THURSDAY, DECEMBER 2, 1897.

TEA.

A Text-Book of Tea Planting and Manufacture. By David Crole. Pp. xii + 242. (London: Crosby Lockwood and Son, 1897.)

THIS handsomely got-up book, although written with too obvious a bias in favour of the produce of India and Ceylon, as distinguished from that of China, is a valuable contribution to the literature of an important subject. Mr. Crole's experience has been mainly gained in the "gardens" and "houses" of Assam, but he has evidently had good opportunities of acquiring information from personal observation of the methods of cultivation and manufacture in other parts of our East Indian possessions. Of China he apparently knows nothing from personal experience, and the value of his strictures on the character of the produce, as well as of the modes of manufacture, of the Celestial Empire may be said to suffer in consequence. The book is mainly written for the benefit of planters, but there is much in it of interest to the general reader who is not insusceptible to the charms of "the sovereign drink of pleasure and of health." The extraordinary growth in the consumption of tea in Great Britain is a significant feature in our social and domestic economy. As it is the fashion just now to compare everything at present with what it was in 1837, it may be interesting to note that whereas in that year the amount of tea consumed in this country did not exceed 30,000,000 lbs., all of which came from China, the quantity now imported is upwards of 230,000,000 lbs., or more than 5¾ lbs. per head of population. China now furnishes less than half the amount she sent into this country at the time of the Queen's accession. The import from India, which began in the early 'sixties, now amounts to more than five times that from China; whilst Ceylon, which has only sent tea into this country to any extent during the last fifteen years, furnishes us with more than three times the quantity of that from China. In other words, China now sends us only about 10 per cent. of our tea, whereas ten years ago she gave us half the amount we then consumed. It is obvious, therefore, that unless China can be induced to abandon her absurdly exclusive policy, her tea trade with and through this country is doomed.

As is well known, Chinese tea is mainly made from the *Thea chinensis*, whilst that from India is the produce of *T. assamica*. Mr. Crole calls the former variety "a poor, scrubby-looking shrub" and "a wretched plant." From his remarks it would appear that the only service that Fortune rendered to the Indian tea industry by the introduction of the Chinese plant was the deterioration of the indigenous seed, giving rise to quantities of hybrids of various qualities, "from very rank stuff to fairly good." According to the author, the most that can be said in favour of the China plant is that it is distinctly more hardy than the Assam variety. We are disposed to believe that Mr. Crole's prejudices affect his judgment. There is no question whatever that some of the finest and most wholesome tea the world produces is to be met with in China. Whether it is to be met with in this country is wholly a question of price.

Mr. Crole's account of the rise and development of the Indian tea industry forms one of the most interesting chapters in his book, although here, as in the whole work, he never loses an opportunity of casting a slur upon the China tea plant. This he stigmatises as "the pest of Assam," and its introduction a curse "that at one time seemed as if it would prove as disastrous to Assam as ever the *Phylloxera vastatrix* has been to France, or the *Hemileia vastatrix* in Ceylon." No mention is made of Fortune and his labours—which, whatever may have been his merits or demerits, is inexcusable in what purports to be an historical narrative. Full justice, however, is done to Sir Joseph Banks' efforts to introduce the Chinese plant into India as far back as 1793, and to the remarkable and accurate knowledge he showed in his selection of suitable stations for its cultivation. The discovery that a variety of *Thea* was indigenous to Assam has been claimed for a number of persons, but, according to the author, the credit indubitably belongs to Mr. R. Bruce, who first met with the plant on the hills round Rungpore in 1823. The justice of the award for this discovery, subsequently made by the Government to Mr. Bruce, which gave rise to some little controversy at the time, is thus borne witness to.

The chapters on cultivation and manufacture, although perhaps too technical for the ordinary reader, are undoubtedly the most valuable in the work. They are based upon the author's individual experience and upon a comparison of the methods employed in different parts of the various provinces, not only in Assam proper, in Cachar and Sylhet, but also in the Dooars and Darjeeling districts of Bengal, in the Punjab, in Madras and in Ceylon. They are, of course, of special interest to the planter, by whom they will doubtless be studied with the attention they merit. It is, however, noteworthy that certain minor details of manufacture, especially the operation of sorting, as usually conducted, have only served to confirm the author's inherent dislike to the beverage; for he tells us, with a perfect candour, that he never drinks tea by any chance—but rather wishes to be transported, with Pope's Belinda, to some isle where "none e'er drink Bohea."

Perhaps the least satisfactory portions of the book are those relating to the chemistry of tea during growth and manufacture. The subject is no doubt beset with difficulties, and although the author, with the assistance of Prof. Bayne, has evidently done his best, the result compares somewhat unfavourably with the rest of the work. To be told that tea contains organic acids, and that organic acids in their turn "contain the carboxyl group radical (COOH)," which is all the information vouchsafed, is not instructive to the average man, and not worth the telling to the chemist. Nor even if its construction were to be amended, is any precise information to be extracted from the following sentence. "Volatile oils . . . consist of two parts: (1) solid stearopton, and (2) liquid oleopton; all contain decone ($C_{10}H_{16}$), which is a member of the turpene series of hydrocarbons, or some polymer, and are obtained by distillation with water." The author appears to be somewhat sceptical as to the identity of caffeine with theine, and sees in the

experiments of Brunton and Cash evidence that the substances are isomeric and not identical. He finds from observations made on himself that coffee is decidedly antidotal to nicotine, whereas tea is not; but he admits that this circumstance does not go far towards proving the essential dissimilarity of the two alkaloids. By nicotine is presumably meant tobacco-smoke, which is by no means the same thing.

Mr. Crole is of opinion that the value of a tea should be in direct proportion to the theine it contains. This is surely no more true than that the value of a wine depends upon its alcoholic strength. Indeed, the author admits that what the consumer likes in tea is strength, body, and delicacy of flavour, and that he does not trouble himself about the theine, of which he has no means of estimating the amount. As a matter of fact, there is absolutely no connection between the commercial value of tea and the quantity of theine which may be present in it.

The last chapter in the book deals with the thorny question of the coolie. The Assam plantations, as well as those of Ceylon, have to depend entirely upon imported labour; but whereas the Ceylon gardens are almost wholly worked by Tamil coolies, who are free labourers, those in Upper Assam are recruited under Government licence, and by means of a system which, it is admitted, is attended with much cruelty and deception. There is, in consequence, considerable disaffection and much disquietude occasionally on the plantations, and the local magistrates are at times greatly exercised to settle the "labour troubles" which now and again break out. Mr. Crole lifts the veil only slightly, but it is sufficiently obvious that when disciplinary duty is to be done, the planter's lot, as well as that of the coolie, is not altogether a happy one. The social life on an Indian tea-garden is, perhaps, not to be judged of from a Western standpoint; but probably nothing exactly resembling a Fagua festival in wanton licence and depravity was ever seen on a Louisiana plantation, even in the best (or worst) of the "good old times."

In spite of occasional grammatical lapses and faults of style, Mr. Crole's book may be recommended as an accurate and fairly impartial account of the present state of the tea industry in our East Indian possessions.

WILD-FOWLING.

A History of Fowling, being an Account of the many Curious Devices by which Wild Birds are or have been Captured in Different Parts of the World. By the Rev. H. A. Macpherson. 8vo. Pp. liv + 511, illustrated. (Edinburgh: Douglas, 1897.)

ALTHOUGH the treatise before us can in no way be regarded as a scientific work, yet the capture of wild birds entails so many accurate observations on the habits and mode of life of the quarry, that such a full account of all that is known on the subject must of necessity throw many interesting side-lights on the study of ornithology proper. And no lover of birds will fail to find much matter worthy of his attention in Mr. Macpherson's handsome and well illustrated volume. The author appears to have spared no pains in collecting material for his history, and he has been fortunate in finding correspondents in all parts of the world who have supplied materials relating to their own particular countries which probably could not have been obtained from any other sources. Indeed, the work largely consists of extracts from the letters and publications of such correspondents, the source of which is, however, fully acknowledged both in the preface and in the text.

The work practically has the field to itself, and is long likely to remain the standard authority on the subject. The number of types of curious instruments for the ensnaring of birds Mr. Macpherson has succeeded in recording is astonishing, and speaks well for his own industry, and the interest that has been taken in the subject by his numerous correspondents. Perhaps the most remarkable of all is a snare employed in Borneo and Tenasserim for the ensnaring of the lovely Argus Pheasant. This bird, as is well known, exhibits a peculiar intolerance to the presence of any foreign object which interferes with free progress over its favourite playground. Taking advantage of this trait, the natives fix on the playground a couple of sharp bamboo knives tied together in the form of an inverted V, with their sharp edges downwards. Finding the knives thus fixed on its own particular territory, the Argus endeavours to remove them by twisting its neck round one of the blades from beneath, and, in the course of its efforts to overturn them, eventually manages to cut its own throat. In connection with this passage, it may be mentioned that the word "Argus" is omitted from the index, although it is mentioned under the heading "Pheasant."

Some limitations have necessarily had to be imposed on the extent of the subject, which might well have included punt-shooting and hawking, if not ordinary covert-shooting and driving. For since the author includes the blow-pipe and the bow-and-arrow among the engines of destruction used in fowling, there is no logical reason for the exclusion of the punt-gun and the shot-gun. But as treatises on shooting exist by the score, while hawking has also numerous works devoted to its mysteries, the author seems to have exercised a wise discretion in the limits he has laid down. And even as it is, the work extends to a very considerable bulk, although there are not a few portions where considerable abridgement would have been no disadvantage.

The author divides the implements employed in fowling into four main classes. Firstly, weapons of attack, such as the blow-pipe, the bolas, and the bumerang; secondly, the stalking-horse, or some analogous method for approaching the game without being seen; thirdly, birdlime; and fourthly, the various kinds of snares and traps, including decoys, nets, gins, &c. Having cursorily glanced at the leading types of these, Mr. Macpherson next gives a classified list of the birds treated of, and then in the text proceeds to dilate upon the particular method of capturing the members of each group or species. It is in regard to the snaring of the smaller birds that condensation might have been advantageously resorted to, as numbers of these might perfectly well have been treated *en bloc*, instead of having separate sections devoted to them, which are only too likely to weary the great majority of readers. Indeed, from the

point of view of the present reviewer, the work would have been doubled in value had it been diminished by at least one half in bulk.

Passing by these long chapters devoted to the smaller birds, more general interest will be found in the section on hawk-catching, as this is a subject on which comparatively little is often found in works on hawking; and it is decidedly interesting to know how the captors are themselves taken. We have descriptions of the capture of the Peregrine in our own islands, of the Gyrfalcon in Iceland, the Shahin in India, and many other species in different parts of the world. After full descriptions of the capture of swans and geese, several very interesting chapters are devoted to the taking of the various kinds of ducks, in the course of which driving and spearing, snaring, the different types of decoys, and clap-nets, receive their full meed of attention. The information in regard to decoying in Europe may, for the most part at any rate, be found in other works, but much of that relating to Japan and other Oriental countries appears to be new to English readers. The Japanese are described as peculiarly dexterous in the use of an ingenious collapsible triangular hand-net, in which they take the birds already enticed into the pipe of the decoy. They have three favourite methods of using this ingenious and handy instrument. The first is to spoon the duck into the net as the bird is swimming; the second, to capture the bird as it rises from the water in the pipe; while the third feat is to hurl the instrument at a duck flying out of reach, and bring it to the ground entangled in the meshes. In the course of one of these chapters on duck-catching, the shot-gun is for once introduced, in connection with a method of attracting the wily birds within range by means of a brilliant light and reflector. Another peculiarly Japanese method is to fish for ducks with a hook and line.

Numerous and various are the methods employed for trapping and decoying the various kinds of pigeons and game-birds, but, interesting as many of them are, they must be passed without notice. The last chapter relates to the ostriches and their kindred, in which we have accounts of African, Patagonian, and Australian hunting. Here the author is doubtless right in his statement that the Arabs used to kill ostriches by disguising themselves in the skin and feathers of one of these birds; but was not the same method in use among the Bushmen of the Cape?

In the matter of letterpress and illustrations the book is for the most part all that can be desired; and it can scarcely fail to claim a wide circle of readers. R. L.

OUR BOOK SHELF.

Life Histories of American Insects. By C. M. Weed, D.Sc., Professor of Zoology and Entomology, New Hampshire College. Pp. xii + 272. Woodcuts. (New York: The Macmillan Co. London: Macmillan and Co., Ltd., 1897.)

WE opened this book with lively expectations of something good. Though there has been considerable activity among American entomologists during the last ten years, our knowledge of the life histories of American insects is still very defective, and there is urgent need of more labourers, especially of such as bend their minds to the solution of really important questions. Not only the title of the book, but the printing and the figures are attractive, and we began the first chapter with high hopes, only to draw a blank. The author had nothing particular to say about Belostoma. Chauliodes came next—nothing of the slightest importance here. Then came the tiger-beetles and their larvæ—again nothing new. The rest of the book is of the same slight texture. Nothing is worked out with any completeness; we have merely scraps of information, mostly from printed sources. The author's use of books is uncritical. Thus Dr. Le Conte is quoted for the explanation of the leaping of the click-beetle, and Prof. Comstock for the description of the sonorous file of the cricket, though these authors did not discover the facts for which they are cited. Let us hope that Prof. Weed or some one else will before long give us a book which is really entitled to bear the name of "Life Histories of American Insects." L. C. M.

The Röntgen Rays in Medical Work. By David Walsh, M.D. With an introductory section by J. E. Greenhill. Pp. x + 144. (London: Baillière, Tindall, and Cox, 1897.)

THIS book, as is intended, will be of interest chiefly to the medical profession. The introductory part, which deals briefly though clearly with the practical and physical side of the subject, will also be found useful by those who desire to employ X-rays for other purposes.

The book is methodically arranged, well got up, and is illustrated with a large number of remarkable and excellent specimens of X-ray photography, mostly of anatomical interest.

Altogether it contains good evidence of the real value of X-rays in practical surgery and medicine, especially the former, and of the rapid progress that their employment has made in their application to these important fields.

It is interesting to note that while the author is fully cognisant of the powerful effects that X-rays under certain circumstances may produce upon the skins of particular individuals, he is satisfied that, so far as present experience goes, they have no particular action upon micro-organisms.

The introduction is somewhat misleading where it states, on p. 23, that the action of the induction coil depends upon the fact discovered by Faraday, that an electrified body is capable of inducing a similar condition in an unelectrified body lying within the sphere of its influence. It was electro-magnetic, and not electro-static induction which Faraday discovered, and it is owing to the former, and not to the latter phenomenon that the induction coil is possible. Again, there is another slip on p. 26, where it is mentioned that kathode rays can be reflected, refracted, polarised, and deflected by a magnet just as ordinary light. Kathode rays, of course, have never been refracted or polarised, and ordinary light is not deflected by a magnet.

Air, Food and Exercises; an Essay on the Predisposing Causes of Disease. By A. Rabagliati, M.A., M.D., F.R.C.S.Ed. Pp. xvi + 220. (London: Baillière, Tindall, and Cox.)

THE book under review is an amplification of papers contributed to the *Scalpel* during the year 1896. The main proposition elucidated in the essay may, in the words of the author, be said to be this: "that there are three predisposing causes of disease, as there are, conversely, three chief predisposing causes of health, and that these are air, food and exercises." In the course of his essay, the writer gives his opinion on the subject of heredity, which, he thinks, "counts for very little as a predisposing cause of disease and of health, among adults at least, if not even among persons who have

passed the tender years of early childhood." Heredity is indeed spoken of somewhat contemptuously in the book, and, bracketed with germs, is described as a fetish, "so blindly and superstitiously is it invoked." In the opinion of the author, five per cent. would be a fairer estimate for the hereditary diseases incident to adult humanity than even ten—an estimate previously conceded in the course of the argument. The book is not written for the practitioner, by whom, in fact, many of the opinions and views of the author might be challenged, but for the lay- man and woman, who will find in it many hints as to the diet and physical exercise of the body, which may be calculated to make easier the task of keeping the body in a state of health. Being intended for the perusal of the non-professional reader, the work throughout is written in a style which will be easily understood by all.

Elementary Drawing: a Series of Practical Papers for Beginners. Written and illustrated by Elisabeth Moore Hallowell. Pp. 54. (London: Macmillan and Co., Ltd., 1897.)

AT first sight the scope of this small book does not seem to fall within the area covered by the columns of NATURE, the series of papers of which the work is composed having originally been written for the *Art Amateur*, "to give to beginners in drawing a simple explanation of some matters usually considered too elementary for text-books"; yet it will be owned by all that a knowledge of drawing is, if not absolutely necessary, very useful to the student of science in whatsoever branch he may be engaged, and thus a brief notice of the volume may not be out of place here. The book, although written in easy language, is not intended for very young readers, but "for those who are able to follow from one lesson to another, up to the point where the present volume ends and the general text-book begins." It will, we should think, be found very acceptable to many who have not had the advantage of early training in art, but who wish to gain some idea of its principles; and especially useful will it be to those to whom attendance at a drawing class is impracticable. A careful student of this unpretentious volume will be in possession of some very useful hints, and will have acquired knowledge which will stand him in good stead in his after studies.

Botanisches Bilderbuch für Jung und Alt. By Franz Bley. Part i. With explanatory text by H. Berdrow. Pp. 96. Plates 24. (Berlin: Gustav Schmidt, 1897.)

THE best way to obtain a knowledge of common flowers is to go into the woods and meadows with an outdoor botanist. Unfortunately, a naturalist cannot always be found able and willing to impart the required information, and the most satisfactory substitute in such cases is a collection of coloured pictures (uncoloured pictures are useless for purposes of identification) of flowering plants commonly seen. We have several works of this kind in our own language, a very good one being Mr. Edward Step's "Wayside and Woodland Blossoms." The volume before us is similar in character, though not so handy in size as Mr. Step's. There are 216 coloured figures of plants on twenty-four plates, and brief descriptions of each species represented. The species described and illustrated are those which flower in the first half of the year, and they are arranged according to the succession of the months. Another volume will be published for flowers of the second half-year. The figures are mostly very good, and the text has been designed to interest the reader in plant life and functions. The plant-lore referred to in the descriptions of many of the species will assist in popularising the book and making it acceptable to young students of botany in Germany.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

The Volcanic Condition of Stromboli.

IN view of the fact that all published accounts of Stromboli, according to the *résumé* given by Bergeat ("Der Stromboli," A. Bergeat, Habilitationschrift, München, 1896), have agreed in describing the volcano as being explosively active, there may some interest attach to a statement of the present condition of affairs, as seen by Prof. H. F. Reid, of Johns Hopkins University, and the writer, on October 27 and 28 of the present year. The westernmost of the four small craters described by Bergeat was not observed at all, the next two were discharging rather copious volumes of vapour, and the easternmost, or "old," crater was giving out a very little steam from its bottom. The most steam was issuing from cracks in the eastern rim of the "old" crater, especially from one at the north-eastern or seaward corner of the rim. Much steam was issuing from the southern rim overhanging the second and third craters and the ridge leading from it to the main mountain mass. Nothing in the nature of an eruption was taking place, and it was evident that the craters had been in this condition for some time. Later inquiry at Lipari elicited the information from Bartolo Nicotera, the guide, that there had been no eruption on Stromboli for about a year. The high ridge over the crater, known as the Cima, showed steam issuing from along its summit, more than 200 metres above the crater. E. O. HOVEY.

Naples, November 26.

The Colours of Flowers Blooming Out of Season.

I HARDLY think it probable that you will be able to spare your valuable space for my communication; nevertheless, I venture to send you the following observations on the tendency of flowers to revert in colour when blooming out of season. We have had little frost here, and many flowers which are ordinarily out of bloom at this season still persist. The changes, however, in their normal colours are in some cases very remarkable. The red cactus dahlias are blooming almost orange, the outer florets being often nearly yellow. These dahlias are also, in many cases, showing a tendency to revert to the single form. A species of tropeolum, normally vivid scarlet, is blooming in a cool greenhouse, where air is kept on, and has in some cases reverted almost to clear yellow; a streak of red down the centre of the petal being the only remains of its normal colour. In both the above cases I note that the edges of the petals are the first to change. A species of myosotis, ordinarily of a deep and very vivid blue, is flowering now a clear rosy pink, without the least tinge of blue. The flowers are well opened and normal in size. Lastly, a pure white phlox of dwarf habit shows a tendency to revert in some of its blooms, though not in all, to a greenish yellow hue. Such cases are probably common; but it is with the feeling that they may point to climatic conditions as influencing the coloration of flowers, and as having, possibly, borne a large part in the gradual evolution of their respective tints, that I venture to record them. E. HUGHES-GIBB.

The Manor House, Tarrant Gunville,
Blandford, November 20.

A Rose-Coloured Rainbow.

ON page 263 of Lord Tennyson's "Memoirs" there is mention of a "red rainbow" seen at sunset in 1882. As it was considered noteworthy by Sir Norman Lockyer, and was the first he had heard of, it may be of interest respecting sunset phenomena that near Hayward's Heath, on June 29 of this year, at sunset there was a rainbow entirely of a clear rose-pink against heavy storm clouds over half the sky, and facing a deep golden sunset in a clear sky. It was a perfect arch, and lasted for some minutes. Just for a moment I saw a streak of pale sea-green in the midst of the rose colour. M. S. ZACHARY.

Holy Cross Home, Hayward's Heath.

Critical Temperature of Water.

IN answer to Mr. Martin's letter in your last issue (p. 80), Cailletet and Colardeau found the critical temperature of water to be 365° C., the corresponding pressure being 200·5 atmos. An account of their experiments is given in Preston's "Theory of Heat," p. 384. S. GEOGHEGAN.

Dublin, November 29.

SPECTRUM OF A METEOR.[1]

THE photographs of the spectra of the stars taken at the Harvard College Observatory as part of the Henry Draper Memorial differ in two respects from those ordinarily taken elsewhere. Instead of using a spectroscope with a slit, in which but one star is photographed at a time, a large prism is placed over the object-glass of the telescope, and thus spectra of all the bright stars in the field of view are obtained. The number of stars photographed simultaneously is still further increased by substituting for the object-glass a portrait lens like that used by photographers, only larger. The field of view is in this way increased from two degrees square to ten degrees square, and a photograph is obtained of the spectra of all the brighter stars in this large region. Many thousand plates, covering the entire sky, have been taken in this way at the Cambridge and Arequipa Stations of this Observatory. All have been examined by Mrs. Fleming, and, as a result, numerous remarkable objects have been discovered. One of the latest is the spectrum of a meteor which has thus been photographed for the first time. Since it is impossible to foresee when the bright meteors will appear, or what path they will follow, a photograph will be obtained only when one happens to cross the field of the telescope. A number of trails of meteors have been obtained, both here and elsewhere, when charts of the stars were photographed, no prism being used. When the prism was in place no meteor bright enough to leave a noticeable trail has heretofore been photographed on the many thousand plates examined. At about 11 p.m. on June 18, 1897, however, when the 8-inch Bache telescope at Arequipa was directed towards the constellation Telescopium, a bright meteor appeared in right ascension 18h. 19m., declination −47° 10′, and passed out of the field at right ascension 18h. 29m., declination −50° 30′. The spectrum consists of six bright lines whose intensity varies in different portions of the photograph, thereby showing that the light of the meteor changed as its image passed across the plate. The approximate wave-lengths of these lines are 3954, 4121, 4195, 4344, 4636, and 4857, and their intensities are estimated as 40,100, 2, 13, 10, and 10, respectively. The first, second, fourth, and sixth of these lines are probably identical with the hydrogen lines Hε, Hδ, Hγ, and Hβ, whose wave-lengths are 3970, 4101, 4341, and 4862. The fifth line is probably identical with the band at wave-length 4633, present in spectra of stars of the fifth type and forming the distinctive feature of the third class of these stars. The third line, which is barely visible, is perhaps identical with the band at wave-length 4200, contained in these stars (*Astron. Nach.* 127, p. 1).

It will be noticed that of the four hydrogen lines in the spectrum of the meteor, Hδ is the most intense. This is also the case in the spectrum of *o* Ceti and of many other variable stars of long period. In some variables of long period Hδ and Hγ are equally intense, while in others Hγ is the more intense. In some stars of the first type in which the hydrogen lines are bright, like γ Cassiopeiæ, the line Hβ is much more intense in the photographic spectrum than any of the other lines, while in the spectra of stars like P Cygni and η Carinæ, Hδ, Hγ, and Hβ are nearly equally bright. These results show an important resemblance between meteors and stars having bright lines in their spectra, and may aid in determining the conditions of temperature and pressure in these bodies. Since bright meteors sometimes appear during the November meteoric shower, a special effort will be made to obtain photographs of them, both trails and spectra, on November 13.

November 8. EDWARD C. PICKERING.

[1] *Harvard College Observatory. Circular* No. 20.

GEOLOGY AND SANITARY SCIENCE.

THE address recently delivered by Mr. W. Whitaker, F.R.S., before Section iii. of the Congress of the Sanitary Institute (*Journal of the Sanitary Institute*, vol. xviii., 1897, pp. 304–316), touches upon several matters of special interest at the present time. Section iii. deals with chemistry, meteorology, and geology, and Mr. Whitaker chose for his subject "Water," as being appropriate for such a triple alliance. Most important is his suggestion "that round each work for the public supply of water a certain tract of the water-bearing bed should be saved from the assaults of surface-contamination." The address was delivered before the Maidstone epidemic had occurred, but reference is made to it in a postcript, and no stronger support for Mr. Whitaker's proposal could have been given. He rightly observes that "we are yet without much information as to how far pollution may be able to reach along an underground course," but "it is here that geology comes in, for the nature of the surroundings of waterworks must be taken into account, often for some distance and to some depth." From a sanitary point of view the mapping of all the surface deposits on the six-inch scale by the Geological Survey is referred to as most necessary. A great deal has been done, but very much more remains to be done; and, as Mr. Whitaker observes, "a survey of the drifts in the London area on the six-inch scale is greatly needed."

It is a serious matter when sewage-farms and cemeteries are placed on porous strata, which are perhaps in adjacent tracts utilised for their supply of water; and yet, as Mr. Whitaker remarks, "sewage-farms and cemeteries must exist, until some other methods of disposing of waste material are not only found out, but are generally adopted."

Clearly there is need for greater control over the sites chosen for any of the purposes mentioned, and public sources of water-supply must be carefully safeguarded. The question of federation in the matter of water-supply in many localities is one to which attention is drawn, and this also is becoming urgent.

NOTES.

THE French Government, through its Embassy in London, has presented to Sir Archibald Geikie a handsome vase of Sèvres porcelain in recognition of the services rendered by him to the Geological Survey of France.

WE are pleased to hear of the foundation of the Zoological Society of Western Australia, with the object of establishing a Zoological Garden at South Perth in that colony. Mr. E. A. Le Souef has been appointed director of the new institution.

IT is announced that the Council of the Iron and Steel Institute have accepted an invitation from the Association of Swedish Ironmasters to hold the autumn meeting of the Institute next year at Stockholm. The meeting will be held in August, and, in view of the large quantities of Swedish iron and ores consumed in this country, there is no doubt that it will prove a very popular meeting. Previous autumn meetings of the Institute have been held at Belgium, France, Germany, Austria-Hungary, Spain, and the United States.

A BUST of Pasteur was unveiled at Melun on Monday as a memorial of his investigations on anti-anthrax serum.

THE death is announced of Dr. Harrison Allen, Emeritus Professor of Comparative Anatomy in the University of Pennsylvania.

THE Allahabad *Pioneer Mail* states that the Röntgen rays are proving of the greatest assistance in dealing with the gun-shot wounds among the troops engaged on the frontier.

THE Bradshaw lecture, in connection with the Royal College of Surgeons, England, will be delivered on Wednesday, December 8, by Mr. Alfred Willett, who will take as his subject the "Correction of certain deformities by operative measures upon bones."

THE New York Zoological Society is making headway in its undertaking to convert a portion of South Bronx Park into the largest zoological garden in the world. It has the right to use the ground; it has the plans for the chief structures to be erected; it has part of the money; and it believes that the public-spirited citizens of New York will contribute the remainder of the funds necessary. In the second number of the new bulletin issued by the Society, we read: "The Society does not propose that any feature of its work shall be performed on a small or cheap scale. The Greater New York should not plan a mere menagerie on the matchless site set aside as a Zoological Park. The Society is carefully studying in this country and abroad what constitutes an ideal vivarium, and it proposes to build one worthy of a great city, or none!" As already announced, the City of New York will provide 125,000 dollars to meet the cost of preparing South Bronx Park for the reception of the Society's costly buildings and collections, and making them accessible to the public, as soon as the Society's improvement fund reaches 100,000 dollars.

AT the Royal Geographical Society on December 6, Lieutenant Peary will give an account of his Arctic work. On December 13, Colonel H. W. Feilden will read a paper on recent visits by Mr. Pearson and himself to the Barents and Kara Seas and Novaya Zemlya. Mr. F. G. Jackson and Mr. Arnold Pike will also speak of their observations on the open Polar Sea of the past summer. On Friday, January 7, and Monday, January 10, at 4 p.m., two Lectures to Young People will be given by Dr. H. R. Mill; the subject being: "A Geographical Holiday through Forest, Prairie and Mountain." The lectures will be illustrated by many photographic lantern slides.

IT is proposed to erect a monument of grey granite, twenty-three feet high, over the grave of Baron von Mueller in St. Kilda Cemetery, and donations are invited for that purpose by the late investigator's executors. Botanists will be pleased to know that the Baron's supplemental volume of the "Flora Australiensis," upon which he had worked for years and was preparing for the press at the time of his death, together with two volumes on his administration as Director of the Botanical Gardens, embracing a biography and complete bibliography of his writings, are to be published. His executors will feel favoured by the loan of any of his letters, or the communication of incidents in the Baron's life which his friends deem to be worthy of notice in his biography. Subscriptions for the monument, or material for the biography, should be sent to the Rev. W. Potter, "Vonmueller," Arnold Street, South Yarra, Victoria.

THE annual dinner of the Institution of Electrical Engineers was held on Wednesday in last week, and was attended by more than two hundred members and friends. In proposing the toast of "The Scientific Societies," Prof. Ayrton compared the conditions of physical research thirty years ago with the laboratories of to-day. Lord Kelvin responded on behalf of the Royal Society, and pointed out the assistance given by that scientific Society to the advancement of natural knowledge. Sir J. Wolfe Barry replied for the Institution of Civil Engineers, and Sir James Crichton Browne on behalf of the Royal Institution. Prof. S. P. Thompson proposed the toast of "Our Guests," and the Marquis of Tweeddale and Dr. Collins (Chairman of the London County Council) replied to it. Sir Courtenay Boyle, in proposing the toast of "The Institution of Electrical Engineers," mentioned that the Board of Trade had already made 256 provisional orders for electric lighting: he hoped that electric traction would soon develop in this country. The President, Sir Henry Mance, replied to the toast, and gave a brief survey of the work of the Institution.

THE autumn meeting of the U.S. National Academy of Science was recently held at Boston. Miss Alice Bates Gould, daughter of the late Prof. B. A. Gould, who was one of the founders of the Academy, presented the sum of twenty thousand dollars, to be known as the Gould Memorial Fund, the income to be used for astronomical and mathematical purposes.—The Academy visited the Jeffersonian Laboratory at Harvard, by invitation of Prof. John Trowbridge of the Scientific School. Prof. Trowbridge exhibited his new X-ray machine. It has a voltage of 1,200,000, and with it are used 10,000 cells and 60 condensers. The condensers are charged in parallel and discharged in series by a movable framework. The spark is 48 inches long.—On the last day of the meeting, Prof. O. C. Marsh made a further contribution to the subject of the Jurassic formation of the Atlantic coast, which he has been investigating for several years. Prof. A. E. Merrill described the effects of tropical seas upon certain animals. Prof. Charles R. Cross explained experiments made by him on the wave siren for determining the pitch of musical sounds. Prof. Seth C. Chandler made a further contribution on the motion of the earth's pole. His experiments, continued for many years, warrant the statement that the area traversed by the pole does not exceed twenty feet in radius. He exhibited charts showing the varying position of the pole for seven years. Major J. W. Powell presented an hypothesis to account for movements in the crust of the earth.—After the adjournment of the meeting, members of the Academy visited the Harvard Observatory under the charge of Prof. Edward C. Pickering, and examined the apparatus and the collection of nearly 200,000 photographs of the heavens which have been made during a period of several years.—The spring meeting of the Academy will be held at Washington on April 19, 1898.

THE reports issued by the Meteorological Office on Saturday last showed that an abrupt change of the conditions of high barometric pressure, which had prevailed more or less persistently for some time past, was taking place; the wind had become more generally south-westerly, and a rise of more than 20° had taken place in the temperature, in parts of England, since the previous day. The fall of the barometer was very rapid, and by Sunday the whole type of weather had thoroughly changed; a large and important cyclonic disturbance had arrived from the Atlantic, and the centre of the storm on Sunday morning lay over the north of Scotland. South-westerly and westerly gales were blowing in most parts of our islands during Sunday, and the barometer near the centre of the storm was becoming still lower as the disturbance advanced. By 8h. a.m. on Monday the centre had travelled in a south-easterly direction across the North Sea to Denmark, causing terrific seas and northerly gales on our eastern and south-eastern coasts. The unusual track followed by the storm was probably owing to the barrier offered by the relatively higher barometric area extend-

ing over Scandinavia, while its fury was augmented by an area of high barometric pressure advancing in the rear of the storm, from the Atlantic, and thus increasing the steepness of the barometric gradients over our islands. Much damage has been wrought on our coasts by the violence of both the wind and sea, and now that the high barometric area has been displaced from over this country, further atmospheric disturbances are likely soon to reach us from the westward.

AN example of the reticulated python (*Python reticulatus*), the largest snake that has been in the Zoological Society's reptile-house for many years, and, so far as is known, the largest that has ever been there, died in the Gardens on November 14 last. It measured just over 20 feet in length. This snake was obtained in Malacca, and presented to the Society by Dr. Hampshire on August 29, 1876, and had, therefore, lived rather more than twenty years in this country. During this period it has been fed principally with ducks, of which it sometimes swallowed four or five at one meal. Its food was offered to it once a week, but it sometimes refused to eat for a month together. The specimen will be mounted for the Tring Museum. The largest snake now remaining alive in the Zoological Society's collection is a female Indian python (*Python molurus*), which measures about 18 feet in length. It was obtained by purchase in October 1889.

THE forthcoming annual report to the U.S. Congress of the Secretary of the Interior (Mr. Cornelius N. Bliss), contains much interesting information and many valuable suggestions in renard to Alaska, for which territory a government is contemplated adapted to its rapid development. In the report of the Governor of the territory, Mr. John G. Brady gives a summary of events which have transpired there during the last thirty years. He attaches great importance to the introduction of the reindeer by the Government as an important step in the solution of problems of food supply and transportation. A journey of over 2000 miles, taken with reindeer last winter by the Superintendent of the Government Reindeer Station and two Lapps, shows how well adapted this animal is to the necessities of the people there. It has this great advantage over dogs, that it can feed on the moss which grows everywhere, whereas food has to be transported for the dogs. The report states that, with care, grasses and other staple crops can be cultivated. The whole coast of Alaska, including the islands clear to the eastern end of Kadiak Island, is covered with timber of great value. Statistics regarding pelagic sealing are given, and the branding of all female pups is commended.

A WINTER weather record from the Klondike region is given by Mr. E. W. Nelson in the *National Geographic Magazine* (November). The record was obtained in the autumn and winter of the years 1880-81, at a fur-trading station on the Upper Yukon, not far from Dawson City. It covers the period from the early autumn to the opening of navigation on the Upper Yukon in spring, and is of peculiar interest at present, as showing some of the meteorological conditions in the area which is now attracting world-wide attention. The Yukon froze over on November 2, and was covered with a practically unbroken sheet of ice for more than six months. The temperature sank steadily from the end of October, and in December the lowest temperature, $-67°$ Fahr., was noted The lowest temperatures reached in January, February, and March were $-41°$, $-58°$, and $-43°$ respectively. In the last-named month the effect of the returning sun became evident, the greatest range (88°) being obtained during that month. Not until the middle of May, however, did the ice start on the river, and it was some weeks before the river was free enough from floating ice to permit navigation.

IN the *Engineer* of November 19 there is an article upon the measurement of the velocity and pressure of the wind, with illustrations of the various parts of Dines' pressure tube anemometer and of its records. Some years ago the Royal Meteorological Society appointed a committee to consider the subject of wind force, of which Mr. W. H. Dines was a member; he took great interest in the subject and carried out an exhaustive series of experiments, the chief expense of which was borne by the Meteorological Council, who were fully aware of the importance of the subject. The experiments modified to a considerable extent the values of the results obtained by the principal anemometers then in use, viz. the Robinson cup anemometer and the pressure-plate anemometer, and ultimately led to the invention by Mr. Dines of the instrument which bears his name. It consists of two independent parts, the head, with vane, which is exposed to the wind, and the recording apparatus, which may be put in any convenient, sheltered place, at a considerable distance away. These two parts are connected by means of flexible metal tubes, and the arrangement obviates the great difficulty experienced where a mechanical connection has to be maintained between them, as in the case of the two instruments above mentioned, which can never be placed far above a building. The Dines' instrument possesses many advantages over the cup and pressure-plate anemometers, and is much cheaper, while its records combine the characteristic features of both. It is now in action at many stations both in this country and abroad, and will, no doubt, throw considerable light on questions about which there has hitherto been much uncertainty.

THE last number of the *Annales de l'Institut Pasteur* contains the report for the past year of the work carried out at the Station Pasteur de Tiflis. No less than 242 persons of very diverse nationalities received the antirabic treatment; 5 were Persians, 4 Greeks, 32 Armenians, 5 Tartars, 10 Germans, 110 Russians, &c. Bites from dogs were principally recorded; but there were also 6 from horses, 2 from cats, and 1 from a donkey. The mortality, as estimated according to the Pasteur method, only amounted to 0·45 per cent. An extremely remarkable case is specially recorded, in which a station-master was treated for hysteria, he having no recollection of ever having been bitten by any animal whatever. On being, however, repeatedly pressed, he recalled having been bitten, a year and seven months previously, by a dog in the chest. The characteristic symptoms of rabies soon declared themselves; the patient was not, however, treated for hydrophobia, and he died. Subsequent inoculations proved that he had succumbed to undoubted rabies. So prolonged a period of incubation for hydrophobia is, we believe, unknown. Experiments were conducted at the station to determine the action of Röntgen rays on the virulence of rabid marrows, and it was found that the virulence was diminished slightly by considerable exposure to these rays. Researches were also carried out to ascertain how long rabid marrows can be preserved in glycerine and water without losing their virulence, and the period, Dr. Frantzius tells us, is a longer one than Roux, Nocard, and other investigators have thought.

THE so-called canning industry has made such vast strides all over the world, and notably in America, that it is not surprising that this method of preserving foods should form the subject of inquiry at the hands of the bacteriologist. When we learn that in Baltimore alone 1,250,000 bushels of oysters are annually canned, and that the United States is responsible for 120,000,000 cans of tomatoes, and of other articles, such as fish of various kinds, and fruits, &c., in similarly large numbers, it is remarkable that Messrs. Prescott's and Underwood's paper, "Micro-organisms and sterilising processes in the canning industry," published in the *Technology Quarterly*, should be the first contribution to so important a subject. These gentlemen have

specially studied the bacterial flora of canned clams and lobsters which have broken down, or, in other words, been imperfectly preserved. In every case where "spoiling" had occurred, bacteria were present in large numbers, whilst in no instance were any discovered in sound cans. Sometimes only a single variety, or a pure culture of a particular microbe, was found in unsound cans, but usually the latter contained a mixture of several species. Nine different bacteria were selected and isolated for subsequent study, both as regards their macroscopic and microscopic appearances; two of these were cocci, the remainder bacilli forms. These bacteria were afterwards inoculated into the contents of sound cans, with the result that the latter invariably decomposed, whilst experiments were also made to test the method of applying heat to canned articles which would most effectually destroy the chances of these micro-organisms surviving and spoiling the contents. An account of the numerous experiments carried out by the authors on this highly important commercial side of the inquiry will be published later; meanwhile their investigations go to show that, given a proper control of the temperature, it is possible to preserve clams and lobsters with absolute certainty, and in a more perfect condition than has hitherto been possible.

THE *Journal de Physique* for November contains a specially good collection of abstracts of physical papers, in addition to an important paper by M. Gerrit Bakker, on the thermodynamic properties of liquids with simple molecules, and a note by M. J. Schurr, on electric resistance and self-induction.

FROM Mr. F. W. Frankland, of New York, we have received several papers on the "Theory of Discrete Manifolds," dealing with the postulates of Euclidian geometry and their hypothetical counter-propositions, space-curvature, and the geometric axioms. Almost concurrently with these essays, Signor G. Veronese gives in the *Atti dei Lincei* a disquisition on the postulate of continuity, in which he arrives at certain conclusions contrary to the views of Schönflies.

SOME ten years ago, Weber discovered that a heated body begins to emit visible radiations at a lower temperature than that at which it exhibits the well-known glow of red heat. This "grey-glow," as it has been termed, has been investigated from a physiological standpoint by Herr O. Lummer (*Annalen der Physik und Chemie*, 62). According to the author's theory the observed appearances are due to the different susceptibilities of the rods and cones of the retina to light of varying intensity, the grey-glow being perceptible only to the rods, while the red-glow stimulates the cones. It is proposed to make observations of the lowest temperature at which luminosity occurs. Herr Lummer expresses the view that this temperature depends in some degree on the area of retinal surface exposed to the radiations.

FROM a series of investigations on the temperature-coefficient of the potential of the calomel electrode (*Proceedings of the American Academy of Arts and Sciences*, xxxiii. No. 1), Mr. Theodore William Richards draws the following conclusions: (*a*) The temperature-coefficient increases with the dilution of the electrolyte; (*b*) the kation of the electrode influences the result by affecting the degree of dissociation of the chloride in solution; (*c*) both of these effects may be approximately computed by a simple logarithmic formula based upon Nernst's hypothesis; (*d*) the accuracy of the results is, however, affected by at least one important modifying influence, the "catalytic" decomposition of mercurous chloride into mercuric chloride and mercury; (*e*) this side reaction is responsible for the slight inconstancy of the normal calomel electrode; (*f*) the "decinormal electrode" is much more uniform in its behaviour than the normal, and hence for some purposes might be a more useful means of measuring potential differences; (*g*) hydrochloric acid and ammonic chloride are anomalous in their behaviour.

AMONG recent contributions to systematic botany are "North American Lemnaceæ," by Mr. R. C. H. Thompson, all four genera which comprise the order being represented; and "Contributions to the Flora of Queensland," by Mr. F. M. Bailey, in which two new species of *Nepenthes* are described and figured.

THE *Botanical Gazette* states that another botanical journal has entered the field as a popular magazine in America. The *Asa Gray Bulletin* has ceased to be the organ of the Agassiz Association, and has entered upon a larger field. It will in future be published monthly, at Washington, D.C.

THE last issue (Appendix i., 1898) of the *Kew Bulletin of Miscellaneous Information* consists of a list of seeds of hardy herbaceous plants, and of trees and shrubs (mostly ripened at Kew during 1897), available for exchange with colonial, Indian, and foreign botanic gardens, as well as with regular correspondents of Kew.

TWO useful publications recently received from the U.S. Department of Agriculture (Division of Vegetable Physiology and Pathology) are "The Bermuda Lily Disease," by Mr. A. F. Woods, attributed by the author to a variety of causes, chiefly negligent horticulture; and "Notes on the Grasses and Forage Plants of Iowa, Nebraska, and Colorado," by Prof. L. H. Pammel, illustrated by a number of excellent woodcuts. Dr. E. F. Smith sends us a reprint from the *Centralblatt für Bakteriologie, Parasitenkunde, und Infektionskrankheiten* (in English), on *Pseudomonas campestris*, the cause of a brown rot in cruciferous plants caused by a Schizomycete, hitherto known as *Bacillus campestris*. Having only a single long polar flagellum, the author regards it as belonging to Migula's genus *Pseudomonas*. The life-history and effects of the parasite are described in detail.

THE second edition of a series of "Laboratory Tables for Qualitative Analysis," drawn up by the demonstrators in chemistry of the Owens College, Manchester, has been published by Mr. J. E. Cornish. The tables show in a systematic way, how the student should proceed to examine a solid substance, to make a preliminary examination for acids, to examine acid mixtures, or make a preliminary examination of an organic substance. Following these instructions are tables for the various groups of metals. Each schedule or table occupies one sheet (except the two first tables, which cover two sheets each). The tables are thus handy for use in chemical laboratories where simple analysis has to be carried on, though the demonstrators themselves would often prefer to give the laboratary work a more educational value if they were at liberty to do so, or if time enough was allowed them. Where a course of qualitative analysis is a part of the curriculum, and the demonstrator has thirty or forty students to look after, the tables should be found useful, for they will save the student from worrying his instructor with unnecessary questions.

THE additions to the Zoological Society's Gardens during the past week include a Common Marmoset (*Hapale jacchus*) from South-east Brazil, presented by Mr. G. Willison; an African Brush-tailed Porcupine (*Atherura africana*) from West Africa, presented by Captain W. C. Woollett; a Flat-backed Terrapin (*Cyclemmys platynota*) from Johore, Malay Peninsula, presented by Mr. S. S. Flower; a Leopard Tortoise (*Testudo pardalis*) from South Africa, presented by Miss E. Harold; a Hawk's-billed Turtle (*Chelone imbricata*) from the East Indies, two Scorpion Mud Terrapins (*Cinosternon scorpioides*) from Guiana, eleven Dumeril's Grieved Tortoises (*Podocnemis dunerilliana*) from South America, presented by Dr. J. Bach; a Smooth

Snake (*Coronella austriaca*) from Hampshire, presented by Mr. E. Penton; a Mozambique Monkey (*Cercopithecus pygerythrus*, ♂) from East Africa, a Red Deer (*Cervus elaphus*), European, deposited; two Bridled Wallabys (*Onychogale frenata*) from Australia, an Electric Eel (*Gymnotus electricus*) from South America, purchased.

THE illustrations for Profs. Parker and Haswell's forthcoming "Text-book of Zoology" have been drawn by Mr. M. P. Parker, and not Mr. N. J. Parker, as announced last week.

OUR ASTRONOMICAL COLUMN.

THE VARIABLE STAR *o* CETI (MIRA).—For many years past the brightness of this star at maximum has not come up to expectation, neither has its time of maximum occurred when predicted, a fact which might be accounted for by an irregularity of some twenty-five days either one way or the other. This year, however, as observed on November 28 by Mr. Shackleton, it was already brighter than γ Ceti (3·38), and nearly as bright as α Ceti (2·44) {Oxford Uranometria}, so that its magnitude will be about 2·9. Another observation on November 29, made at the Solar Physics Observatory, South Kensington, by the same observer and Mr. Butler, gave its brightness equal to γ Eridani (2·8) (U.A) (3·0 H.P.).

The predicted and observed maxima for the last three years are as follows:—

	Predicted (*Observatory* Companion).	Observed.	Mag.
1895 ...	December 9 ...	February 27 ...	3·8
1896 ...	November 3 ...	February 1 ...	3·5
1897 ...	November 9 ...	? ...	(2·9)?

From the observations of last year and the period of 332 days, it should be at its maximum about December 30, so that it may still be expected to increase in brightness, though its light curve is very irregular near maximum.

THE COMING TOTAL SOLAR ECLIPSE.—Owing to the presence of the plague in some parts of the country near the line of central totality, several parties intending to observe the total solar eclipse of January 22 next have had to make new arrangements. At present the following seems to represent the locations of the several parties on the central line. The most western station, Viziadurg, will be occupied by Sir Norman Lockyer with his party, backed up by the officers and crew of one of Her Majesty's ships. Karad, the next station to the east, lying on the Southern Mahratta railway, will be the place of observation by Prof. Michie Smith with his party from the Madras Observatory. Prof. Naegamvala with his followers will also probably adopt this region for work. Further to the east lies Talni, where Mr. Newall, Captain Hills, and a party from the British Astronomical Association will be stationed. Where the central line of totality cuts the road between Nagpur and Seoni, Dr. Copeland will take up his station, while about 150 miles further along the track, at Sohagpur, the Astronomer Royal and Prof. Turner will be stationed. Still further eastward, at Buxar on the Ganges, will be located two parties—one consisting of a second section of the British Astronomical Association, and the other the main party of the Great Indian Trigonometrical Survey. It is also likely that the Japanese astronomers will be in this neighbourhood. At another station, still further along the line, it is stated that the Fathers of the St. Xavier's College, Calcutta, will make observations. Profs. Campbell, Schaeberle, Todd, and not improbably M. Deslandres, will be present somewhere on the central line, but the actual positions they will take up are not yet definitely known.

SYSTEMATIC OBSERVATIONS OF OCCULTATIONS.—Herr H. Batterman has recently published (*Astr. Nach.*, 3457-8) the individual observations of a very complete set of occultations of stars by the moon, numbering altogether 641. The instrument he employed was a Merz refractor of 6 inches aperture and 8 feet focal length, and was set up at the Berlin Observatory. The object of these observations was to determine the parallactic inequality of the moon, and thence the parallax of the sun. For such an undertaking it was necessary to make observations on as many days as possible, especially near the time of full moon; the observations had, further, to be regular as regards immersion and emersion, and homogeneous as much as possible over the lunar orbit. Herr Batterman was handicapped very considerably by the local conditions of Berlin, and by being restricted as regards his visible horizon; but, nevertheless, he was able to secure a considerable number of observations in the two and a quarter years he devoted to them. This communication contains simply the individual observations, but he hopes at some future date to publish the results when the large work of computation has been completed.

THE VARIABLES S CEPHEI AND T URSÆ MAJORIS.—Mr. C. E. Peek, who is the owner of the Rousdon Observatory, Devon, has just published two very interesting series of observations relating to the light changes of the variables S Cephei and T Ursæ Majoris. All the observations were made with a Merz 6·4-inch equatorial refractor, and each is the mean of fine visual comparisons with stars that are seen in the same field of view as the variable. The author does not, however, state his actual method of observing, but we presume that this will be included in the introduction (No. 1) which he proposes to issue subsequently. In addition to the list of the individual observations, Mr. Peek has plotted the curves representing the light changes during this period of ten years (1887–1896 inclusive) over which the observations extend. These curves do not appear to have been smoothed, so that they represent the observed light fluctuations. In the case of T Ursæ Majoris, there is a very suggestive brightening about the time of minimum in nearly all the curves of this variable here drawn, and it would be interesting to know if other observers have recorded it.

SOME SYSTEMS OF METEORS.—Prof. Th. Bredikine contributes to the *Bulletin* of the St. Petersburg Academy (5th series, vol. v. No. 5) an investigation with the object of determining which member or members of our solar system have a disturbing action on those systems of meteors which the earth passes through in her revolution round the sun. The disturbing agents taken into account are: the action of some major planet, that of the earth, which is somewhat of the second order, and last, but not least, that of the sun, whose power acts in two ways, namely, first by attraction, and secondly by creating great disturbances in the nucleus. In nearly all cases the sun's effect is predominant, especially when the distance at perihelion passage is small, but sometimes a near approach to one of the major planets is very marked. Prof. Bredikine has previously shown that from an examination of comets' tails the force of projection at the times of outbursts is sufficient to convert the orbits of several of the composing particles from parabolic to elliptic of short period. He assumes that all meteor streams contain particles originally belonging to comets which passed through the solar system, and lost matter by disturbing actions of the members of this system. Employing as a starting-point the positions of some of the more prominent radiant points, as given in the catalogue published by Mr. Denning in the *Monthly Notices* (May 1890), he investigates the probable disturbing agent in each case. Most of the meteor streams dealt with have, according to this investigation, resulted from large disturbances at the nucleus caused by the sun itself; among these are the Leonids, Quadrantides, Geminides, Aquarides, &c. The Orionides owe their presence to the planet disturbing influence of Jupiter, while the Lyrids are due to that of Saturn.

COMET PERRINE (OCTOBER 16).—The ephemeris of comet Perrine, which we have recently given in this column, begins now to indicate variations from the observed place. Herr Möller (*Astr. Nachr.*, No. 3459) has therefore determined new elements from the variation of proportionate distances, using the observations made on October 16, Mount Hamilton; October 24, Hamburg; and November 1, Arcetri, Florence. The following are the new computed positions:—

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

1897.	R.A. h. m. s.	Decl. ° ′	log *r*.	log Δ.	Br.
Dec. 2 ...	18 10 37 ...	+54 56·5 ...	0·1334 ...	0·0539 ...	0·7
3 ...	10 4 ...	54 25·0			
4 ...	9 33 ...	53 54·6			
5 ...	9 4 ...	53 25·4			
6 ...	8 38 ...	52 57·2 ...	0·1325 ...	0·0704 ...	0·6
7 ...	8 14 ...	52 30·0			
8 ...	7 52 ...	52 3·8			
9 ...	7 31 ...	51 38·5			
10 ...	18 7 12 ...	+51 14·2 ...	0·1325 ...	0·0858 ...	0·6

THE ANNIVERSARY MEETING OF THE ROYAL SOCIETY.

TUESDAY last being St. Andrew's Day, the anniversary meeting of the Royal Society was held in their apartments at Burlington House. The auditors of the Treasurer's accounts having read their report, and the Secretary having read the list of Fellows elected and deceased since the last anniversary, the President (Lord Lister) proceeded to deliver the anniversary address. The medals were then presented.

The Society next proceeded to elect the officers and council for the ensuing year. The following is a list of those elected:—President: Lord Lister. Treasurer: Sir John Evans, K.C.B. Secretaries: Prof. Michael Foster, Prof. Arthur William Rücker. Foreign Secretary: Sir Edward Frankland, K.C.B. Other Members of the Council: Prof. William Grylls Adams, Prof. Thomas Clifford Allbutt Sir Robert Stawell Ball, Rev. Thomas George Bonney, Prof. John Cleland, Prof. Robert Bellamy Clifton, Prof. James Alfred Ewing, Mr. Alfred Bray Kempe, Dr. John Newport Langley, Dr. Joseph Larmor, Prof. Nevil Story Maskelyne, Prof. Raphael Meldola, Prof. Edward Bagnall Poulton, Dr. William James Russell, Dr. Dukinfield Henry Scott, Prof. Walter Frank Raphael Weldon.

The following is the address of the President:—

Since the last anniversary meeting fifteen Fellows and six Foreign Members have passed away.

The deceased Fellows are—

Edward Ballard, January 19, 1897, aged 76.
Charles Tomlinson, February 15, 1897, aged 89.
Samuel James Augustus Salter, March 1897, aged 72.
James Joseph Sylvester, March 15, 1897, aged 83.
Edward James Stone, May 9, 1897, aged 66.
Major-General Robert Mann Parsons, May 20, 1897, aged 68.
Sir Augustus Wollaston Franks, May 21, 1897, aged 72.
Sir John Charles Bucknill, July 19, 1897, aged 79.
Right Hon. Anthony John Mundella, July 21, 1897, aged 72.
William Archer, August 14, 1897, aged 65.
Lieutenant-General Sir William Francis Drummond Jervois, August 17, 1897, aged 76.
John Braxton Hicks, August 28, 1897, aged 74.
Charles Smart Roy, October 4, 1897, aged 43.
James Heywood, October 17, 1897, aged 87.
Rev. Samuel Haughton, October 31, 1897, aged 76.

The Foreign Members are—

Emil Heinrich du Bois Reymond, December 26, 1896, aged 79.
Carl Weierstrass, February 20, 1897, aged 82.
Alfred Louis Olivier Des Cloiseaux, May 8, 1897, aged 79.
Julius von Sachs, May 29, 1897, aged 65.
Johannes Japetus Smith Steenstrup, June 20, 1897, aged 84.
Rudolph P. H. Heidenhain, October 1897, aged 63.

Of these some seem to demand special notice from this Chair.

In Sylvester, English mathematical science has lost one of its best known and most gifted exponents. During his long and active career he wrote several hundreds of memoirs on the most refined and technical parts of pure mathematics. It is not for me to attempt to enumerate even the most important of his labours, which were as solid as they were brilliant. To quote the words of one well qualified to judge, "originality, imagination, and enthusiasm were the ever present notes in the chords which he struck with a master's hand; and it may be safely predicted that he will always find an honoured place in the small roll which contains the names of the men who have been pre-eminent in the science which he loved and to which he devoted his life."

Our Fellow for more than fifty years, he received the highest recognition our Society can bestow, having been awarded a Royal Medal in 1861, and the Copley Medal in 1880. No less was he honoured by other countries, foreign scientific academies having showered their distinctions upon him. Thus full of honours, as of years, he died at the advanced age of eighty-three.

In Sir Augustus Wollaston Franks we have lost one of the most distinguished archæologists of this or any other country. During a connection with the British Museum extending over a period of forty-five years, he practically founded the Department of British and Mediæval Antiquities and Ethnography, and its growth was in no small degree due to his private liberality.

In all that related to the subject of the antiquity of man, he was one of our first authorities; and the Christy collection of which he was a trustee, and which is now incorporated with the British Museum, assumed its present great importance under his careful superintendence and through his generous aid. The mediæval collections which he bequeathed to the nation testify alike to his taste and judgment and to his rare munificence.

The Rev. Dr. Haughton was a man of great intellectual power and amazing versatility. He made original contributions, based often upon very laborious researches, to physics, chemistry, geology, biology, and medicine, while continuing to discharge from time to time the functions of a minister of the gospel. If his many-sidedness prevented him from attaining a high eminence in any one branch of science, it pre-eminently fitted him for the place he was to fill in the government of a large educational institution.

After receiving his school education in his native town of Carlow, he proceeded to Trinity College, Dublin, where, his brilliant studentship having procured him a Fellowship at an unusually early age, he threw himself with great zeal into the educational work of the University. As a boy he had been fond of geology, and as a young man he so greatly distinguished himself in it that at the age of thirty he was appointed to the Geological chair in Trinity College. Here he found himself unable to deal satisfactorily with fossil remains without a knowledge of comparative anatomy, and for this an acquaintance with human anatomy seemed an essential preliminary. Thus he was drawn to Medicine, for which indeed he had an early predilection; and entering comparatively late in life on medical study, he devoted himself to the entire curriculum with characteristic energy. Soon after he had taken his medical degree, an epidemic of cholera occurred in Dublin, and he showed the true spirit of a devotee of Medicine by placing himself at the head of a band of medical students, to supply the want of any adequate system of nursing. In this self-denying labour Haughton bore more than his full share, and its beneficial results left in his mind an abiding sense of the value of bedside work. He was thus led to found medals for the encouragement of clinical study; and the last act of his life was, out of very scanty savings, to provide for making those rewards more substantial.

In the course of his studentship he had been deeply impressed with the abuses which then existed in the medical department of Trinity College, and on becoming connected with the governing body, he entered on the task of reform with indomitable courage; and it was mainly due to his exertions that the school was raised from a comparatively subordinate position to the leading place which it now holds.

The high opinion entertained of him by his colleagues was shown by the fact that he was for many years their representative on the General Medical Council. He was of a most genial and loyal nature, and it is said of him that, while he made many friends, he never lost one.

Edward Ballard was one of the chief promoters of the sanitary science of the Victorian era. His researches into problems regarding public health, which extended over forty years, were characterised by very remarkable far-sightedness and exactitude. To him we are indebted for most of our certain knowledge on the subject of effluvium nuisances in their relation to health, and for the indication of trustworthy means of mitigating the deleterious influences of noxious trades. He, too, was among the first to insist on the importance of strict study of the ætiological relations of "sickness" and "mortality"; and by his labours in this connection he laid a foundation for that system of compulsory notification of infectious illness which is now practically universal in this country. But Dr. Ballard's completed work in these and other directions by no means represents the full measure of the value of his services to public health. By his industry in the accumulation of facts bearing on a number of unsolved problems, and his exposition of such facts in their several connections, he has not only indicated lines of further research, but has tended to lighten the labours of those who will come after him. He was a man of noble nature; and the devotion of his great abilities to the service of mankind was utterly devoid of self-seeking.

James Heywood was a man of considerable scientific attainments, who deserves to be specially remembered on account of his great services in the cause of university reform. He was born in 1810 at Everton, Lancashire, and on leaving school at Bristol, entered Trinity College, Cambridge, where he was

Senior Optime in 1833. He could not, however, proceed to his degree until twenty-three years later, on account of the religious tests which were only abolished in 1856 by the Cambridge University Reform Act. Of this, as member for North Lancashire, he was the chief promoter: for, already in 1854, he moved and carried, after several previous attempts, a clause by 233 against 78, in favour of the abolition of religious tests for the Bachelor's degree in Arts, Laws, Medicine, and Music. There can be no doubt that this fundamental reform led the way to the introduction of experimental science into our universities.

He was one of the original trustees of Owens College, Manchester, and took a keen interest in the establishment and development of the scientific chairs in that institution. He was elected into the Royal Society in 1839, and was, at the time of his death, the Fellow of longest standing.

On February 19 last, Karl Weierstrass, one of our Foreign Members, died in his eighty-second year. He was elected a Foreign Member in 1881, and in 1895 the Copley Medal was awarded to him in recognition of the contributions he had made to pure mathematics. The grounds on which the award was made were set out in the President's Address in that year; and so it is not necessary now to refer in detail to his researches. The results which he obtained and the rigorous precision of method which he adopted have made his influence remarkable; and it can fairly be claimed for him that he is not the least eminent on the roll of the great mathematicians of the century.

Alfred Des Cloizeaux was a veteran mineralogist of great eminence. His first paper was published fifty-four years ago, and was the beginning of a long series treating of the forms and optical characters of crystals. After being Professor of Mineralogy for eighteen years at the École Normale Supérieure, he was appointed to the charge of the minerals at the Musée d'Histoire Naturelle, in which office he remained until he reached the limit of age prescribed by the rules of the French Civil Service. His fame rests upon the thoroughness and accuracy of his systematic investigation of the crystals of minerals, more especially as regards their optical properties. The results are incorporated in his "Manuel de Minéralogie," a standard book of reference. Prof. Des Cloizeaux died in the eightieth year of his age.

In Julius von Sachs botanical science has lost one of the most conspicuous figures of the latter half of the century. His widespread influence was due in the main to two memorable books.

In his "Experimental-Physiologie" (1866) he at once put the subject on a new footing. He returned to the methods long ago pursued by Hales and Knight in this country, and, while giving a critical estimate of the results achieved by his predecessors, everywhere turned the light of experimental investigation on the problems presented by the living plant. The success which he met with was due to a broad grasp of general principles and a singular directness of aim at the object in view, associated with great experimental skill. In his mechanical ingenuity and aptitude for making simple yet effective appliances he somewhat resembled Faraday.

His "Lehrbuch" (1868) produced a profound impression on the teaching of botany both in Europe and America. It did for botany what Gegenbaur achieved for zoology, in presenting the morphological facts of the vegetable kingdom for the first time as a whole. As with the "Experimental-Physiologie," it was no mere compilation, but was at every point subjected to the test of original investigation.

Sachs, moreover, presented the somewhat unusual combination in science of great gifts of original investigation accompanied by no less great gifts of exposition. The insight of his attack on a problem was equalled by the masterly lucidity with which he expounded his results.

Emile du Bois-Reymond, who died in December of last year at the age of seventy-eight, was a Foreign Member of the Royal Society since 1877. Although born in Berlin, he was of French-Swiss extraction, his father being a native of Neufchâtel, and his mother belonging to a French Huguenot family. He studied in the Universities of Berlin and Bonn, and took his Doctor's degree in Medicine in Berlin. In 1840, at the age of twenty-two he became the assistant of Johannes Müller, whose successor he was appointed, in the chair of Physiology in Berlin, in 1858. He has himself told us that it was Johannes Müller who first turned his attention to the study of animal electricity, to which the labours of his life were chiefly devoted. His publications on the subject were very numerous, while his observations were characterised by mathematical accuracy which stamped them as trustworthy. And it is not too much to say that his discoveries constitute the main fabric of our knowledge of animal electricity.

Although his energies were chiefly devoted to one branch of physiology, he was not unmindful of other departments of the science. Ever since 1859 his name has been associated with the editorship of the "Archiv für Anatomie und Physiologie," which he carried on in conjunction with Reichert, after the death of Johannes Müller. He was a man of wide sympathies and high culture. His semi-popular discourses, scientific, literary, and historical, are models of well-selected language, clear exposition, and deep erudition. His address "On the Limits of Natural Knowledge" has passed through numerous editions, and has been translated into many languages. Du Bois-Reymond ranks with men like Bernard, Brücke, Helmholtz, and Ludwig, as one of those by whom the science of modern physiology has been built up.

As regards the work of the Society during the past year I have little to add to the Council's Report.

On July 15 I had the honour of taking part in a deputation to the Queen at Windsor to present the address of congratulation which had received the sanction of the Society. On this memorable occasion I was accompanied by the other officers, including all the Vice-Presidents, and also by three former Presidents, whom we all revere, Sir Joseph Hooker, Sir George Stokes, and Lord Kelvin. Her Majesty received us in person, and made the following very gracious reply:—

"I thank you for your loyal and dutiful Address. I am much gratified by the attachment which your ancient and learned Society expresses to my Throne and Person.

"I am fully sensible how far the labours and ingenuity of men of science, whom you worthily represent, have advanced the industrial and social prosperity of my people, and have tended alike to their good and refinement, and I confidently expect the same excellent fruit in years to come from the indefatigable and reverent investigation of nature for the promotion of which the Royal Society was founded."

In the early part of the year a deputation from the Royal Society, the British Association, and several others of the most important scientific and technical societies, waited upon the Prime Minister to urge upon him the importance of establishing in this country a National Physical Laboratory in which the testing and verification of instruments and the construction and improvement of standards of various kinds should be undertaken in a regular and systematic way. There was nothing new in principle in this proposal. Work of the kind referred to has for many years been carried out at Kew under the auspices of the Royal Society. It has been as successful as the limited means at the disposal of the Kew Observatory Committee would allow; and all that is needed is sufficient State aid to enable work of the same kind to be done on a larger and more useful scale.

It is satisfactory to be able to state that the efforts of the deputation were not in vain. A committee, of which Lord Rayleigh is chairman, has been appointed by the Treasury to investigate and report upon the desirability of the scheme. Evidence is being taken, and we may fairly hope that the Government will finally consent to promote an undertaking which could not fail to advance the interests both of pure science and of scientific industry.

In January last I was requested by the Council to approach the India Office in order to call their attention to Yersin's treatment of bubonic plague, which was causing such grave anxiety in the Bombay Presidency. I gladly undertook this service, as I had been greatly impressed with an account which that distinguished man, himself an independent discoverer of the plague bacillus, had given of a trial he had made of his remedy in China. The cases were, indeed, not very numerous, but the success recorded was most striking, and was in every detail so exactly proportioned to the shortness of the duration of the disease at the time when the treatment was begun that it was difficult to conceive it to be a matter of accidental concomitance. A similar correspondence of results with theory, taken along with complete trustworthiness of the source of information, had made me early feel and express confidence in the analogous serum treatment of diphtheria, which has since proved of such signal benefit to the community.

I was received at the India Office with the utmost cordiality, and I am not violating confidence when I say that my repre-

sentations tended to strengthen the Home Government in their disposition to afford encouragement to M. Yersin to labour in the stricken district.

The vague rumours which reached us some time ago regarding his work in Bombay were not of an encouraging character. But I was glad to see from a paper read lately by M. Metchnikoff at the International Medical Congress in Moscow, that the treatment had been by no means a complete failure, and that the smaller degree of success than that obtained in China was sufficiently explained by the fact that the serum in the present state of knowledge takes a very long time to prepare, and Yersin had been obliged to employ what he knew was not as potent as that which he used in China. We may therefore fairly hope that in due time, if the pestilence should last so long, the original full measure of success will be again obtained.

The communications made to the Society during the year have been of a high order of excellence. In illustration of this I must content myself with referring to two examples taken from the domains of physics and biology respectively. The remarkable series of ten papers by Profs. Dewar and Fleming, describing their continued researches on the electric and magnetic properties of matter at low temperatures, have brought before us new facts of fundamental importance. Such, for instance, is their discovery that at very low temperatures the electrical resistance of bismuth is remarkably increased by transverse magnetisation; so much so that the observations seem to indicate that at the absolute zero pure bismuth would be a perfect conductor if not in a magnetfc field, but a perfect non-conductor if transversely magnetised.

The illustration wh'ch I will take from the domain of biology is the recent communication of Mr. Gardiner on the Histology of the Cell-Wall. Before 1883, when his former paper on this subject was published in our *Proceedings*, other observers had seen and described threads passing through the walls of certain vegetable cells, and supposed to connect the protoplasm of one cell with that of adjacent ones. But the observation had only been made in certain exceptional cases, and, moreover, they were not of such a character as in Mr. Gardiner's opinion to afford conclusive evidence that the threads really consisted of protoplasm. Since the date referred to he has laboured at this most important subject with remarkable ingenuity and perseverance; and by new methods of preparation varied to overcome the special difficulties presented by the various forms of tissue, he has succeeded in demonstrating, throughout the long series of cases which he has already examined, the presence of threads of undoubtedly protoplasmic nature, often of exquisite delicacy, passing in large numbers through the walls of adjacent cells, not only where they are thinned by the presence of pits, but elsewhere also. And to use his own words, "there can be little doubt that such connecting threads occur universally in the cells of all the tissues of all plants. From this arises the fundamental conception that the plant body must be regarded as a connected whole." And the transmission of impulses and of nutrient material from one part of the vegetable organism to another, quite unintelligible as long as the protoplasm of each cell was believed to be shut off from that of its neighbours by a wall of cellulose, receives a ready explanation.

The attendance at our meetings during the past session has been very satisfactory. There can be no doubt that the great improvement which has taken place of late years in this respect has been in no small measure due to the alteration of the time of meeting to the afternoon, which is more convenient to the large majority of the Fellows than the evening. I thus freely admit that the change has been very advantageous, although I was opposed to it when it was made, as I was apprehensive that it would interfere with participation of members of my own profession in the work of the Society; for I should greatly regret anything like a severance of Medicine from the Royal Society, believing as I do that they are very helpful to each other, medical practice affording the suggestion and stimulus of much scientific investigation, while it is often the ultimate test of the validity of the conclusions arrived at.

At the risk of seeming to dwell too much upon matters connected with the healing art, I am tempted to refer to one recent instance of its intimate connection with science. In the Society's *Proceedings* for 1893 (vol. liv. p. 187) appeared a paper by Dr. Monkton Copeman, relating important researches on Variola and Vaccinia, and referring to a discovery which he had announced two years previously at the International Hygienic Congress, in London (*Trans.* of Internat. Congress of Hygiene, 1891), that an admixture of glycerine in certain proportions with vaccine lymph derived from the calf had the effect of causing, in no long time, the disappearance of what he termed the "adventitious microbes" invariably present in that material at the outset, without diminishing the efficacy of the lymph for the purpose of vaccination. It had been known before that glycerine might be added to the lymph without destroying its vaccinal property, but that it would thus cause the disappearance of concomitant microbes was quite new. In the scant intervals of leisure permitted by his duties as inspector under the Local Government Board, Dr. Copeman has continued to prosecute his researches. He has ascertained, among other things, that if tubercle bacilli are intentionally mixed in considerable quantity with the lymph, they soon lose their life under the influence of the glycerine, thus removing the last rational objection that could be urged against vaccination. For while the use of calf lymph excludes the possibility of conveying human disease in general by the process, the cow, like man, is liable to tuberculosis. It is true that tubercle is very rare in the young animal, and that the practice of killing the calf after it has furnished the vaccine and subjecting the body to competent inspection before the lymph is set aside for use, would reduce the risk of communication of the disease almost to zero. But it is satisfactory to learn that Dr. Copeman's process makes such a thing absolutely impossible. It further turns out that the use of the glycerine, so far from impairing the efficacy of the lymph for vaccination, considerably enhances it; so that it becomes susceptible of large dilution, one calf thus furnishing material for a much greater number of vaccinations than was formerly thought possible. And further the glycerinised lymph being stored in sterile glass tubes, the chance of contaminating the vaccination scratches with extraneous impuri ies, somewhat difficult to prevent in vaccinating directly from the calf, is entirely avoided. Lastly, it has been found that the inflammatory disturbance at the seat of vaccination in the human arm, with concomitant febrile disturbance, is greatly lessened by the use of the pure essential ingredient.

Comparatively little advantage has yet been taken of the system in this country. But it has been otherwise abroad; and the English Commission on Vaccination having made favourable reference to the subject, the President of the Local Government Board recently requested their Medical Officer, Sir Richard T. Thorne, to make a tour of inspection of the continental practice. In this he was accompanied by Dr. Copeman, and we learn from the report which they have issued that they found our countryman's precepts very extensively acted on in the various countries which they visited. In Germany, especially, they are carried out with the thoroughness characteristic of that nation, so much so that while arm to arm vaccination has been entirely discarded, the use of glycerine-stored lymph has almost entirely superseded the practice of vaccinating from calf to arm.

It has given me pleasure to learn that Mr. Chaplin is likely soon to propose legislation for the purpose of giving the full benefits of this valuable process to the country of its discoverer.

It afforded great though melancholy satisfaction to the Treasurer and myself to be present last Christmas at the final obsequies of the man to whose labours is due the possibility of carrying on such investigations as those just referred to. M. Pasteur was buried in his own "Institut", with a splendour befitting the memory of so great and good a man.

I have also been glad to be the means, as President of the Society, of aiding our French brethren in erecting a monument to him to whom the world in general owes so much. Having received last year a letter from the Perpetual Secretary of the French Academy inviting my help in raising a fund to supplement that which was being subscribed in France, I called a meeting held here on March 26 of last year, at which it was decided to form a committee, in order to collect contributions to the International Pasteur Memorial. I wrote in the first instance to such of our Fellows as are members of the Academy, requesting them to allow their names to be on the committee, and received in almost every instance a cordial assent. Our Treasurer having consented to act as treasurer to the fund, and Prof. Percy Frankland undertaking the somewhat onerous duties of secretary, a sum has been raised, amounting in all to 877*l.* 0*s.* 3*d.*, from which 17*l.* 7*s.* 2*d.* was deducted for expenses, leaving a balance of 859*l.* 13*s.* 1*d.*

I know that our French friends were much gratified by this result; and I learn from a letter written to the Treasurer by

M. Bertrand, acknowledging a final cheque, that the monument in Paris promises to be worthy of its object.

It is noteworthy that rather more than half the entire sum contributed has come from India, chiefly from the medical officers, through Surgeon-General Cleghorn. It seems probable that their great liberality was prompted by a sense of gratitude for the good work done on Pasteur's lines in that great dependency, such as Haffkine's preventive inoculations against cholera, and the efforts being made to cope with the plague in Bombay.

I have the sad pleasure, if I may so express myself, of announcing that my old friend, that distinguished medical officer and very gallant soldier, Sir William Mackinnon, late Director-General of the Medical Department of the Army, has, by will and codicils dated 1896 and 1897, after making certain specific legacies, including one of 2000*l.* to the University of Glasgow, bequeathed the whole residue of his property to the Royal Society, subject to certain life annuities. The proceeds of the fund are to be applied by the Royal Society for the foundation of such prizes and scholarships for the special purpose of furthering Natural and Physical Science, including Geology and Astronomy, and for furthering original research and investigation in Pathology, as the Society may think best and most conducive to the promotion of those sciences and of original discoveries therein; such prizes and scholarships to be called after the name of the testator.

COPLEY MEDAL.

Prof. Albrecht von Kölliker, For. Mem. R.S.

The Copley Medal is given to one who well deserves the highest honour that it is in the power of the Royal Society to confer. For nearly sixty years past Albrecht von Kölliker has made contributions of the highest value to histology, embryology, and comparative anatomy. Though his labours have embraced so wide a field, they have always been of a high order of excellence, and have often been of far-reaching significance.

His early histological discoveries were invaluable for the systematic development of the cell theory. Of these I must, on the present occasion, content myself with referring to two: his demonstration of the continuity between the nerve fibres and nerve cells of Vertebrata in 1845, followed by his memoir on nerve cells in 1849; and his isolation in 1848 of the cellular elements of smooth muscular tissue, together with his essay on the distribution of smooth muscle in the vertebrate body, and his final demonstration of the existence of muscular tissue in the walls of the blood-vessels, where its presence, although previously asserted by Henle and Sharpey, was at the time denied by Arnold and many others.

These are examples of the histological results achieved by von Kölliker during the first ten years of his scientific activity. They are of fundamental importance, and they have been followed by a long series of other valuable histological discoveries. The whole series show not only his power as an investigator, but the wide range of his knowledge, and the eagerness with which he has appreciated and applied whatever was new in the work of others. This last quality is well shown in his various essays on the structure of the nervous system, from his early acceptance of Remak's statements concerning non-medullated nerves, to his work of the last few years.

Prof. von Kölliker's influence upon histological science is due not only to his fame as an investigator, but in part also to his skill as a teacher and as a writer. Every successive edition of his text-book has been an important addition to the literature of the subject.

Among his embryological papers, that dealing with the development of Cephalopods, dating from 1844, is still a standard work, and figures copied from it are to be found in most modern text-books. His memoir on the development of Amphibia (1846) contains important statements on the behaviour of the nucleus during segmentation, and on the formation of cartilage and blood-vessels. The papers on the development of the skull (1849-50), and the subsequent work on the part played by the notochord and its sheath in the formation of the vertebral column, must be mentioned as of fundamental importance. His many later researches on mammalian embryology, which are summarised in the various editions of his text-book of vertebrate embryology, need not now be mentioned in detail.

Although it is as a histologist that von Kölliker is pre-eminently distinguished, his zoological papers are numerous and important. Among his labours in this direction were his early demonstration of the unicellular nature of the Gregarinidæ, his description of the Dicyemidæ, his memoirs on the structure and development of the Hydroids and Medusæ, and his later magnificent works on the Alcyonaria.

Many of von Kölliker's papers have appeared in the *Zeitschrift für Wissenschaftliche Zoologie*, founded by him and von Siebold in 1848, of which he is still one of the chief editors. It is pleasing to know that, at the advanced age of eighty, he is still able to prosecute with unflagging zeal his work as an investigator and as a teacher. One of the reasons of his absence to-day is his reluctance to leave his lectures.

ROYAL MEDAL.

Prof. Andrew Russell Forsyth, F.R.S.

One of the Royal Medals is awarded to Prof. Andrew Russell Forsyth on account of his contributions to the progress of pure mathematics.

He is known principally for his excellent treatises on many subjects of mathematical analysis. These works are not mere compilations; they contain original work, and exhibit great creativeness of thought.

The treatise on differential equations was immediately successful, and established firmly his reputation as a teacher. This was followed by a scholarly work on Pfaff's problem and, later, by the treatise on the Theory of Functions, the first in English on the subject, and noteworthy for the manner in which the parallel theories of Cauchy, Riemann, and Weierstrass are marshalled. The appearance of this work is responsible for the newly awakened interest in this country concerning the great works on this subject of Weierstrass, Jordan, Klein, Lie, Poincaré, and Mittag-Leffler.

Prof. Forsyth is, in addition, a prolific author on other subjects covering a wide range of pure mathematics.

ROYAL MEDAL.

Lieut.-General Sir Richard Strachey, F.R.S.

The other Royal Medal is conferred on Lieut.-General Sir Richard Strachey for his investigations in physical and botanical geography, geology and meteorology. Two of the most recent of these are recorded in his report, published in 1888, on the barometrical disturbances and sounds produced by the eruption of Krakatoa, and in his paper in the *Phil. Trans.* of 1893, entitled "Harmonic Analysis of Hourly Observations of the Temperature and Pressure at British Observatories." These, while important in themselves, were but the last of a long series of valuable memoirs. He was the first to treat scientifically of the physical and botanical geography, geology, and meteorology of the Western Himalaya and Tibet. His numerous papers on these subjects, dating from the year 1847, are published in the *Journals* of the Bengal Asiatic, Geological, and Royal Geographical Societies, in the Royal Society's *Proceedings*, and in the Reports of the British Association.

Sir R. Strachey's scientifically annotated and very complete botanical collections made in Kumaon, during his physical survey of that province (in company with Mr. Winterbottom), and in Tibet, at all elevations from 2000 to 18,500 feet, are unique in value and interest, as being the first from which could be determined the successive zones of vegetation according to altitude in the mountains of any part of Asia.

Sir R. Strachey is justly regarded as the founder of scientific meteorology in India, whether by virtue of his early personal labours in that branch of science, or for the zeal and energy with which, during his long career as a member, first of the Government of India in that country, subsequently of the Council of the Secretary of State, he promoted the establishment of meteorological observatories and stations all over our Eastern dominions. Nor were his exertions in this respect confined to meteorology, for there are few scientific institutions or publications now supported by the Indian Government which are not largely indebted for their existence or organisation to his efforts.

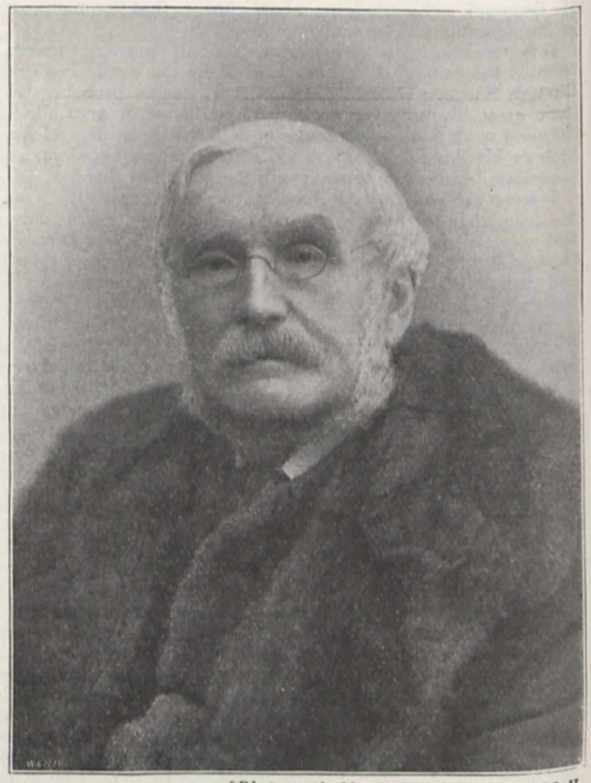
DAVY MEDAL.

Dr. John Hall Gladstone, F.R.S.

The Davy Medal is awarded to Dr. John Hall Gladstone on the ground of the great extent and value of his chemical and physical researches, extending over a period of forty-nine years. His first paper was printed in 1847, and his last in the *Proceedings* of the Royal Society for 1896. During

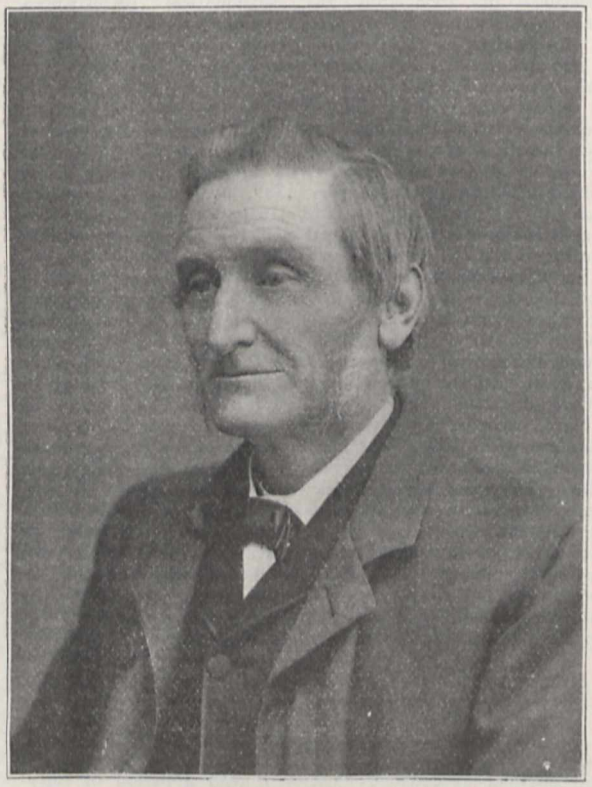
[*Photographed by Elliott and Fry, Baker Street.*

PROF. A. R. FORSYTH (ROYAL MEDALLIST).



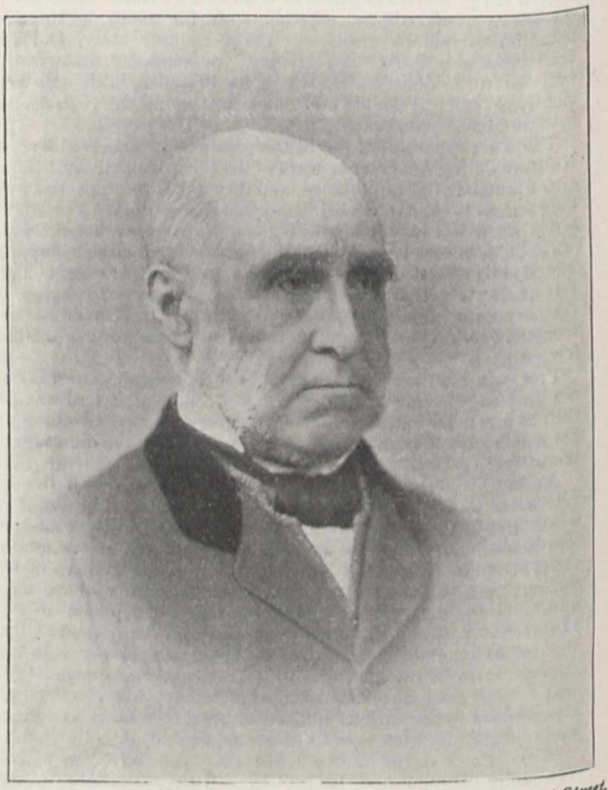
[*Photographed by A. J. Melhuish, Pall Mall.*

LIEUT.-GENERAL SIR RICHARD STRACHEY, G.C.S.I.
(ROYAL MEDALLIST).



[*Photographed by A. J. Melhuish, Pall Mall.*

DR. J. H. GLADSTONE (DAVY MEDALLIST).



[*Photographed at Claudet's Photo. Studio, Regent Street.*

SIR JOHN SIMON, K.C.B. (BUCHANAN MEDALLIST).

this time he has published seventy-six papers, recording the results of his own researches, and forty-eight relating to investigations made in conjunction with other workers.

These papers cover a wide range of subjects. In chemistry he showed, in 1847, that urea is formed by the breaking up of some of the salts of fulminic acid. He demonstrated the composition of the so-called iodide of nitrogen. His memoir on the relations of the atomic weights of the elements suggested analogies with the homologous series of organic compounds. An important monograph on chemical affinity occupies forty-five pages of the *Philosophical Transactions* of 1855; in it the behaviour of salts in solution is discussed with much acuteness.

Amongst Dr. Gladstone's other very numerous contributions to chemical science, may be mentioned the study of the influence of carbonic anhydride on the germination of plants, his researches on the chemistry of storage batteries, on the molecular weight of caoutchouc and gums, and on the zinc-copper couple and its application to the production of organo-zinc compounds and the hydrides of the organic radicals. Dr. Gladstone's new and simple method of producing organo-zinc compounds conferred a most valuable boon upon organic chemistry, and led to the very extensive use of these bodies in organic research, and consequently to many important discoveries in that domain of chemistry.

Amongst Dr. Gladstone's numerous researches in physical chemistry, may be mentioned the following:—"On the Spectra produced by Solutions of Coloured Salts in Hollow Prisms"; "On the Use of the Prism in Qualitative Analysis" (1857). He shows that when a coloured acid and base combine, a solution of the salt so formed only allows those rays to pass which are not absorbed by either constituent separately. He taught us the optical detection of didymium in the same year, and also studied the influence of heat on the colour of saline solutions, showing that whilst in some cases the intensity only of the colour was altered, in others the tint was completely changed. In 1860 he published a useful paper on the use of the polariscope in chemical investigation. Of his other papers on physical subjects, the following may be mentioned:—"On the Connection between the Optical Behaviour, Specific Gravity, and Chemical Composition of Ethereal Oils"; "On the Refraction Equivalents of some Elements"; "On the Refraction and Dispersion Equivalents of Chlorine, Bromine, and Iodine"; "On the Refraction Equivalents of Carbon, Hydrogen, Oxygen, and Nitrogen"; "On the Specific Refraction and Dispersion in Isomeric Bodies"; and (with Dr. Perkin) "On the Relation between Molecular Magnetic Rotation and the Refraction and Dispersion of Nitrogenous Compounds."

One of Dr. Gladstone's most important investigations was the determination of the refractive equivalents of many of the metals. The object was not, however, only to determine these equivalents, but also to answer the question whether any of the elements possessed more than one refractive equivalent. As the refractive indices of the metals could not, on account of their opacity, be directly determined, he operated upon solutions of their salts, first proving, in cases where both solid and solution were available, that the refraction was the same in the solid and in its solution, whether the solvent was aqueous or alcoholic, and whether concentrated or dilute. As the refraction equivalents of all sodium compounds were between 3 and 3·9 less than the corresponding potassium compounds, it was proved that the electro-negative constituent of the salt had the same optical effect no matter with what metal it was combined. By taking the refractive equivalent of potassium as 8, and dividing it by the atomic weight (39) of potassium, he obtained for the specific refractive power of that element the number 0·205, and by a similar series of determinations the specific refractive power of sodium, lithium, magnesium, barium, strontium, calcium, zinc, nickel, cobalt, lead, and mercury were ascertained.

BUCHANAN MEDAL.

Sir John Simon, F.R.S.

The Buchanan Medal is presented to Sir John Simon, who may fairly be termed the founder of modern sanitary science.

When, in consequence of the appalling facts relating to the condition of the indigent classes in London which were brought to light by the Sanitary Commission of 1843, powers were conferred by the Legislature on the Corporation for the improvement of so much of the metropolis as is under their control, John Simon was appointed Medical Officer of Health of the city. In this capacity he brought into existence a system of sanitary administration which has served as the model on which similar systems have been organised, not only in Great Britain, but throughout the civilised world.

When, in 1858, the powers of the General Board of Health were transferred to the Privy Council, the knowledge and experience gained by Mr. Simon during his seven years of office in the city were made available for the country at large by his appointment as Medical Adviser of the Government. He held this office for fifteen years, during which he not only energetically and effectually promoted measures of sanitary improvement both in town and country, but initiated a system of scientific investigations to be conducted year by year at the public expense, and it is deeply to be regretted that his plans were not fully carried out.

The funds for this medal were supplied by Sir John Simon's late distinguished pupil, Dr. Buchanan, and it is fitting that the first award should be to the master.

[We are glad to be able to reproduce the portraits of the Royal, Davy, and Buchanan medallists. The portrait of the Copley Medallist, Prof. Albert von Kölliker, will be given on a subsequent occasion in connection with an account of his life and work.]

Report of the Council.

Many of the subjects referred to by the President in his Address at the last anniversary have continued to engage the attention of the President and Council during the past year.

Among the most important duties discharged by the Council is that connected with the consideration of papers communicated to the Society, with a view to ultimate publication in the *Philosophical Transactions* or *Proceedings*. In this duty they have received the most valuable assistance from the Sectional Committees, which were appointed under the Standing Orders mentioned in the last Presidential Address, and which now present a record of their first complete year of working.

In all 116 papers were received between the close of the Session, 1896, and the corresponding period in 1897. Of these, 37 were submitted for publication in the *Philosophical Transactions*, and 70 in the *Proceedings*; and 23 and 75 have been ordered for publication in the two categories respectively.

During the past year 22 papers have been published in the Mathematics and Physics section, and 10 in the Biological section of the *Philosophical Transactions*. The two sections together contain in all 1312 pages of letterpress and 22 plates. Nineteen numbers of the *Proceedings* have been issued, containing 991 pages and 9 plates.

A meeting for discussion in accordance with the regulations contained in the Standing Orders adopted last year was held in March of the current year. The discussion was based on a paper contributed by Sir Norman Lockyer "On the Chemistry of the Hottest Stars"; this, together with some of the principal contributions to the discussion, has been printed in the *Proceedings*.

In pursuance of the resolution of the International Conference on a Catalogue of Scientific Literature, the Council at the beginning of the Session, upon receiving the report of the British delegates to the Conference, and in accordance with the 26th resolution of the Conference, viz.:—

> (26) "That the Royal Society be requested to form a Committee to study all questions relating to the Catalogue referred to it by the Conference, or remaining undecided at the close of the present sittings of the Conference, and to report thereon to the Governments concerned,"

appointed a Committee with full executive powers. This Committee has since been engaged in developing a scheme for the preparation of the projected complete Catalogue of Scientific Literature.

The Committee has held a number of meetings, has devoted much time to the discussion of the difficult questions which arise in devising methods for carrying out so large a scheme as that contemplated by the Conference, and has appointed a number of special Sub Committees for drawing up schemes of classification for the several branches of science.

In view of the resolutions of the Conference, it appeared desirable to establish a (provisional) British Catalogue Committee, which might be consulted by the Committee of the Royal Society on questions relating to the collection and preparation of the material supplied by the scientific literature of Great Britain and Ireland, and might ultimately develop into the National Bureau for the United Kingdom contemplated by the Conference.

An appeal was, therefore, made by the Royal Society's Committee to the chief Societies representative of the sciences to be included in the Catalogue, and to certain important libraries, requesting the appointment of representatives.

Excepting in two cases, in which the nominations are delayed, all the societies and libraries applied to nominated representatives as requested.

At the first meeting of the British Committee thus constituted, representatives of nearly all the sciences included in the invitation attended, and expressed the willingness of the bodies they represented to co-operate in the work of the International Catalogue, though in some cases it was stated that they would not be able to contribute towards the expenses.

The further action to be taken by the various societies towards carrying out the work indicated above, will be considered by committees specially appointed by them for the purpose, and will form the subject of reports to be made to the British Committee.

With the object of keeping the delegates to the International Conference informed as to the work of the Committee, and of eliciting from them suggestions and criticisms upon the matters still under discussion, an *ad interim* statement of the progress so far made in its deliberations has been sent confidentially to all the delegates.

Progress continues to be made with the "Catalogue of Scientific Papers" and with the classified Index thereto.

As regards the supplementary portion of the Catalogue, the transcription of the copy is now approaching completion, and the Council hope that the first instalment of copy may be ready for the printer early in the new year. During the year ending on October 31, about 130 serials have been indexed for the purposes of the Catalogue, representing approximately 774 volumes, and involving the transcription of about 41,000 titles.

Of the classified Index to the Catalogue, about 275,000 slips have now been prepared, of which about 100,000 have been translated. An experimental classification of these slips is being made, in the course of which about 53,000 have already been classified under the eleven divisions sanctioned by the Catalogue Committee. During the past year about 65,000 slips have been prepared, of which about 13,000 have been revised, or translated, as occasion required.

Under the regulations for the administration of the Government Grant Fund, the Council have, upon the recommendation of the Government Grant Committee, made grants amounting to 3115*l.*, in addition to a grant of 1500*l.* made to the Joint Permanent Eclipse Committee out of the Reserve Fund towards the expenses of observing the approaching solar eclipse.

Early in the year, the Council appointed a Committee, called the Government Grant Review Committee, to report upon the manner in which the grants made from the Government Grant have been expended, and on the scientific results thereby attained. The Committee has met, but has not yet reported to the Council. The question of the reappointment of the Committee to make an annual report on the subject referred to them is under consideration.

The Report upon the results of the expedition sent out last year, under the direction of a Committee of the Royal Society, to investigate the structure of a Coral Reef by boring, was presented to the Society in a paper which was printed in the *Proceedings* of February 18, 1897 (vol. lx. p. 502). In that report, the Chairman of the Committee expressed the opinion that a more successful attempt would probably be made from Australia, and the Council therefore heard with satisfaction early in March that the authorities at Sydney would probably be willing to renew the attempt at boring with some assistance in money and influence from the Royal Society. Later, the Council was informed that a second expedition had been despatched from Sydney with the assistance of the Royal Geographical Society of Australasia on the agreement that the core, when recovered, should be sent to the Royal Society, and that all scientific details of the results of the expedition should be reserved for the Royal Society to publish. On the recommendation of the Coral Reef Committee, the balance remaining in hand from last year's expedition was voted in aid of the Australian expedition.

Early in the present month, the Secretaries received a preliminary report from Prof. David, in which he informed them that on September 6 the boring had attained a depth of 557 feet, and in the lower part had pierced more than one mass of coral limestone, one—about 20 feet thick—ending at 550 feet; they have also been informed that the boring was continued after the above-named date, and was still proceeding in generally similar material to that above, at a depth of 643 feet.

The Joint Permanent Eclipse Committee has organised expeditions for the observation of the Total Solar Eclipse in January next; and, at the request of the Committee, applications have been made to the War Office for leave of absence for Capt. Hills, R.E., in order that he may take part in the observation of the Eclipse; to the India Office, for facilities for the landing of instruments free of duty; to the Admiralty, for the conveyance of one of the observing parties to and from their observing station in one of H.M.'s ships; and to the Colonial Office, for facilities for the transhipment of that party from a passenger steamer to the ship of war at Colombo.

All these requests have been acceded to by the authorities.

The Committee appointed last year at the request of Her Majesty's Secretary of State for the Colonies, to investigate the subject of the Tsetse Fly Disease in South Africa has, in the course of the year, through Drs. Kanthack and Durham, and Mr. Blandford, conducted a careful investigation into the disease so far as it can be studied in this country, in subjects inoculated from a dog sent over from South Africa by Surgeon-Major Bruce. The Committee have, at the same time, been in communication with Surgeon-Major Bruce, keeping him informed of the progress of the inquiry here, and offering him suggestions for further investigation in South Africa. The experimental investigations, under Dr. Kanthack, are being pursued at Cambridge, with the aid of a grant of 200*l.*, generously placed at the disposal of the Council by Mr. A. Beit for this purpose. A letter, however, has recently been received from the Colonial Office, stating that Surgeon-Major Bruce's investigations have, for the present, been suspended, and he himself has been directed to return to military duty. The investigations have, so far, not resulted in the indication of any practical preventive treatment of the disease, but the life-history of the hæmatozoon, discovered by Surgeon-Major Bruce and shown by him to be the essential cause of the disease, has been carefully studied, and still presents problems of great interest.

Acting upon the recommendations of the Scientific Relief Committee, the Council has during the year granted 545*l.* to assist scientific men or their relatives in distress. Early in the year the Council found it expedient to codify the practice and original regulations, which had been modified from time to time since the formation of the Scientific Relief Fund, in a series of regulations for the guidance of the Committee in the administration of the fund. The revised regulations will be printed in the new edition of the "Year-Book."

In January the Council received a letter from the Royal Society of Canada urging them to move the Government to give their adhesion to a scheme for the unification of time at sea by the assimilation of the astronomical and civil day, with a view to the necessary alteration being made in the *Nautical Almanac* for 1901. The Council appointed an influential committee to consider the question, and received from them the following report:—

"The Committee report that as there is a great diversity of opinion amongst astronomers and sailors as to the advisability of the adoption of civil reckoning for astronomical purposes, and as it is impossible to carry out such a change in the *Nautical Almanac* for the year 1901, they do not recommend that the Royal Society should at present take any steps in support of the suggested change of reckoning."

Acting upon this advice, the Council have for the present refrained from taking any steps in support of the suggested change of reckoning.

The biennial election to the Joule Studentship was, under the terms of the Trust, placed by the Council last year in the hands of the Académie des Sciences, Paris, which has conferred the award on M. Jules Perrin, Doctor of Sciences, of the École Normale.

Early in the year, the attention of the Council was called to the system of teaching natural science in schools, and a Conference on the subject was arranged between the President and Council and the Fellows appointed by the Society as members of the governing bodies of the public schools. At this Conference an interesting discussion on the subject took place, and a general expression of opinion as to the desirability of attaching increased importance to the teaching of science as a necessary element of education was recorded; but the Council has not at present decided upon taking any further steps in the matter.

About a year ago the President and Council were invited by the Council of the British Association to co-operate in approaching Her Majesty's Government with a view to the establishment of a National Physical Laboratory. At the suggestion of the President and Council, a Joint Committee was formed to discuss the question, and to take action in furtherance of the desired object. This Committee waited upon Lord Salisbury, and laid before him the arguments in favour of the scheme. As a result a Committee has been appointed, with Lord Rayleigh as Chairman, to consider the desirability of establishing such a laboratory, and is now sitting. This Committee recently invited the Royal Society to appoint one or two Fellows to give evidence before the Committee on the subject under reference, and the President and Council have accordingly invited Lord Kelvin and Prof. Oliver Lodge to undertake this duty, which they have accepted.

In May last the Council received a request from Sir Benjamin Stone to nominate representatives upon the preliminary Committee for carrying out a scheme for a National Collection of Photographic Records, and Prof. Lapworth and Prof. Meldola were accordingly appointed to serve on the Committee.

Occasion arose during the past year for the exercise of the functions assigned in 1885 to a Committee designated the Indian Observatories Committee, which, however, has been held to be not a Committee of the Royal Society. The Astronomer Royal having called the attention of the President and Council to the anomalous position of this Committee, it was decided to appoint a new Committee of the Royal Society, to be named the Observatories Committee, to advise the Council on any questions similar to those formerly referred to the Indian Observatories Committee.

Reports have been received from the Kew Observatory Committee (published in the *Proceedings*), the Water Research Committee, and the Meteorological Council.

The Library continues to grow, especially in the section of scientific serials, and, although two book-cases have been added in the saloon, the question of shelf accommodation must soon become a matter for serious consideration. During the past year 10 new serial publications have been added to the 440 which the Society already received at regular intervals by exchange or purchase. Of these 450 serial publications, about

46	are issued	in monthly	parts
14	,,	,, weekly	,,
10	,,	,, fortnightly	,,
10	,,	,, quarterly	,,

and the remainder at irregular intervals.

Besides these, 53 complete books have been added to the library by presentation or purchase. Among these may be specially mentioned the first volume of the collected papers of the late Prof. J. Couch Adams, two further volumes of the collected papers of Prof. Cayley, Sir Joseph Hooker's "Journal of Sir Joseph Banks," Capt. Lyons's "Report on the Islands and Temples of Philæ," the Procès-Verbaux of the "Conference Internationale des Étoiles Fondamentales de 1896," and the completion of Helmholtz's "Physiologische Optik."

THE ANNIVERSARY DINNER.

In the evening the Fellows and their friends dined together at the Whitehall Rooms, Hôtel Métropôle. The dinner was the most numerously attended of all that have been held in connection with the anniversary meetings of the Society. After the usual loyal toasts had been proposed by the President, Sir John Evans proposed the toast of "Her Majesty's Ministers and the Members of the Legislature," coupling with it the name of the Duke of Devonshire, the Lord President of the Council. In responding, the Duke of Devonshire is reported by the *Times* to have spoken as follows:—

As this is the first occasion on which I have had the honour and pleasure of being present at one of these gatherings, I am not acquainted with the subjects to which the speeches on this occasion are expected to be addressed. But, before accepting the invitation of your President to respond to this toast, I took the precaution of entering into a little negotiation with him, in which I succeeded in obtaining the concession that, whatever happened, I should not be called upon or expected to make a speech upon scientific subjects; and I think the President will bear me out in the statement which I make, that, therefore, I may be dispensed from any attempt to follow Sir John Evans, who has so kindly proposed this toast, into any scientific analogies which he may have been able to discover between the evolution of the human body and the government of the country. In making this confession of incapacity to address you upon scientific subjects, I feel that I am only acknowledging the existence in my own person of a defect which appears to be almost inherent in those who have devoted themselves to the pursuit of politics. I doubt very much whether since the time of Bacon there has ever, with one exception which I will refer to in a moment, been a Minister of the Crown who has been capable of saying anything upon these subjects to an assembly composed of the leading men of science of the day, such as those whom I have the honour of addressing, in words which would be worth their attention. The solitary exception which I can call to my mind is in the person of the present Prime Minister, who, if he had not devoted his powers so vigorously to political and public affairs, would, without doubt, have been an eminent man of science, and who, even now, amidst all his numerous and important avocations, has been able to keep up a not inconsiderable knowledge of the progress and discoveries of many branches of scientific pursuits. Gentlemen, I believe that the divorce which apparently has always existed between the pursuits of politics and science in our country has not been so complete in the case of other nations. We are all of us acquainted with the names of men in many foreign countries who have been eminent in science, and at the same time have, to say the least of it, been conspicuous in politics. Whether that fusion of political and scientific pursuits has always been a success, I do not think is a subject upon which I am called on to enter at the present moment. But, at all events, with regard to our own case, I think it appears to be certain that the calls which the pursuit of politics makes upon the time and strength of any man who desires to attain success in that career are so severe as to leave but little residue for the equally increasing calls upon the strength and time of those who aspire to distinguish themselves in scientific pursuits. But, while I do not look forward to any immediate closer connection between the pursuits of politics and science, I am not by any means sure that in some time not very far distant some greater knowledge and acquaintance with at least the results of scientific investigation and inquiry and research may not come to be a necessary part of the equipment of some portion at least even of our Government. The recent discoveries of science and their practical results have had so profound an influence on the social condition of all the peoples of the world, uncivilised as well as civilised; they have had, and are having, so great an influence upon the industrial progress, and therefore upon the growth or decline of nations, that it is almost impossible that some knowledge at least of the results, if not of the methods, of scientific discovery should become almost as indispensable a part of the training of statesmen as the knowledge of the instincts, the passions, and the interests of the people to which their studies have hitherto been almost entirely, or at any rate mainly, directed. The question whether with advantage the State can more directly interest itself in the direction or assistance of scientific inquiry is one which I have no doubt has been frequently discussed amongst you and upon which, probably, there would be considerable difference of opinion even among those who are assembled here. That is a question which I have no intention of entering upon, but there is a less ambitious object—the object of making some of the main principles of science and a knowledge of the results at least of the discoveries of science more accessible to the main body of the people—which has occupied our attention in recent years. It is also an object which has occupied a greater share of the attention of other nations, and one which, in my opinion, will require and demand greater attention on our part in the future. I hope and trust that at no distant time Her Majesty's Government may be able to make proposals and submit measures to you bearing in

some degree upon the subjects to which I have referred. Among these I may mention such subjects as that of the creation of a teaching University for the City of London. I should not say for the city, but for London itself; and for the whole country some reorganisation of its secondary education, which is the indispensable foundation of any progress towards higher scientific study. I myself entertain a strong conviction that these are subjects of far greater importance than a great many which excite much more general and widespread interest. But strong as my own conviction, or the convictions of my colleagues, upon these subjects may be, I am not here to hold out to you any sanguine hope that we shall be able to induce Parliament to devote to them the attention which these subjects, in my opinion, richly deserve. Certainly we shall not be able to induce Parliament to give them the attention which they demand and require unless we can create in the country a widespread public opinion of their importance and their necessity. I think that many of those I have the honour of addressing, who stand at the head of the scientific professions, may be able in these matters to render great assistance to the Government by guidance, counsel, or advice, and, by helping us, thus assist to create throughout the country a public opinion of the importance of these matters. I think you can assist us in bringing home to the minds of many who have hitherto given, perhaps, an incomplete consideration to these questions the fact that that country cannot prosper which neglects the prosecution of either the higher or the subordinate branches of scientific research, or which is indifferent to the scientific training of those who are destined in the near or even the more distant future to conduct the industrial and commercial enterprises of this Empire. I will not trespass further upon your time except to thank you in the name of my colleagues for the very cordial manner in which this toast has been proposed for your acceptance by Sir John Evans and for the manner in which you have received it.

The American Ambassador in rising to propose the health of the Royal Society, said :—I can only follow at a great distance the example set by his Grace the Duke of Devonshire, and apologise at the beginning for my lack of qualification to address such an assembly as this. I regret that I have not even that smattering of scientific knowledge which would enable me to put on an appearance even of saying anything instructive or amusing. The only reason why I do not stand entirely mute is that I am unwilling by silence to seem indifferent to the great compliment which has been paid me in assigning to me this honourable duty. It is in associations of men like this, in institutions like the Royal Society, and similar bodies in America, of course of more recent date and of narrower resources, that there exists one of the strongest bonds of union that unite the two great branches of our race. They are held together by a common love and pursuit of universal truth, by devotion to the highest interest of mankind, by a kindred passion for light and progress. In your pursuits there is everything that unites and nothing that divides. The results of science are all gain and no loss. The triumphs of war are bought by the tears and anguish of both sides. The success of diplomacy and trade are often attended by the discomfiture of one party. But the whole world is brightened and made more livable by the achievements of a Faraday, a Morse, or a Fulton. The genius of a Lister or a Morton lessens incalculably the whole vast sum of human suffering, and every invention or discovery on either side of the sea—the product of the patient, self-denying labour of any of the scholars of our race, whether it be Lord Kelvin or Edison, Bessemer or Graham Bell, Huxley, Tyndall, or Marsh—is at once thrown into the common stock of the world's intellectual riches, profiting every one and injuring none. It is for this reason that I—although I have no claim to sit among scholars or men of science—am glad to be allowed to come here and pay my humble tribute of profound respect to those eminent men who, under the auspices of this venerable institution, are doing so much to hasten the glad day when all misconceptions and misunderstandings, born of ignorance and prejudice, shall fade away in the light of dawning truth and widening knowledge; when, to use the language of your great poet, who was himself through life a patient and devoted student of science, "Universal Peace" shall

> Lie like a shaft of light across the land,
> And like a lane of beams athwart the sea.

I have the honour to propose the health of the Royal Society, and to couple with the toast the name, honoured and revered in every country upon earth where high genius, devoted to the loftiest purposes, is valued and appreciated—the name of Lord Lister.

The President responded, and afterwards proposed the toast of "The medallists," to which Prof. Forsyth replied. The dinner terminated with the toast of "The guests," proposed by Lord Kelvin, and responded to by Prof. Lewis Campbell.

USEFUL INSECT PRODUCTS.

THE commercial value of the insects from which cochineal, lac, and Japanese white wax are obtained were briefly referred to, by Dr. L. O. Howard, in the course of a short paper on a useful American scale insect, read at the last meeting of the Association of Economic Entomologists. It was pointed out that for many years the cochineal or cactus scale insect, now called *Coccus cacti*, was used as the basis of an important red dye, until practically superseded by the introduction of aniline dyes. In the same way the European Porphyrophora was used in the production of a purple dye. Aside from the dye insects, we have the lac insects, of which a single species, *Tachardia lacca*, produces practically all of the shell-lac, stick lac, and button lac of commerce. This species is Asiatic in its distribution; but in the south-west States, upon the very abundant creosote bush, a lac insect occurs in an enormous quantity, the commercial possibilities of which have not been developed. This is the congeneric species, *Tachardia larreæ* (Comstock). This insect has been known to science only since 1881, but was long prior to that time known to the Indians, who for many years have been in the habit of collecting the scale insects and forming them into more or less elastic balls, which their runners were in the habit of kicking before them as they journeyed from one point to another. There are other species of the same genus inhabiting North America. The third substance of commercial importance derived from scale insects is a pure white wax, which is secreted by the Chinese and Japanese *Ericerus pé-la* and by the Indian *Ceroplastes ceriferus*. On account of its expense, and on account of more or less available substitutes, this wax has not become of great commercial importance in Europe, but is much used in the Eastern countries, both in the making of wax-candles and in medicine. The Chinese wax is said to have ten times the illuminating power of other waxes. It is a beautiful wax, resembling beeswax in its chemical composition more nearly than the vegetable waxes, and is clear white in colour. Dr. Howard calls attention to the fact that in the far south-west of the United States there is a wax insect (*Cerococcus quercus*) which apparently needs careful investigation from the commercial point of view. Three species of oak are recorded by Prof. Comstock as offering food for this insect, viz. *Quercus oblongifolia*, *Q. undulata* variety *wrightii*, and *Q. agrifolia*. Dr. Howard recently received specimens of the insect from Mesa Grande, California. They were not sent in position on the twigs, but had been removed from the twigs, and compressed together by hand into a more or less pliable lump, somewhat resembling a lump of india-rubber, but not possessing the same elasticity. The substance, it is remarked, makes an admirable chewing gum, as it takes and retains flavours better than other gums. Part of it has been proved by chemical analysis to be a true wax, and part resembles rubber in its physical properties. The product is not only interesting from a chemical standpoint, but it may prove to be also of economic value, as the supply is well-nigh inexhaustible. By directing attention to these products of potential importance, Dr. Howard demonstrates the commercial uses of entomology.

THE RAINFALL OF SOUTH AFRICA.

A SHORT time ago the Meteorological Commission of Cape Town placed in the hands of Dr. Alexander Buchan the rainfall statistics obtained at 278 stations in Cape Colony during the ten years 1885–1894, in order that he might analyse and discuss them. Dr. Buchan has now completed his task, and the results are given in a publication just received from the Meteorological Commission. The report contains sixteen maps printed in different shades of blue to exhibit the rainfall in South Africa (from lat. 25° to 35° S.) for every month of the year, the maximum annual rainfall, the minimum rainfall, the mean annual rainfall, and the range of mean annual rainfall. All the infor-

mation which the statistics are capable of affording has thus been extracted from them, and is shown graphically upon this series of maps.

In a brief introduction to the tables and maps, Dr. Buchan refers to a few points of interest to meteorologists and physiographers. It appears from this, and the map of mean annual rainfall, that the annual distribution over South Africa, to the north of the latitude of Clanwilliam, steadily increases from west to east, the amount on the Atlantic coast falling short of five inches a year, whereas on the east coast, for some distance to the north and south of Durban, it exceeds forty inches. From Philadelphia, a little to the north of Cape Town, all along the south and south-eastern coast (with the exception of a small portion from Cape Agulhas to Mossel Bay), and for some distance inland, the annual rainfall exceeds twenty inches. These southern slopes appear to be, longitude for longitude, the best watered portions of South Africa.

Dr. Buchan studied the statistics with reference to the sunspot period; and with reference to the subject reports as follows:—

Sunspot Period of the Rainfall.

"In order to see what connection may be between the sunspot period and the rainfall of Cape Town, the annual amounts are thus arranged:—

"Table showingthe difference of each year's rainfall from fifty-four years' average of 25·82 inches.[1]

Year of period	1	2	3	4	5	6	7	8	9	10	11
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1842–43 ...	...	...	...	...	...	...	...	..	...	**·45**	·99
1844–54 ...	7·05	4·91	3·31	3·43	2·56	1·20	**7·65**	5·52	2·60	4·59	5·76
1855–65 ...	1·24	6·34	3·78	3·54	**10·91**	**3·31**	·36	**6·18**	·21	6·90	7·14
1866–76 ...	6·61	2·87	5·86	**6·52**	**2·24**	5·70	**3·51**	2·05	**·38**	·10	**·83**
1877–87 ...	**9·75**	**15·21**	7·07	8·11	·21	**3·49**	**6·24**	**2·47**	**2·10**	**2·03**	2·74
1888–94 ...	**10·24**	**5·16**	**·52**	**4·48**	**15·10**	2·40	3·27	...	...	..	...
Means ...	1·02	1·25	4·90	·42	5·10	·50	2·75	·27	·08	1·82	3·16
Means Bloxamed	·30	·88	1·36	·07	1·73	2·78	1·17	·98	·54	1·69	1·32

"The individual years' rainfall shows sudden transitions in amount from year to year. Thus 1877 and 1878 show respectively 9·75 inches, and 15·21 inches of excess above the average; whereas the two following years, 1879 and 1880, show 7·07 inches and 8·11 inches of deficiency. These two pairs of consecutive years are, further, the greatest departures above and below the average annual rainfall of the whole fifty-four years.

"The means of the eleven-year period have been 'bloxamed' thus, 1st year $= \frac{11+1+2}{3}$, 2nd year $= \frac{1+2+3}{3}$, and so on. The smoothed curve thus obtained is a remarkable one. The rainfall is above the average in the fifth, sixth, seventh, and eighth years of the sunspot period, but under the average in the other years. The curve further shows two maxima and two minima. The smaller maximum occurs on the first year, thence the rainfall diminishes to the smaller of the two minima on the third year; then gradually rises to the principal maximum, 2·78 inches above the average, on the sixth year; and thereafter steadily falls to the principal minimum, 1·69 inch below the average, on the tenth year. There is thus a difference of 4·47 inches between the annual rainfall of the wettest and driest years of the sunspot period. The steadiness of the increase and decrease of the rainfall during the period is the most remarkable feature of the curve. It must, however, be noted that the extreme irregularity of the annual amounts from year to year cannot be said to hold out a hope that the cycle can be turned to practical account in forecasting dry and wet years."

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—Mr. F. Harrison (New Coll.) has been appointed Examiner in Mechanics and Physics, Mr. W. W. Fisher (C.C.C.) in Chemistry, and Mr. C. H. Barks (Camb.) in Botany, for the preliminary examination in the Final Honours School of Natural Science.

[1] The heavy type indicates an excess or plus amount, and the light, a deficiency or minus quantity as compared with the mean.

Convocation has directed that 600*l.* a year be paid to the Visitors of the University Observatory for its use for the next five years, beginning January 1, 1898.

The following grants have been made to the Botanical Department: (1) for the Herbarium, Library, and Museum such a sum as will, with the Fielding Fund, make up 400*l.* a year; (2) 650*l.* a year for the Botanic Garden. The grants extend over the years 1898–1900.

The Professor of Chinese, James Legge, died on Monday at his residence in Oxford.

Mr. J. O. Griffiths, of Llandovery College, has been elected to a Mathematical Scholarship, and Mr. O. T. Falk, of Rugby, to an Exhibition at Balliol College. Mr. E. W. Shobridge, Bradford Grammar School, has been awarded a Mathematical Scholarship at Queen's College, and Mr. F. R. Sandbach to one at Corpus Christi College. At Hertford College, Mr. H. A. Brown, of Plymouth College, has obtained a Mathematical Scholarship, and Mr. R. Cambridge an Exhibition.

Mr. G. Priestley, of Eton College, has been elected to a Natural Science Scholarship, and Mr. S. Douglas, of Wyggeston School, Leicester, to an Exhibition at Christ Church.

THE Russian Government has granted 400,000 roubles for the construction of a chemical laboratory at the Polytechnic Institute at Riga.

A COURSE of ten Thomson Lectures on Magnetism will be given at the Free Church College, Aberdeen, by Prof. J. A. Ewing, F.R.S., from December 9–22.

DR. F. STANLEY KIPPING, F.R.S., Lecturer and Assistant in the Chemical Research Laboratory of the Central Technical College, has been appointed to the Professorship of Chemistry in University College, Nottingham.

PRESIDENT SETH LOW, at the request of the trustees of Columbia University, has withdrawn his resignation, which was presented before the election in order to leave him unembarrassed in the canvass; he will, therefore, continue to preside.

WE learn from *Science* that the Technical Institute in Munich has been given by the Government 175,000 marks for enlarging the electro-technical laboratory, 150,000 marks for the erection of a laboratory for the agricultural station, and 170,000 marks for enlarging other buildings.

THE Root Hall of Science and the Benedict Hall of Languages of Hamilton College were dedicated a few days ago. The former, which cost 31,000 dollars, was the gift of Mr. Elihu Root, and the latter, which cost 30,000 dollars, of Mr. H. H. Benedict, both of New York City.

THE Council of the College of Preceptors have arranged a number of lectures to be delivered between January 4 and January 14, and visits to Educational Institutions, for teachers (especially Secondary Teachers), who will be in London at that period. Among the subjects of the courses of lectures are the principles of class teaching, by Mr. J. J. Findlay; and the teaching of science, by Dr. C. W. Kimmins. This course will have special reference to the Headmasters' Association's syllabus of physics and chemistry. An address on eyesight in relation to school life, will be given by Dr. W. S. Colman; and one on circulating school museums, by Mr. E. Howarth. There will also be an exhibition of geographical lantern slides, specially prepared for the Geographical Association, by Mr. B. B. Dickinson.

AT the annual meeting of the Scottish Association for the promotion of Technical and Secondary Education, held in Edinburgh on Saturday, the President, Lord Reay, delivered an address on the necessity of paying more attention in this country to organising and systematising technical education. In the course of his remarks he said that though the Victorian era had been rich in men of the highest scientific eminence, other nations not possessing men of equal eminence had enriched themselves by the teaching of the men who filled such glorious pages in our history. In chemistry, in physics, in electricity, in geology, in astronomy, the most illustrious names of Scotsmen and Englishmen could be mentioned, but when it came to the adaptation of their teaching in the school, in the workshop, on large landed estates, they had to go to Germany, to the United States, to Switzerland, and to Belgium. Our system of education ought to

be worked on better lines. No spasmodic efforts here and there to form science classes, but technical schools which led to technical colleges, on a carefully graded system, were needed. The Education Department would have to determine clearly the lines of demarcation of the various forms of education which it would support. In the United States, Germany, France, and Switzerland, public money was ungrudgingly given to technical schools, and there was no reason why in this country there should be so much hesitation. The cause of the success and progress of continental industry was due to the keen sense of competition and to the widespread conviction that all production must be placed on a scientific basis. Science there was not considered as a luxury, but as a powerful agent of economic production. The sooner we realised that our very existence as an industrial nation was threatened the better.

THE opinions expressed by Prof. Priestley Smith in a pamphlet on the "Aims and Methods of Education" (Cornish Brothers, Manchester), just received, are accepted by the majority of people who have given thought to educational systems. The ordinary middle-class parent is content to know nothing about the efficiency of the instructors in the schools to which he sends his children. Happily, the times are not without signs of the growth of a healthy interest in the subject of rational education, and we welcome every publication which will encourage its development. All of us are of much the same opinion as regards the futility of learning by rote, and the truly educational value of a kindergarten system of education for the young. A kindergarten may be described as a place where children learn by natural instead of unnatural methods, and consequently acquire more realknowledge than by any other system. But not every school that is called a kindergarten justifies the title, for in many of these schools, as in many private schools for the middle-class, qualification to teach is often a secondary matter compared with local influence. The elementary school teacher must show himself qualified to teach before he can be recognised by the Education Department, but we have not yet reached the stage of educational progress when the master of a private school must produce similar credentials. When these anomalies are destroyed we may perhaps hope for the establishment of a rational system of education, for we shall then have the men to put it into effect. Prof. Smith says many hard but true things with regard to the classical veneer which effectually covers up natural tendencies in the public school. "The follower of nature," he remarks, "in education, adopts a different system. He believes less in books, which supply information ready cut and dried, than in mental exercises carried on in class by question, discussion, and demonstration. He helps the boy to observe and compare examples, to discover likenesses and differences, and to arrive at rules and principles by inferring them for himself. He aims at *self-training*, and studies the art of promoting it. He declares that this system arouses a greater activity of interest in the boy, and makes of his mind an instrument for observation and reflection rather than a storehouse." This is the system of education we should encourage, because it is the one which will most benefit the child, the country, and the race.

SCIENTIFIC SERIALS.

Bollettino della Società Sismologica Italiana, vol. iii. N. 3.—An electric seismoscope of double sensitiveness, by G. Agamennone.—An elastic pendulum for mechanical action, by C. Guzzanti.—Notices of earthquakes recorded in Italy (February 18–March 20, 1897), by G. Agamennone, the most interesting being those of distant, but unknown, earthquakes on February 19–20 and March 2.

N. 4.—The earthquake of Kishm (Persian Gulf) of the night of January 10–11, 1897, by G. Agamennone. A correlation of some records of a previously unknown earthquake obtained at European observatories between 9.15 and 9.32 p.m. (Greenwich mean time) on January 10, with an earthquake occurring at 9.30 (?) in the island of Kishm, but the times are too discordant to enable the velocity to be determined.—Summary of the principal eruptive phenomena in Sicily and the adjacent islands during the half-year January-June 1897, by S. Arcidiacono.—Condition of the central crater of Etna from the second half-year of 1895 to the first half-year of 1897, by A. Riccò.—Notices of the earthquakes recorded in Italy (March 20–April 27, 1897), by G. Agamennone, the most important being the Umbrian earthquake of March 21–22, the Roman earthquakes of April 3, the Lucano earthquake of April 16, and the Abruzzi earthquake of April 26–27.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 25.—"On the Geometrical Treatment of the 'Normal Curve' of Statistics, with especial Reference to Correlation and to the Theory of Error." By W. F. Sheppard, LL.M., formerly Fellow of Trinity College, Cambridge.

The object of the paper was, in the first place, to simplify and extend the treatment of normal correlation as expounded by Francis Galton and Karl Pearson; and in the second place to obtain general formulæ in the theory of error, and to apply them to questions which arise in relation to normal distributions and normal correlation. The method was, throughout, elementary, the use of the differential and integral calculus being avoided, though geometrical infinitesimals were to a certain extent employed.

Physical Society, November 26.—Mr. Shelford Bidwell, President, in the chair.—Mr. Rollo Appleyard read a paper on the failure of German-silver and platinoid wires. The mechanical defectiveness, and the consequent electrical instability of alloys used for electrical wires, may be discussed from two points of view: (1) as to the constitution and metallurgy of the alloy; (2) with regard to the subsequent treatment and environment of the wire. In stating the case, the author gives instances of the failure of German-silver and platinoid wire that have occurred among several thousands of resistance-coils distributed over widely different latitudes. In periods of time, varying from six weeks to several years after manufacture, the wire on some of the bobbins became brittle and broke, not only on the outer layers, but also within the coils. The towns where the faults appeared are all within the tropics, and included nearly within the isotherm of 25° C. Other coils, of nominally the same material, manufacture, and environment, have retained their original good condition. It follows that metallurgical differences exist between different samples of the same nominal quality of alloy. Examples are given to prove that failure sometimes occurs with platinoid through which no electricity has passed. Provided that the wire is good, the effect of environment is almost insignificant, *i.e.* the question is one of metallurgy, rather than of instrument-making. The author introduces a distinction in regard to brittleness. He discriminates between "primary" and "secondary" brittleness. "Primary" brittleness is characteristic of certain alloys (for instance, of gold-lead, or of gold-bismuth) from the moment of their solidification. But the brittleness of German-silver and of platinoid is of a different order; it is a subsequent phenomenon. "Primary" brittleness is thus an accident of birth, and "secondary" brittleness is a disease that develops with age and circumstance. The fracture of bad specimens of German-silver and platinoid shows patches of dark metal, crevices, and fissures. It may be supposed that, during the process of cooling, "liquation" occurs—the metals that first solidify, rejecting yet molten portions, as ice rejects foreign matter. Consequently, the strength of the final alloy varies from point to point of its mass, and in passing afterwards through the die, the weaker portions give way, and the general structure is loosened: moisture can then intrude through the capillary channels. At all fissures and crevices the electric current produces undue heating; this accounts for the failure of resistance-coils on arc-light and other circuits. As regards the protection of coils against moisture, paraffin-wax is of no use whatever; it is highly absorbent. Shellac varnish is greatly to be preferred. Ebonite does not seem to have any deteriorating effect, but it may be well to keep the alloys out of actual contact with it. In conclusion, Mr. Appleyard expressed a hope that British metallurgists would give electrical alloys special consideration. Already, British cable-manufacturers are importing thousands of tons, annually, of sheathing-wire from Germany; this is sufficiently to be regretted; he had good

reason to know that instrument-makers were beginning to get the wire for their resistance-coils also from Germany. He had not enough experience of manganin to say whether that material would stand rough service in the tropics. Prof. Ayrton said the paper had raised the extremely interesting question of the permanency of metals used for resistance-coils. Some time ago he had immersed bare platinoid wires in running water in metal tanks, and the wires all broke into short pieces. He thought, at the time, this might be due to electrolysis. On another occasion he had found that by raising the temperature of platinoid to a dull-red heat in the air, by an electric current, any acquired faults in the wire were corrected, and the original resistance and flexibility were restored. Even when such metals are in good condition, the resistance temperature curve does not return upon itself; it encloses a loop, indicating two distinct values for resistance at each temperature. He had been told by Dr. Muirhead that coils intended for hot climates should be enclosed in air-tight metal cases. English manufacturers were still dubious in regard to manganin. In 1892 he had twenty coils of this material, each of a thousand ohms; the wire was silk covered. There were 2000 volts between the terminals. Their resistance had certainly not changed by 1 in 1000, although there was some amount of vagueness regarding the fifth figure, which might be due to molecular alteration, for they were heated more than was good for resistance coils. He confessed that this manganin had come from Germany. Dr. S. P. Thompson mentioned an alloy that was proposed in Germany under the name of "Constantin." He would like to know whether any information could be obtained as to the employment of cast-iron wire. It was a metal that in some respects commended itself. He had observed the failure of some German-silver coils, but he had generally attributed it to rough handling. Mr. W. Watson referred to the recent work done at the Reichsanstalt with regard to German-silver and platinoid. It was there found that all alloys containing zinc were liable to erratic change of resistance, and were unsuitable for standard coils. Moreover, even the slight amount of zinc introduced into manganin during soldering with soft solder robbed that alloy of its constancy. Silver solder, containing 75 per cent. of silver, should be employed for manganin. If Prof. Ayrton's coils were soldered with soft solder, that was sufficient to account for the change in the fifth figure. Shellac varnish was undoubtedly the best protection for coils. Absolute alcohol should be used as the solvent, and the coils should afterwards be heated for some hours at 140° C. If a heating-current was passed through German-silver or platinoid coils immersed in water, the general result was to produce brittleness.—Mr. Watson then described a thermostat which he had contrived for drying the coils after applying the shellac varnish. A hot-air oven contains a thermometer with a platinum contact at the 140° mark, and an 8 candle-power lamp. The thermometer is in circuit with a relay actuating a mercury-key for the 8 candle-power lamp. The key consists of two mercury-cups, and a corresponding U-piece of copper, inverted, one limb to each cup. It is important to keep the heating-circuit always made; for this purpose a 32 candle-power lamp is permanently connected between the two cups.—Prof. Perry then read a note on a question in thermo-dynamics, arising from correspondence that had taken place between himself, Prof. Ramsay, and Mr. Rose-Innes, with regard to a paper in the *Roy. Soc. Trans.* Mr. Rose-Innes replied.—The President proposed a vote of thanks to the authors, and the meeting adjourned until December 10.

Mathematical Society, November 11.—Prof. Elliott, F.R.S., President, in the chair.—The President briefly referred to the recent decease of Lieut.-Colonel J. R. Campbell, who had served on the Council, and rendered signal service to the Society by his liberal gift of 500*l.* to its funds.—The Treasurer gave an abstract of his report, and, in the course of his remarks, pointed out that the publications of the Society had of recent years grown to such an extent as to tax its utmost resources, and that, were it not for the help of the funds munificently established many years ago by Lord Rayleigh, and more recently by the late Lieut.-Colonel Campbell, the Society would be compelled to materially restrict its sphere of activity.—The ballot having been taken, the President announced that the gentlemen whose names were given in NATURE (October 21) had been duly elected to serve on the Council for the ensuing session.—The following communications were made: On an extension of the exponential theorem, by J. E. Campbell; the integral $\int P_n^\sigma dx$, and allied forms in Legendre's functions, between arbitrary limits, by R. Hargreaves; on the Poncelet polygons of a Limaçon, by Prof. F. Morley; the calculus of equivalent statements (No. 7), by H. MacColl; the character of the general integral of partial differential equations, by Prof. Forsyth; note on Bessel functions, by H. M. Macdonald.

Geological Society, November 17.—Dr. Henry Hicks, F.R.S., President, in the chair.—The geology of Rotuma, by J. Stanley Gardiner. The author described the relationship of the island of Rotuma (situated in lat. 12° 30′ S., long. 177° 1′ E.) to the adjoining isles. It is almost separated into two parts, which are united by a narrow neck of sand. The interior is composed of volcanoes, which have emitted lavas and fragmental rocks. Around the volcanic rocks are stratified deposits composed of sea-sand with volcanic fragments. These are partly denuded, and are mantled round by coral-reef and beach sand-flats. A remarkable cavern in the lava of Sol Mapii, with lava-stalactites, was described; there is a similar cavern in Au Huf Huf. An account of the prevalent meteorological conditions was also given. In an appendix by Mr. H. Woods, some of the rocks were described. They consist of olivine-dolerites and basalts and associated fragmental rocks.—A geological survey of the Witwatersrand and other districts in the Southern Transvaal, by Dr. Frederick H. Hatch. After giving an account of the physical characters of the area, the author proceeded to describe the various rocks, referred to (1) the Karoo system; (2) the Cape system; (3) the Primary or Archæan system. The Archæan rocks protrude in a few places through the sedimentary beds, which form the greater part of the area, and consist of an igneous complex of rocks of varied composition. The Cape system is capable of division into five distinct series:—

Upper Beds.	Magaliesberg and Gatsrand series; alternating quartzites, shales, and lava-flows.	16,000 to 20,000 feet.
	Dolomite and cherts, thickly bedded.	6000 to 8000 feet.
	Black reef; a bed of quartzite and conglomerate, 20 to 50 feet, and Klipriversberg amygdaloid; a basic volcanic rock, 5000 to 6000 feet.	
Lower Beds.	Witwatersrand beds; sandstones and conglomerate (in part auriferous).	11,000 to 15,000 feet.
	Hospital Hill series; quartzites and ferruginous shales.	8000 to 10,000 feet.

The Karoo formation is represented by the coal-measures of Vereeniging and the district south of Heidelberg, and by the measures of other coal-areas. They have furnished plants which Mr. Seward refers to in a note as being of Permo-Carboniferous age. The age of the Cape system is doubtful. The Upper beds rest unconformably on the Lower ones, and if the latter be of Devonian age, as has been inferred, the former may represent the Lower Carboniferous rocks. In the discussion which followed the reading of the paper, the President asked whether there was any fossil evidence to show the age of the beds under those of Permo-Carboniferous age. The unconformities were important, and might indicate that there were rocks in the area older than those of Palæozoic age. Would it not be better to avoid using the term "Primary" for crystalline rocks suggested to be of "Archæan" age? Mr. C. Dawson pointed out the great lithological resemblance of the specimens on the table from the Hospital Hill series to some of the fluviatile rocks of the English Wealden group; particularly to the lower beds of the Hastings sands and Ashburnham group. The Cape series, of course, was a much older formation and had suffered change, but the rocks of the Hospital Hill series appeared to have suffered least. Prof. Le Neve Foster said that he considered that all persons interested in gold-mining were much indebted to the author for his very valuable contribution to our knowledge of the geology of a great gold-bearing region. He desired information upon two points: (1) whether the conglomerate-beds on the southern side of the synclinal are as rich in gold as those which have been so largely worked on the north side; and (2) what surface-indications guide the prospector in searching for the outcrop of the beds. Is their existence indicated by quartz-pebbles on the surface, or by ferruginous outcrops, or what? In conclusion, he complained of the use by the author of the expression "mineralisation of the conglomerate"; he wished in season and out of season to protest against this use of the word

"mineralisation" Mr. W. H. Merritt said that what he thought of special interest was the mode of occurrence of the gold in these conglomerates. He said that this showed that auriferous solutions may occur in a very unexpected manner, and in very unexpected places; and in confirmation of this he alluded to a locality in British Columbia where gold occurred, and was worked in deposits of cupriferous pyrrhotite containing virtually no free quartz and occurring chiefly in gabbro. The Rev. J. F. Blake and Dr. J. W. Gregory also spoke. The author, replying to the President, admitted that in describing the ancient crystalline rocks he had used the term "Primary" indiscriminately with "Archæan." He agreed that it would perhaps be better to discard the former, and to use the latter term in preference. With regard to the age of the Cape formation, he had pointed out in the paper that the Witwatersrand beds were probably correctly correlated with the Table Mountain sandstone, and that the latter was underlain by the Bokkeveld shales, in which characteristic Palæozoic (Devonian) fossils had been found. Replying to Prof. Le Neve Foster, he instanced the Nigel Mine as one that had been opened up in payable ore on the south side of the synclinal. There was nothing to indicate which of the conglomerate-beds might carry gold, short of taking samples for panning or assay. He saw no objection to the use of the word "mineralisation" to indicate a secondary impregnation with mineral matter. He was glad to find that Dr. Gregory confirmed him in the idea that the Dwyka conglomerate was a volcanic breccia, and consequently indicative of volcanic activity. —Observations on the genus *Aclisina*, de Koninck, with descriptions of British species, and of some other carboniferous gastropoda, by Miss J. Donald, of Carlisle. The author made some preliminary observations on the genus *Aclisina*, and considered it advisable to regard *A. pulchra* as the type of the genus, while the so-called *A. striatula* must be placed among the *Murchsoniæ*, and *A. nana* is placed in a new genus.

Entomological Society, November 17.—Mr. R. McLachlan, F.R.S., Vice-President and Treasurer, in the chair.—Mr. Selwyn Image exhibited male examples of *Pieris brassicæ*, with a black spot on the disc of the forewings. They were bred from larvæ found on *Tropæolum* at Lee, N. Devon, and six out of ten males showed this variation. He also showed a dark aberration of *Vanessa urticæ*, taken at Copthorne in Sussex, and two fine specimens of *Plusia moneta* taken at Valerian, near Balcombe, Sussex.—Mr. M. Burr exhibited three new species of Rumanian Orthoptera in illustration of a later communication.—On behalf of Mr. T. D. A. Cockerell, of Mesilla, New Mexico, two specimens of *Synchloe lacinia* from that locality were exhibited to show the remarkable forms of variation found in individuals occurring at the same time and place and on the same flowers.—Mrs. Nicholl communicated a paper on the butterflies of Aragon, and Mr. Burr a list of Rumanian Orthoptera.—Mr. Tutt read a paper entitled "Some results of recent experiments in hybridising *Tephrosia bistortata* and *Tephrosia crepuscularia*."

Royal Meteorological Society, November 17.—Mr. E. Mawley, President, in the chair.—Mr. R. H. Curtis gave the results of a comparison between the sunshine records obtained simultaneously from a Campbell-Stokes burning recorder and from a Jordan photographic recorder. The Campbell-Stokes recorder consists of a sphere of glass, four inches in diameter, supported in a metal zodiacal frame. A card being inserted in one of the grooves according to the season of the year, the sun when shining burns away or chars the surface at the points on which its image successively falls, and so gives a record of the duration of bright sunshine. The Jordan recorder consists of a cylindrical box, on the inside of which is placed a sheet of sensitive cyanotype paper. The sunlight, which is admitted into the box by two small apertures, acts on the paper, and travelling over it by reason of the earth's rotation, leaves a distinct trace of chemical action. In an improved pattern two semi-cylindrical boxes are used, one to contain the morning, and the other the afternoon record. The Campbell-Stokes instrument gives a record of sun heat and the Jordan instrument a record of sun light; and whilst it is probably true that, as a rule, the burning and chemical effects vary directly with the brightness of the sun's rays, yet it by no means follows that the conditions which will produce the most active chemical action must necessarily and always be those most favourable for burning. It has been the opinion of most observers that the photographic instruments yield a larger record than those of the burning type. In order to set the matter at rest the Council of the Royal Meteorological Society determined to institute a comparison between the Campbell-Stokes and the Jordan recorders, which should thoroughly test the capabilities of the two instruments, and at the same time afford trustworthy data for determining how far the records yielded by the one may be accepted for comparison with those obtained from the other. These simultaneous observations were carried out by Mr. E. T. Dowson, at Geldeston, near Beccles, and extended over a period of twelve months. The records were sent to Mr. Curtis for tabulation, who gave the results of his examination in this paper. After describing the methods adopted for the measurement of the records, Mr. Curtis drew the following conclusions from the figures: (1) In the case of the Campbell-Stokes instrument the records are capable of being measured with a very fair degree of accuracy. (2) The records of the Jordan instrument afford room for much greater difference of opinion as to what ought to be tabulated, and consequently measurements of the Jordan curves are open to considerably more doubt than are measurements of the Campbell-Stokes curves. (3) When the whole of the photographic trace which can be distinctly seen, but including portions of it which are decidedly faint, has been carefully measured, the amount will approximate sufficiently to that of the Campbell-Stokes instrument to allow of records obtained from both forms of instrument being compared *inter se*. From an examination of the records at other stations it appears that on some occasions the instruments have begun to record within thirteen minutes after sunrise, and has continued up to ten minutes before sunset. Mr. Curtis concluded his paper by calling attention to various defects in the adjustment and working of the instruments, and pointed out how these might be overcome. After the paper had been read, an interesting discussion ensued as to the merits of the respective sunshine recorders.

Linnean Society, November 18.—Dr. A. Günther, F.R.S., President, in the chair—The President announced that since the close of last session they had been so fortunate as to receive from Prof. G. J. Allman, a former President of the Society, a portrait of himself painted by Miss Busk, whose portrait of her late father was now hanging near it. It was an excellent likeness, and he was sure it would be highly valued. He moved that a vote of thanks be recorded for the presentation, and this was unanimously agreed to.—Mr. Alan F. Crossman exhibited photographs of a fasciated lily (*Lilium auratum*), on which some information was given by Mr. A. D. Michael.—Mr. R. Morton Middleton exhibited and made remarks on some ants received from Ephesus. These had been referred to in a previous communication as being made use of in Asia Minor for the purpose of holding together the edges of incised wounds by means of their strongly-hooked and sharp mandibles (*Journ. Linn. Soc., Zool.* vol. xxv. p. 405). The species was now identified as *Cataglyphus viatica*, Fabr. Mr. Thomas Christy gave some additional information resulting from inquiries he had made of foreign correspondents.—Mr. J. E. Harting exhibited a specimen of the great black woodpecker (*Picus martius*), lately received from Colonel W. C. Dawson, of Weston Hall, Otley, Yorkshire, where it had been shot in his presence by a friend on September 8. It was shown that this could not be the bird which had recently been lost from the Zoological Gardens, since the latter did not escape until October 9. Allusion was made to the numerous records of the occurrence of this species in England, some of which at least seemed worthy of credence, since the recorded specimens had been obtained, and were preserved in the possession of trustworthy persons. Mr. Howard Saunders expressed the opinion that there was no sufficient ground for including *Picus martius* in the list of British birds, as from its partiality for pine forests and its stationary habits, it was not likely to be a voluntary visitor to this country. The President remarked that the perfect state of plumage of the specimen exhibited was satisfactory evidence of its not having recently escaped from captivity; and that the late Lord Lilford, the year before his death (which occurred on June 17, 1896), had two black woodpeckers in his aviary in Northamptonshire, and in consequence of their ailing in health, had given them their liberty. It seemed possible that one of these might be the bird lately shot in Yorkshire.—Mr. J. E. Harting also exhibited in the flesh a hybrid pheasant and black grouse, which had been received that day from Shropshire. In appearance it precisely resembled a similar hybrid of which a coloured figure is given in early editions of White's "Selborne."—On behalf of Mr. Leonard Lush, of Stonehouse, Gloucestershire, three white

partridges (*Perdix cinerea*) were exhibited, which had been shot by him on the Berwyn Mountains in Wales early in October last. It was remarkable that in the covey, which consisted of nine birds, no less than five of them were white, four only being of the normal colour.—Mr. Hamilton Leigh exhibited the skull of a red deer recently shot by him in Scotland, in which there was a singular distortion of the pedicel, resulting from an ancient fracture of the left temporal bone.—A paper by Prof. A. Dendy, of Canterbury College, N.Z., was read, on *Pontobolbos Manaarensis* (gen. et. spec. nov.), a problematical cushion-shaped marine object, measuring from 13 to 36 mm. in transverse diameter, found attached to rocks in shallow water in the Gulf of Manaar, of which he had received fifteen specimens among a collection of sponges sent to him by Mr. Edgar Thurston, Superintendent of the Madras Museum. The object was found to be concentrically laminated and to contain calcareous material, and a "ground-substance," the various microchemical reactions of which were carefully described, and which, if protoplasmic, yielded no traces of nuclear structures. Minute algæ were also detected, and in the deeper layers foreign particles in the form of sand-grains. The predominant component was found to be a dense feltwork of minute filaments, for the most part radially arranged and destitute of contents, which after prolonged study the author had come to regard as bacterial. Comparison was instituted between these filaments and certain Schizophyta, and between the entire object and certain calcareous algoid "pebbles," described by Murray, from Michigan and elsewhere, as also between it and the gigantic Rhizopod *Loftusia* (Carp. and Brady); and as an admittedly tentative conclusion, the author, anxious to record the existence of so remarkable an object, inclined to the belief that it may be a symbiote involving some gigantic rhizopod undetermined and a bacterial organism. Prof. Howes, in reading the paper, submitted some microscopic sections of the object which had been made at South Kensington from material sent him by the author. He pointed out that spicules apparently of sponges could be detected among the foreign particles; and remarked that to him and his colleagues at the Royal College of Science it appeared that while bacteria were present, algal filaments were overwhelmingly predominant, and that the evidence for the supposed presence of a gigantic rhizopod was exceedingly slender. In this criticism he was supported by Mr. George Murray, who had also examined the material, and who, after considering the comparison with the afore-mentioned "pebbles," put forward a suggestion of probable similarity to the algal "pseudomorphs" apparently parasitic on sponges, first recorded by Carter in the *Annals and Mag. Nat. Hist.* for 1878.—Mr. F. Chapman read a paper on *Haddonia*, a new genus of Foraminifera, from Torres Straits. He explained, with the aid of lantern-slides, that *Haddonia* is a calcareo-arenaceous type, of the subfamily *Lituolinæ* (of Brady).

CAMBRIDGE.

Philosophical Society, November 22.—Demonstration of the influence of uranium rays upon the formation of clouds, by Mr. C. T. R. Wilson. The effect was clearly seen by the members of the Society present.—Exhibition of models of the regular and semi-regular solids, by W. W. Taylor. Mr. Taylor exhibited and explained the construction of a large number of solids, the star solids having very various forms.—Partial differential equations of the second order, involving three independent variables and possessing an intermediary integral, by Prof. Forsyth. The author discussed the theory of these equations and developed it to the same extent as the corresponding theory in the case of two variables had already been developed. In particular, he dealt with the equations which are the extension of the Monge-Boole form; and he obtained a class of equations which is the generalisation of the class discovered by Goursat: they possess an intermediary integral, though not of the general functional character appropriate to the Monge-Boole equation.—The harmonic expression of the daily variation of solar radiation, and the annual variation of its coefficients, by Mr. R. Hargreaves.—On the fifth book of Euclid's elements, by Dr. M. J. M. Hill.—Electrification of newly prepared gases, by Mr. J. S. Townsend. This paper contained an account of experiments which were applied to find the charge on the individual carriers of the electricity in charged gases, and also the velocity of the carrier when acted on by an electric force. The results of experiments on diffusion show that the charge will not diffuse through porous earthenware with the gas.—On a chemical effect produced by the impact of kathode rays, by Prof. J. J. Thomson and Mr. Skinner. Aluminium is rapidly evaporated from the kathode by an electric discharge in a highly exhausted vacuum tube in which air has been replaced by mercury vapour. The metal is condensed over the walls of the tube in the form of a bright mirror. An iron kathode gives a similar mirror in a mercury vapour discharge tube. When the aluminium coating is dissolved off the wall of the bulb by hydrochloric acid a gelatinous membrane remains which gives the reactions of silica. When potassium vapour is used the glass opposite the aluminium kathode is roughened. In parts sheltered by screens from the discharge the glass is not attacked. In potassium vapour the aluminium kathode is not evaporated to any marked degree. Opposite the kathode both in the mercury vapour and potassium vapour bulbs a dark annular stain of the shape of the kathode is formed. This stain resists the action of strong hot hydrochloric acid, nitric acid, aqua regia and potash solution. The action of hydrochloric acid removed it apparently by dissolving the glass. The tests indicate carbon, but the quantity of the stain is too small to make certain. The stain is also formed on screens of mica, quartz and calcite. Monatomic gases appear to permit the evaporation of aluminium, as Prof. Callendar has observed its evaporation in an argon vacuum tube.—On the effect of zinc and other metals on a photographic plate, by Prof. J. J. Thomson. In the course of a discussion at the Cavendish Physical Society on Dr. Russell's paper on the photographic effect produced by certain metals, Sir George Stokes suggested that possibly light might be thrown on the question as to whether these effects were due to radiation or to the vapour of the metals, if photographs were taken with a stream of air flowing between the metal and the photographic plate. In consequence of this suggestion a series of the photographs made by zinc and amalgamated zinc (1) with nothing but air between the zinc and the photographic plate, (2) when the zinc was covered with a film of celluloid, were taken both with and without an air blast. The photographs with the air blast were found in both cases to be distorted, which is in favour of the view that the effects on the photographic plates are due to the vapour of the metals.

MANCHESTER.

Literary and Philosophical Society, November 16.—Mr. J. Cosmo Melvill, President, in the chair.—Mr. Joyce showed a small pocket form of voltmeter of the permanent magnet class. It is contained in an old-fashioned watch case, the first example having been made by Mr. Joyce in 1885. The present instrument is wound to read to three volts, a reading much required in a cell tester for users of secondary batteries. In order to make the case quite smooth outside, the terminals are formed of two spring chucks contained inside the instrument and capable of gripping any wire from No. 24 to No. 18 B.W.G. Instruments have been made reading to 120 volts total.—The President communicated a paper by Mr. Peter Cameron, entitled "Descriptions of two new species of *Mutilla* from South Africa," the specimens being exhibited at the meeting.

PARIS.

Academy of Sciences, November 22.—M. A. Chatin in the chair.—On the Leonids, by M. J. Janssen. No special increase above the ordinary number of shooting stars was observed on the night of November 13–14, either in Paris or at San Francisco. It is suggested that next year arrangements should be made to secure, if possible, the spectra of some of these bodies.—On the automatic registration of the calorific intensity of the solar radiation, by M. A. Crova. Two self-registering instruments of the pattern previously described when placed side by side yield identical curves. Owing to the delicacy of adjustment, however, this class of instrument is only suitable for an observatory, the necessity for a more portable type leading to the construction of the instrument described in the present paper. This consists essentially of a thermo-electric couple, in circuit with a self registering aperiodic galvanometer. The practical trials of this actinometer at the Meudon Observatory, and on Mount Blanc, have been quite satisfactory.—On certain questions relating to the problem of Dirichlet, by M. A. Liapounoff.—On completely orthogonal systems in any space whatever, by M. G. Ricci.—On the theory of infinite transformation groups, and the integration of partial differential equations, by M. Jules Beudon.—On a method of registering photographically thermal radiations, by M.

A. Guérhard. Five illustrations from photographs accompany this paper, by which it is shown that substances whose temperature differs but slightly from that of the atmosphere may be made to produce effects upon a sensitised plate. These results show that the phenomena described by some authors as photographs of human effluvia are simply due to the temperature of the hand. —Influence of temperature upon the rotatory power of liquids, by M. Ph. A. Guye and Mdlle. E. Aston. Primary amyl alcohol appears to offer an exception to the rules formulated in previous papers for the relation between rotatory power and temperature, inasmuch as in the neighbourhood of the boiling point the specific rotation undergoes a sudden increase. An explanation of this was sought in the observations of Ramsay and Shields, which showed that liquid amyl alcohol is composed of complex molecules, breaking up into single molecules on vaporisation. To confirm this, observations were made of the rotation of amyl alcohol in water and in benzene solutions, cryoscopic determinations showing that the alcohol was not associated in water, but polymerised in benzene. The results were exactly in accordance with the above hypothesis.—On the rotatory power of polymerised bodies, compared with their monomers, by M. Berthelot. Remarks on the preceding paper.—On chlorocyanamide, by M. Paul Lemoult. A thermochemical paper.—Contribution to the study of nitrification in soils, by M. Th. Schlœsing, jun.—Influence of oxygen and other substances upon the formation of chlorophyll, by M. W. Palladine. By placing etiolated leaves containing practically no carbohydrates on the surface of certain solutions and exposing to light, it was found that saccharose, raffinose, glucose, fructose, maltose, glycerine, galactose, lactose and dextrine distinctly favour the production of chlorophyll; inuline and tyrosine are without sensible action; whilst other substances, such as mannite, dulcite, urea, alcohol, retard or even prevent completely the formation of the colouring matter. —On certain improvements to the Bourdon anemometer, by M. R. Mailhat.—An apparatus to determine in a precise manner, by means of the X-Rays, the position of projectiles in the cranium, by MM. Remy and Contremoulins. The skull is photographed successively by two Crookes' tubes placed in different positions, and the trace thus obtained projected on to the head by cranial compasses.—Remarks by M. Marey on this apparatus. In eleven preliminary experiments on the dead subject, the exact position of bullets, and even of splinters of bone, was determined with perfect accuracy. Two cases on the living subject were also carried out with complete success.

DIARY OF SOCIETIES.

THURSDAY, DECEMBER 2.

LINNEAN SOCIETY, at 8.—On the Anatomy of *Caudina coriacea*: Prof Arthur Dendy.—On some Desmids from the United States: W. West and G. S. West.——Exhibitions: Specimens of Galls of *Cecidomya*: Prof. J. B. Farmer.—An Egg of *Echidna*: Martin Woodward.

CHEMICAL SOCIETY, at 8.—Ballot for the Election of Fellows.—On Collie's Space-Formula for Benzene: Dr. F. E. Matthews.

CAMERA CLUB, at 8.15.—Photomicrography: Dr. Spitta.

FRIDAY, DECEMBER 3.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Permanent Way: its Construction and Relaying: Grote Stirling.

GEOLOGISTS' ASSOCIATION, at 8.—Notes on the Geology of the Stort Valley (Herts and Essex) with Special Reference to the Plateau Gravels: Rev. Dr. A. Irving.

MONDAY, DECEMBER 6.

SOCIETY OF ARTS, at 8.—Gutta-Percha: Dr. Eugene F. A. Obach.

IMPERIAL INSTITUTE, at 8.30.—The Mineral Resources of British Columbia and the Yukon: A. J. McMillan.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—The Sulman-Teed Process of Gold Extraction: H. L. Sulman and Dr. F. L. Teed.

VICTORIA INSTITUTE, at 4.30.—Paper by Rev. H. Lansdell.

TUESDAY, DECEMBER 7.

ANTHROPOLOGICAL INSTITUTE, at 8.30.

RÖNTGEN SOCIETY, at 8.30—Adjustable X-Ray-Tubes: A. A. Campbell Swinton.

ROYAL VICTORIA HALL, at 8.30.—Klondike: Dr. T. K. Rose.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Paper to be further discussed: On the Law of Condensation of Steam: Hugh L. Callendar, F.R.S., and John T. Nicolson.

WEDNESDAY, DECEMBER 8.

SOCIETY OF ARTS, at 8.—The Mining and Metallurgical Industries of Sweden as shown at the Stockholm Exhibition of 1897: Bennett H. Brough.

THURSDAY, DECEMBER 9.

ROYAL SOCIETY, at 4.30.—The following Papers will *probably* be read:—On the Densities of Carbonic Oxide, Carbonic Anhydride, and Nitrous Oxide: Lord Rayleigh, F.R.S.—On the Application of Harmonic Analysis to the Dynamical Theory of the Tides. Part II. On the General Integration of Laplace's Dynamical Equations: S. S. Hough.—A Note on some Further Determinations of the Dielectric Constants of Organic Bodies and Electrolytes at Very Low Temperatures.: Prof. Dewar, F.R.S., and Prof. Fleming, F.R.S.—On Methods of making Magnets independent of Changes of Temperature, and some Experiments upon Negative Temperature Co-efficients in Magnets: J. R. Ashworth.—The Electric Conductivity of Nitric Acid: V. H. Veley, F.R.S., and J. J. Manley.—On the Calculation of the Co-efficient of Mutual Induction of a Circle and a Coaxial Helix, and of the Electromagnetic Force between a Helix and a Coaxial Circular Cylindrical Sheet: Prof. J. V. Jones. F.R.S.—On the Refractivities of Air, Nitrogen, Argon, Hydrogen, and Helium: Prof. W. Ramsay, F.R.S., and M. W. Travers.

MATHEMATICAL SOCIETY, at 8.—The Construction of the Straight Line joining Two Given Points: Prof. W. Burnside, F.R.S.—A Theorem concerning the Special Systems of Point Groups on a Particular Type of Base Curve: Miss F. Hardcastle.—A General Type of Vortex Motion; R. Hargreaves.

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

FRIDAY, DECEMBER 10.

ROYAL ASTRONOMICAL SOCIETY, at 8.

MALACOLOGICAL SOCIETY, at 8.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

BOOKS.—Manuel d'Analyse Chimique: Dr. E. Fleurent (Paris, Carré).—Psychologie als Erfahrungswissenschaft: H. Cornelius (Leipzig, Teubner).—Handbuch der Photographie: Prof. H. W. Vogel. iii. Theil. Die Photographische Praxis, Abtg. 1 (Berlin, Schmidt).—The Dawn of Civilization: Egypt and Chaldæa: G. Maspero, translated by M. L. McClure, 3rd edition (S.P.C.K.).—A Handbook to the Geology of Cambridgeshire: F. R. C. Reed (Cambridge University Press).—Petrology for Students: A. Harker, 2nd edition (Cambridge University Press).—The Journals of Walter White, Assistant Secretary of the Royal Society (Chapman).—Modern Architecture: H. H. Statham (Chapman).—Annuario de Estado do Rio Grande do Sul, 1898: G. A. de Azambuja (Porto Alegre).

PAMPHLETS.—Aims and Methods of Education: Prof. P. Smith: Birmingham, Cornish).—Rousdon Observatory, Devon, Meteorological Observations, 1896 (Rousdon).—Some North American Coniferæ: E. S. Bastin and H. Trimble (Philadelphia).

SERIALS.—Rousdon Observatory, Variable Star Notes, No. 2 (Rousdon) —Proceedings, and Transactions of the Queensland Branch of the Royal Geographical Society of Australasia, Session 1896-97 (Brisbane).—English Illustrated Magazine, Christmas (198 Strand).—Longman's Magazine, December (Longmans).—Memoirs of the Peabody Museum, Harvard University. Vol. 1, Nos. 1-3 (Cambridge, Mass.).—Natural Science, December (Dent).—Humanitarian, December (Hutchinson).—Zeitschrift für Wissenschaftliche Zoologie, lxiii. Band, 2 Heft (Leipzig, Engelmann).—Good Words, December and Christmas (Isbister).—Sunday Magazine, December and Christmas (Isbister).—National Geographic Magazine, November (Washington).—Terrestrial Magnetism, September (Cincinnati).

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