering bronze was lost, as it could now be hardened by hammering as well as, if not better than, it was done in the Bronze age. The lecturer also clearly proved that metallic tin was not necessary to the manufacture of bronze, and bronze celts made by him by melting metallic copper with tin ore, and from metal obtained by smelting a mixed ore of copper and tin in a primitive furnace in the metallurgical workshop of the Royal School of Mines, were exhibited. He also showed conclusively that the opinion held by many of the existence of a universal Copper age in Europe, intermediate between the Bronze and Stone periods of culture, was not warranted by the facts of the case.

**Geological Society,** January 24.—Dr. J. E. Marr, F.R.S., president, in the chair.—The igneous and associated sedimentary rocks of Llangynog (Caermarthenshire): T. C. **Cantrill** and H. H. **Thomas.** The sedimentary rocks associated with the igneous masses comprise Lower Old Red Sandstone, Didymograptus-bifidus beds, and Tetragraptus beds of the Ordovician. They occur in two anticlines, overfolded, and complicated by thrusts. The igneous rocks occur in three well defined areas, which belong to the same petrographical province. Both interbedded and intrusive rocks are represented; the latter include diabases and a large porphyry mass. The extrusive rocks occur in the following order:—(1) augite-andesites; (2) rhyolites; and (3) augite-andesites. The extrusive rocks are interbedded with fluxion-breccias and with tuffs; they are associated with the lower members of the Tetragraptus beds, and are consequently of Lower Arenig age; while the intrusive rocks have been injected into the extrusive rocks, and have also affected the Tetragraptus beds.—The Buttermere and Ennerdale granophyre: R. H. **Rastall.** From the facts put forward it is concluded that the intrusion is an example of an acid-magma, which has crystallised under the set of conditions that gives rise to a perfect development of granophyric structure. The masses appear to be of the "cedar-tree" laccolite type intrusive about the junction of the Skiddaw Slates and the Borrowdale rocks. Besides the normal acidic rock, there are some marginal patches of more basic character, showing obvious genetic relationship. These basic forerunners afford evidence of differentiation of the magma before intrusion—an example of Prof. Brögger's deep-magmatic differentiation. Considered as a whole, the character of the magma shows closer affinity to the tonalite group than to the true granites. The more basic types include dolerites, quartz-dolerites, and a rock type intermediate between quartz-dolerites and granophyres. There is also a development of peculiar rock types as the result of the re-mixing of previously differentiated partial magmas of an acid and a basic character respectively.

**Challenger Society,** January 31.—Dr. R. N. Wolfenden in the chair.—Four deep-water Caridæ from the west coast of Ireland: S. W. **Kemp.** *Acanthephyra purpurea*, a species showing so great variation that it is now possible to rank six other "species" as its synonyms; *A. debilis*, a very rare species with about 100 luminous organs; *Ægeon brendani*, and *Leontocaris lar*, spp. nn.—Report on the Chætognatha of the *Siboga* expedition in the Dutch East Indies: Dr. **Fowler.** Of sixteen species, only one appeared to be new. Among those taken only in deep

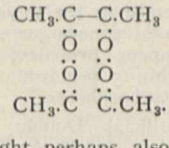
hauls were *Sagitta macrocephala* and *S. zetesios*, known only from deep water in the Atlantic, and *Krohnia hamata*. The species captured at the surface supported the alleged uniformity of the Indo-Pacific epiplankton. A systematic revision of all species hitherto described left twenty-four as valid. A revision of all captures of Chætognatha hitherto recorded appeared to show one (*hexaptera*) as cosmopolitan and pantothermal, others as eurythermal, and having a wide but not a universal range, others as confined to a limited area and stenothermal. As regards depth, four have been only recorded from the mesoplankton; two at the surface in polar waters seek the mesoplankton in warm seas; others are confined to the epiplankton. According to temperature, species appear to fall into five classes:—cold water species with a maximum of about 12° C., temperate species, warm water species with a minimum of about 16° C., species with a wide range of temperature, and a single pantothermal species. The writer also presented a note on Antarctic and sub-Antarctic Chætognatha taken on the *Discovery* and *Challenger* expeditions; these established *Krohnia hamata* as truly bipolar, from 81° 30′ N. to 77° 49′ S., and completed the cosmopolitan record of *hexaptera*; they also enabled the N. limit of *hamata* at the surface, and the S. limit of *serratodentata*, to be determined approximately.

**Chemical Society**, February 1.—Prof. R. Meldola, F.R.S., president, in the chair.—Hydroxylamine-αβ-disulphonates: T. **Haga.** These salts, obtained by hydrolysis of Fremy's *m*-sulphazilates, are decomposed by sodium amalgam, and are proved by the nature of this change to be hydroxylamine-αβ-disulphonates. This is believed to be the first indisputable case of the occurrence of fundamental structural isomerism among inorganic compounds.—Studies in the camphane series, part xxi., benzenediazo-ψ-semicarbazinocamphor and its derivatives: M. O. **Forster.** Compounds of this class have been obtained from diazotised aniline, *p*-toluidine, &c.; they are characterised by the readiness with which dilute alkalis resolve them into camphoryl-ψ-carbamide and the corresponding phenylazoimide.—The relations between absorption spectra and chemical constitution, part i., the chemical reactivity of the carbonyl group: A. W. **Stewart** and E. C. C. **Baly.** It is pointed out that in certain cases the phenomena of tautomerism furnish an explanation of the exceptional reactivity of the carbonyl group. From spectroscopic evidence it appears that in the α-diketones a vibration is going on, which, to a certain extent, resembles that which was found in the case of ethylacetoacetate and its derivatives. The nature of this vibration cannot be easily expressed in the ordinary structural formulæ without the possibility of misconception, but it may be indicated somewhat as follows:—The vibration is brought about by some change in the relations between the carbon and oxygen atoms, and in some respects resembles the transition from the ketonic to the enolic form and back again. Using this analogy, it may be postulated that the two extreme phases of the vibration can be represented by the formulæ



I. II.

It is proposed to call the general phenomenon "isorropesis," and to call "isorropic" those radicals the activity of which is thus produced.—The relation between absorption spectra and chemical constitution, part ii., the quinones and α-diketones: E. C. C. **Baly** and A. W. **Stewart.** In this paper it is shown that isorropesis in α-diketones results in the absorption of light in the visible blue region, so that the substances are intensely yellow. This is evidenced by camphorquinone and diacetyl. These observations strongly support Armstrong's theory that the colour of certain benzene derivatives is due to the quinonoid linking, for they show that the colour is caused, not directly by this linking, but by the isorropesis between the unsaturated atoms where this linking exists.—The relation between absorption spectra and chemical constitution, part iii., the nitranilines and the nitrophenols: E. C. C. **Baly,** W. H. **Edwards,** and A. W. **Stewart.** In this paper are described the absorption spectra of compounds having the quinonoid linking and containing a nitrogen atom in place of one or both of the quinone oxygen atoms. In the discussion, Prof. Armstrong said that Mr. Baly had put aside entirely the view which had long been held that ketonic interactions were conditioned by the combination of various substances with the carbonyl group, and had adopted an entirely *intra*-molecular view of change, whether chemical or physical. He still adhered to the opinion that three absorbing centres were required to produce visible colour, *i.e.* that iodoform, not methylene iodide, might be taken as typical of coloured substances. The colour of compounds such as diacetyl might be accounted for on the assumption that polymeric molecules were present, formed by the association, through the residual affinity of the oxygen atoms, of the ketonic groups, *e.g.*



This explanation might perhaps also apply to metanitrophenol and metanitraniline. He remarked subsequently that the blue colour of water might be accounted for from this point of view, but not by Mr. Baly's hypothesis.—The action of light on benzaldehydephenylhydrazone: F. D. **Chattaway.**—The union of chlorine and hydrogen: C. H. **Burgess** and D. L. **Chapman.**—Note on the molecular weight of epinephrine: G. **Barger** and A. J. **Ewins.**—The critical temperature and value of $ML/\Theta$ of some carbon compounds: J. C. **Brown.** The value of $ML/\Theta$ rises very slightly with the increase of $CH_2$ in the aliphatic alcohols, acids, and esters, but is very constant for the aromatic hydrocarbons.—Slow oxidations in the presence of moisture: N. **Smith.**—Fischer's salt and its decomposition by heat: P. C. **Rây.**—Action of quinones on *o*-diamines, *o*-nitroaniline, *m*-nitroaniline, and 2-nitro-*p*-toluidine. A preliminary note.—Some oxidation products of the hydroxybenzoic acids, ii.: A. G. **Perkin.** When gallic acid dissolved in 76 per cent. sulphuric acid is oxidised by means of potassium persulphate, a colouring matter very similar to ellagic acid is produced. This substance, to which the name flavellagic acid is assigned, is probably hexahydroxydiphenylmethylolid.—Contributions to the chemistry of oxygen compounds, part i., the compounds of tertiary phosphine oxides with acids and salts: R. H. **Pickard** and J. **Kenyon.**—The rapid electro-analysis of metals, preliminary note: H. J. S. **Sand.**

**Mathematical Society**, February 8.—Sir W. D Niven, vice-president, in the chair.—The Eisenstein-Sylvester extension of Fermat's theorem: Dr. H. F. **Baker.** Sylvester gave in 1861 an expression for the residue, to modulus $p$, where $p$ is an odd prime, of the integer $(\gamma^{p-1}-1)/p$. The result admits of simple proof and of extension to the case where the modulus is not prime, and the expression obtained for the residue is shown to be one of a definite number of possible representations.—A chapter of the present state in the historical development of the elliptic functions: Prof. H. **Hancock.** The paper deals chiefly with the contributions of Cayley and Eisenstein to that method of developing the theory of elliptic functions which is usually associated with the name of Weierstrass.—The reduction of the ternary quintic and septimic to their canonical forms: Prof. A. C. **Dixon** and Dr. T. **Stuart.** The method employed in the reduction is Sylvester's extended dialytic method of elimination.—The scattering of sound by spheroids and discs: J. W. **Nicholson.** The diffraction of plane sound waves by a very small spheroid has been discussed by Lord Rayleigh. The paper is occupied with the development of formulæ suitable for expressing the scattered waves in the case where the axis of the spheroid is parallel to the direction of the incident disturbance, and the dimensions of the spheroid are sufficiently small compared with the wave-length for an approximation proceeding by powers of the ratio of the equatorial radius to the wave-length to be valid.—A preliminary communication on partitions of numbers in space of two dimensions was made by Major P. A. **MacMahon.**

DUBLIN.

**Royal Dublin Society**, January 16.—Dr. W. E. Adeney in the chair.—Secondary radiation from compounds: Prof. J. A. **McClelland** and F. E. **Hackett**. The secondary radiation of $\beta$ particles emitted by substances when they are acted upon by the $\beta$ rays of radium has been previously measured by one of the authors for a large number of elementary substances. In the present paper a number of chemical compounds have been tested experimentally, and the secondary radiations from the compounds have also been calculated on the assumption that the secondary radiation is an additive atomic property. The close agreement between the calculated and the experimental value shows that the assumption is fully justified. This result is then used to determine the secondary radiation from a number of elements not available in sufficient quantity in the pure state to enable them to be studied directly. The relations previously established between the secondary radiation and the atomic weight are found to hold for all the additional elements thus investigated.—Electromagnetic mass: Prof. A. W. **Conway**. The electromagnetic inertia of an invariable system of electric charges is considered. A quadric is obtained such that if the force has the direction of the radius vector, the "mass" in that direction is as the inverse square of the length, and the direction of the acceleration is the perpendicular on the tangent plane. The mean mass of any such system is $4/3\,C^{-2}$, the work necessary to assemble it from a state of infinite diffusion.—Note on the sublimation of sulphur at ordinary temperatures: R. J. **Moss**. Twenty-five years ago some fragments of ordinary stick sulphur were enclosed in a glass tube, which was then exhausted by a Sprengel pump and sealed. After the lapse of twenty years indications of the formation of a crystalline sublimate became apparent; during the past five years the crystals have increased in number and in size to a marked extent; some of them are now 0·2 mm. in length, and the sublimate is deposited on one side of the tube throughout its whole length. The crystals are apparently rhombic, and are much more complex than those deposited from sulphur solutions.

EDINBURGH.

**Royal Society**, February 5.—Prof. Crum Brown, vice-president, in the chair.—The relation between normal "take-up" (or contraction) and degree of twist in twisted threads: T. **Oliver**. The paper was chiefly devoted to the properties of two-ply twisted yarns. The effect of twisting together two already twisted single threads was studied theoretically, and special attention was directed to the lengthening in the early stages of the second twisting due to the opening out of the single threads as the second twist was applied in the opposite direction to that of the first twists. Formulæ were deduced connecting the change of length with the amount of twist, and these were then compared with the results of experiment. The comparison was satisfactory, the discrepancies being such as might naturally be expected when due consideration was given to the necessarily imperfect nature of the assumptions on which the theoretical calculations were made. For example, the beginning of the contraction in the second twisting, when experimentally tested, occurred at a later stage than was indicated by the theoretical formula, a discrepancy which could be explained by the extremely probable supposition that the yarn had acquired a "set" in one direction during the first twisting.—Some experimental results in connection with the hydrodynamical theory of seiches: P. **White** and W. **Watson**. These experiments were undertaken at the suggestion of Prof. Chrystal, and the results obtained gave striking confirmation of several of his theoretical conclusions. The seiches were generated in a rectangular trough 5 feet long and 4·5 inches wide. Various bottom contours were obtained by means of blocks of wood cut to the desired form, such as parabola, concave or convex, semi-parabola, symmetrical rectilinear slope, and the quartic form which Prof. Chrystal had found to lead to a simple solution. The seiches were started by the to-and-fro motion of a strip of wire gauze placed at the position of a node of the required seiche, and kept in proper periodic motion by means of an attached heavy pendulum the length of which could be adjusted. By this method seiches of nodalites as high as the fourth, fifth, and even seventh, had in certain cases been obtained. The periods of these were easily determined, but the positions of the nodes and ventral segments could not be determined with the same accuracy. Within the errors of observation, the agreement with theory was generally very close. It was found that with the convex parabolic bottom the seiches were not so persistent as in the case of the concave bottom, but that the trinodal was more persistent than the uninodal. With the quartic contour of bottom the seiches were remarkably persistent up to that of the fourth nodality.

PARIS.

**Academy of Sciences**, February 5.—M. H. Poincaré in the chair.—On the existence of insoluble potassium compounds in the trunk and bark of the oak: M. **Berthelot**.—On the rotatory powers of hexahydrobenzylidene and œnanthylidenecamphors and their corresponding saturated derivatives, compared with the rotatory powers of benzylidene and benzylcamphors: A. **Haller** and F. **March**. These compounds were chosen for comparison since they contain the same number of carbon atoms, the substituting groups, benzylidene, hexahydrobenzylidene, and œnanthylidene, containing gradually increasing numbers of hydrogen atoms. Details are given of the methods of preparation of the various compounds, and of their physical properties. The conclusion is drawn that in benzylidenecamphor and its analogues, as in the benzylcamphors, it is the unsaturated character of the benzene ring which exerts its action on the elevation of the rotatory power of the asymmetric molecule to which it is attached.—Contribution to the chemical study of sea-water: Th. **Schlœsing**. A discussion of the results of chemical analyses of samples of sea-water taken at various points in the Mediterranean. The water of the Mediterranean differs from that of the Atlantic only by its degree of salinity, the mineral constituents of the two oceans being nearly identical.—Quasi-waves of shock, and the distribution of temperature in these quasi-waves: P. **Duhem**.—The provisional elements of the comet 1906*a*: E. **Maubant**. The calculations are based on observations made on January 29, 30, and 31.—Observations made on the sun at the Observatory of Lyons with the 16 cm. Brunner equatorial during the third quarter of 1905: J. **Guillaume**. The results of observations on forty-four days are summarised in three tables giving details of the spots, their distribution in latitude, and the distribution of the faculæ in latitude.—A problem in the calculus of variations: Erik **Holmgren**.—The general solution of the problem of equilibrium in the theory of elasticity, in the case where the displacements of the points of the surface are given: A. **Korn**.—Some results of the triangulation of the Pelvoux-Écrins massif: Paul **Helbronner**. The present paper deals with the rectification of the heights of some of the important peaks.—The condensation of the acetylenic nitriles with alcohols. A general method of synthesis of $\beta$-substituted $\beta$-oxyalkyl acrylic nitriles: Ch. **Moureu** and I. **Lazennec**. The nitrile $R{-}C{\equiv}C{-}CN$ is treated with alcoholic potash; the product is poured on to ice, extracted with ether, and submitted to distillation in a vacuum. The compound $R{-}C(OC_2H_5){=}CH{-}CN$ is thus obtained. In the case of the aromatic compounds, this substance is easily hydrolysed by heating with dilute sulphuric acid, furnishing the ketone $R{-}CO{-}CH_2{-}CN$; with fatty compounds the hydrolysis is more difficult, and generally results in further changes.—Attempts at reduction in the diphenylamine series: H. **Duval**. A study of the effects of stannous chloride and zinc dust in alkaline solutions on azo-diaminodiphenylmethane.—Cyclohexylacetone: P. **Freundler**. The only method, out of several tried, which has given the desired ketone is the condensation of the iodide of hexahydro-benzyl-magnesium with acetaldehyde. The secondary alcohol thus obtained is oxidised to the ketone with chromic acid mixture. The yields are not good.—The absorption of alkaline carbonates by the mineral constituents of the soil: J. **Dumont**.—Observations on the preceding note: L. **Maquenne**.—The passage through the spinal ganglions of bundles arising from the motor roots and leading to the dorsal nerves in the Batrachians: P. **Wintrebert**.—The action of hordenine sulphate on soluble ferments and on micro-organisms: L. **Camus**. The sulphate of hordenine

retards the action of pepsin, trypsin, and rennet, but is without action on invertine, maltase, and lipasidin. It exerts an antiseptic action on bacilli.—The proportions of chloroform contained in arterial blood during anæsthesia and the effects produced: J. **Tissot.** There appears to be no direct proportion between the amounts of chloroform present in arterial blood and the anæsthetic effects produced.—Contribution to the study of the pathological anatomy of epithelial cancers of the prostate: MM. **Motz** and **Majewski.**—Trepanning and ventricular puncture in brain disease: O. **Laurent.**—The existence of limestone breccias in the mountains to the south-east of Mt. Blanc: M. **Kilian** and P. **Lory.**—Results of magnetic observations made at the Observatory of Athens during the years 1900–1903: D. **Eginitis.**—Note on an earthquake shock at Ebro: P. **Cirera.** The instruments at the Observatory of Ebro registered a shock between 3.47 p.m. and 6 p.m. on January 31. The magnetograph showed corresponding disturbances.

NEW SOUTH WALES.

**Linnean Society,** November 29, 1905.—Mr. T. Steel, president, in the chair.—Further notes on hybridisation in the genus Eucalyptus: J. H. **Maiden.** This paper briefly recapitulates recent work on the subject, directs attention to the fact that the credit of the discovery of natural hybridisation in this genus belongs to George Caley, whose observations were made in New South Wales before 1810, and indicates the guides which point to a natural hybrid.—Miscellaneous notes (chiefly taxonomic) on Eucalyptus, part ii.: J. H. **Maiden.** Reasons are given for the contention that the blue or flooded gum of coastal New South Wales (*E. saligna*, Sm.) cannot in reality be separated from the Bangalay (*E. botryoides*, Sm.), and the name var. *botryoides* is proposed for the latter.—On an undescribed species of Cryptocarya from eastern Australia: R. T. **Baker.**—Studies on Australian Mollusca, part ix.: C. **Hedley.** The marine molluscan fauna of New South Wales is enlarged by the addition of new species of Eulimella, Diala, Actæon, Mitromorpha, Rissoa, Bornia, and Cyamiomactra.—Descriptions of three new Australian species of the genus Austrogomphus (Neuroptera: Odonata): R. J. **Tillyard.**—(1) A pleomorphic slime-bacterium; (2) the probable identity of the opsonins with the normal agglutinins: R. Greig **Smith.**

## DIARY OF SOCIETIES.

*THURSDAY*, FEBRUARY 15.

ROYAL SOCIETY, at 4.30.—The Influence of Increased Barometric Pressure on Man, No. 1: Dr. L. Hill, F.R.S., and M. Greenwood.—On the Existence of Cell-communications between Blastomeres: C. Shearer.—Innervation of Antagonistic Muscles. Ninth Note: Successive Spinal Induction: Prof. C. S. Sherrington, F.R.S.—The Chemical Constitution of Protoplasm as shown by the Rate of Tissue Disintegration: Dr. H. M. Vernon.—The Development of the Head-Muscles of the Common Fowl (*Gallus domesticus*), together with some Remarks on the Head-Muscles of Reptiles: Prof. F. H. Edgeworth.—Observations on the Labyrinth of Certain Animals: Dr. A. A. Gray.

CHEMICAL SOCIETY, at 8.30.—Cuprous Formate: A. Angel.—The Solubility of Triphenylmethane in Organic Liquids with which it forms Crystalline Compounds: H. Hartley and N. G. Thomas.—The Spontaneous Crystallisation of Supersaturated Solutions: H. Hartley.—The Preparation and Properties of some New Tropeines: H. A. D Jowett and A. C. O. Hann.—Studies in Asymmetric Synthesis, Part IV., The Application of Grignard's Reaction for Asymmetric Syntheses: A. McKenzie.

LINNEAN SOCIETY, at 8.—The Structure of *Isis hippuris*: J. J. Simpson.—Note on the Geographical Distribution of the Genus Shortia, Torr. and Gray: B. Daydon Jackson.—*Exhibition:* Developmental Changes in Zooglœa (with Lantern Slides): Dr. H. Charlton Bastian, F.R.S.

SOCIETY OF ARTS, at 4.30.—The Navigable Waterways of India: R. B. Buckley, C.S.I.

INSTITUTION OF MINING AND METALLURGY, at 8.—Pyritic Smelting: R. C. Alabaster and F. H. Wintle.—The Acme Combined Concentrating Table: L. H. L. Huddart.—Stadia in Careful Work: A. H. Webb.—The Detailed Mapping of Stoping Areas: H. R. Sleeman.—Sinking, Development and Underground Equipment of Deep Level Shafts on the Rand: A. E. Pettit.—The Hydraulic Filling of a Coal Seam at Lens, Pas de Calais, France: L. E. Hill and M. Butt.

*FRIDAY*, FEBRUARY 16.

ROYAL INSTITUTION, at 9.—The Passage of Electricity through Liquids: W. C. D. Whetham, F.R.S.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Large Locomotive Boilers: G. J. Churchward.

GEOLOGICAL SOCIETY, at 3.—Annual General Meeting.

*SATURDAY*, FEBRUARY 17.

ASSOCIATION OF TEACHERS IN TECHNICAL INSTITUTES (Regent Street Polytechnic), at 7.30.—The Teaching of Mathematics to Engineering Students: G. E. St. L. Carson.—The Teaching of Mathematics to Building Trade Students: H. Bustridge.

*MONDAY*, FEBRUARY 19.

SOCIETY OF ARTS, at 8.—Modern Warships: Sir William White, K.C.B., F.R.S.

VICTORIA INSTITUTE, at 4.30.—The Bible Pedigree of the Nations of the World: M. L. Rouse.

*TUESDAY*, FEBRUARY 20.

ROYAL INSTITUTION, at 5.—Food and Nutrition: Prof. W. Stirling.

INSTITUTION OF CIVIL ENGINEERS, at 8.—A Plea for Better Country Roads: G. R. Jebb.—Country Roads for Modern Traffic: J. E. Blackwall.

ROYAL STATISTICAL SOCIETY, at 5.—Wages in the Engineering and Shipbuilding Trades in the Nineteenth Century: A. L. Bowley and G. H. Wood.

ZOOLOGICAL SOCIETY, at 8.30.

*WEDNESDAY*, FEBRUARY 21.

SOCIETY OF ARTS, at 8.—Fisheries of the North Sea: Walter Garstang.

GEOLOGICAL SOCIETY, at 8.—The Constitution of the Interior of the Earth, as revealed by Earthquakes: R. D. Oldham.—The Tarannon Series of Tarannon: Miss Ethel M. R. Wood.

ROYAL MICROSCOPICAL SOCIETY, at 8.—On an Improved Method of taking Stereophotomicrographs and of Mounting the Prints: H. Taverner.—Exhibition of Slides of Oribatidæ, presented by N. D. F. Pearce.

ROYAL METEOROLOGICAL SOCIETY, at 7.30.—Report on the Phenological Observations for 1905: E. Mawley.—Discussion of the General Features of the Pressure and Wind Conditions over the Trades-Monsoon Area: W. L. Dallas.—The Dispersal or Prevention of Fogs: Dr. W. B Newton.

SOCIOLOGICAL SOCIETY (School of Economics and Political Science, University of London, Clare Market, W.C.), at 8.—A Practicable Eugenic Suggestion: W. McDougall.

*THURSDAY*, FEBRUARY 22.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: On the Coefficient of Viscous Traction and its Relation to that of Viscosity: Prof. F. T. Trouton, F.R.S.—An Account of the Pendulum Observations made at Kew and Greenwich Observatories in 1903: Major G. P. Lenox-Conyngham.—And other Papers.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Crane Motors and Controllers: C. W. Hill.

*FRIDAY*, FEBRUARY 23.

ROYAL INSTITUTION, at 9.—The Internal Architecture of Metals: Prof. John O. Arnold.

PHYSICAL SOCIETY, at 5.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Graphical Determination of the Deflection of Beams: C. H. Sumner.

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