THURSDAY, JUNE 2, 1910.

THE MAMMALS OF SOMALILAND.

The Mammals of Somaliland. By R. E. Drake-Brockman. Pp. xvii+201. (London: Hurst and Blackett, Ltd., 1910.) Price 12*s.* 6*d.* net.

SOMALILAND, it is hardly necessary to point out, for its mammalian fauna, its flora, and to a certain extent its birds, almost constitutes a separate sub-region of the African domain, together with the adjoining districts of Galaland, Abyssinia, and the northern parts of British East Africa. The fullest description of its interesting mammalian fauna was written some years ago by Captain (now Colonel) H. G. C. Swayne, R.E., the discoverer of Swayne's hartebeest, one of the peculiar Somali forms. Since then, alas! through the unending attacks on the Somali fauna by British sportsmen and sportswomen and some of their foreign friends, not a few of the beasts common in the northern or British part of Somaliland in Colonel Swayne's day (beginning in 1885) have now disappeared from that territory or have become extremely scarce, and are not found in the list supplied by Dr. Drake-Brockman. It is curious, nevertheless (since the title of the book under review is "Somaliland"), that its author makes no allusion to some of the most peculiar and characteristic of "Somali" mammals—at least in theory—such as the Somaliland giraffe, an independent species (*G. reticulata*); a subspecies of "Cape" buffalo (probably *Bos caffer aequinoctialis*), which is certainly met with in the western, northern and southern parts of geographical Somaliland; besides other types referred to later in this review.

It may be that the author has preferred to restrict himself to such mammals as have been seen or obtained by himself. Yet he has been on the Juba River and in southern Somaliland, and fails to include in his list another most characteristic mammal of restricted distribution. Hunter's topi (*Damaliscus hunteri*), which from several points of view is like the vanished connecting-link which must have existed between the Bubaline group of antelopes and that of the Gazelline pallas (Æpyceros), just as Swayne's hartebeest suggests a resemblance to the intermediate types between the hartebeests and the gnus. Also, it is probable that among the mammals of Somaliland should be included the Gelada baboon (Theropithecus). The present writer has himself seen live specimens of Theropithecus (probably *T. obscurus*) in French Somaliland, pets of the engineers working on the Harrar railway, which were said to have been captured close by and brought in for sale by the Somalis. Also in this book no allusion is made to the almost certain existence of a Limnotragus tragelaph in the Webbe and other big rivers of Somaliland (*vide* Colonel Swayne's book, "Seventeen Trips through Somaliland").

But though there may be these omissions from a full and complete record of the mammalian fauna of the Somali country, Dr. Drake-Brockman gives excellent descriptions of nine-tenths of the known beasts of this still mysterious and insufficiently explored region (one of those portions of Africa with great discoveries in store for us concerning the past and present faunas of Africa). Also, he emphasises two points worthy of the attention of the League for the Preservation of the Fauna of the Empire (a league which fights despairingly against official apathy and the utter indifference of the overwhelmingly large majority of the British public, a public caring nothing about the fate of the dodo, of the Somaliland giraffe, of the English marten, or the Honduras ocellated turkey); and these two points are: (1) that the Somalis (for example), Midgans, and most other native tribes do not seriously ravage the big or small game of their country; and (2) that in spite of the meticulous game regulations (this qualification is the present writer's) there is a steady destruction of Grevy's zebras, oryxes, and numerous antelopes going on at the hands of European shooting-parties throughout Somaliland. We deduce from what this author says that the wild animals of British Somaliland of any notability must in some portions of the country be extinct. Probably officialdom does what it can. It is the nation from highest to humblest which wants converting to a right interest in biology.

Dr. Drake-Brockman has much of interest to say about the cheetah. He remarks on the much greater growth of mane in the cubs, their grey-white ground colour, and different black markings from those in the adult (a tendency to horizontal stripes instead of spots). He also adds to our knowledge of the life-history of the aard-wolf (Proteles), which he describes as secreting a foul-smelling liquid in glands near the base of the tail, and expressing this fluid secretion when attacked by dogs. According to his observations of the long-eared Otocyon "fox" (which, he says, is an easy animal to tame, and makes a delightful pet), this Eocene canine goes about in small packs rather than in pairs or singly. It seems to live a good deal on insect food. The Somali wild hunting dog (Lycaon) is smaller than the Lycaons of central and southern Africa, and has much shorter fur, is, indeed, inclined towards hairlessness—an interesting trait in view of a similar tendency in some varieties of *Canis familiaris*.

Of the Baira antelope (Beira is the accepted name, but is a misspelling of the Somali pronunciation) it is said that the females are slightly larger than the males. The author's excellent photograph of this peculiar Somali antelope emphasises its kinship with the klipspringer (Oreotragus).

As to the Somali waterbuck, is it really (as stated by Dr. Drake-Brockman) *Cobus defassa*, like that of equatorial East Africa, or an independent Somali species or subspecies? Colonel Swayne classed it as the *ellipsiprymnus* of South Africa, because of its grey-brown colour and the elliptical white mark on the rump. This is somewhat the description given by the present author; but *defassa* is, on the contrary, without a white mark on the rump, and is remarkable for its brilliant bay colour.

The Beisa oryx, the various gazelles of Somaliland —and if this is not *par excellence* "Gazelleland," what is?—the greater and lesser kudus, are all effectively

illustrated and described by Dr. Drake-Brockman. He tells us some new things about the long-necked, long-tailed dibatag (Ammodorcas) and gerenuk (Lithocranius), and about the oryx. In this last type (of which the book gives an excellent photograph) the reader is recalled to one of the problems of faunistic geography as yet unsolved, *i.e.* why is there such a strong affinity in mammalian and bird fauna, and to a lesser extent in flora, between south-west and north-east Africa, between Somaliland (in its largest geographical extent) and Trans-Zambezia? The Beisa oryx of north-east Africa and the Cape gemsbok are more nearly allied than either is to the fringe-eared oryx (*O. callotis*) of East Africa. In both north-east and south-west Africa we have ostriches, aard-wolves, otocyons, gazelles, foxes, black-backed jackals, secretary birds, striped hyænas, caracal lynxes, and cheetahs. North of the Zambezi and the Zambezi-Kunene line they do not exist, nor south of the Tana River and the Anglo-German frontier in Masailand.

There is even a slight correspondence (in these geographical extremes of Africa) in the affinities of the lowest human types. Linguistically, the only allies of the south-west African Hottentots are in equatorial German East Africa, and physically the only resemblances to the Bushman are to be met with in some of the Andorobo, Suk, and Doko helot tribes of north-east Africa, north and east of Unyamwezi and the Kilimanjaro district. Why should the connecting links of so many mammal and bird types have died out in between? The intervening regions were almost certainly covered down to quite recent times by dense forest, a forest only abated by the Neolithic negro. How did the "desert" types referred to of Somaliland and south-west Africa work their way through this forest-land across many degrees of latitude, and yet retain their peculiar adaptability (in colour as well as peculiarities of hoof and habit) for arid countries? A similar problem remains unsolved in regard to South America, in the south-western parts and southernmost extremity of which continent there are mammals related to North American types (such as Andean bear, the Antarctic wolf, and the Auchenia camelids) the nearest affinities of which are with North American forms, yet which to reach their present habitat must have traversed a greater or less breadth of densely forested, steamingly hot equatorial America. H. H. JOHNSTON.

SOME BRITISH FRESH-WATER PROTOZOA.

British Fresh-water Rhizopoda and Heliozoa. Vol. II. Rhizopoda, Part II. By the late James Cash, assisted by John Hopkinson. Pp. xviii + 166 + 32 plates. (London: Ray Society, 1909.) Price 12*s.* 6*d.* net.

THE appearance of the second volume of this useful monograph of the British Rhizopoda was heralded some few months ago by the sad announcement of the death of the author, Mr. James Cash. The descriptions of the species and the beautiful plates which illustrate them were from the hand of the devoted and enthusiastic Manchester microscopist, and it will always be a matter for sincere regret that his life was not spared to see the completion of his work. To Mr. John Hopkinson we are indebted for the notes on synonymy, for the bibliography, and for the responsibility of seeing the volume through the press after the death of Mr. Cash.

The genera dealt with in the present volume are those included in the divisions of the Conchulina called by the authors the Difflugina and Nebelina. This leaves the treatment of the testaceous forms with filamentous pseudopodia and the Heliozoa to a third volume.

As pointed out in our review of the first volume (May 17, 1906), this monograph is one that is essentially systematic in its treatment. It includes the description of a number of forms which are considered by those who have made a special study of them to be specifically distinct or to be racial varieties of distinct species, but it does not attempt to deal with the more difficult problems of life-history and the influence of the environment. To the working microscopist who is anxious to find names for the varieties he discovers in the fresh-waters that he visits it will doubtless be of some value, for it gives him, in a convenient form and with excellent illustrations, a statement of the names that have been given to the varieties of Difflugia, Lesquereusia, Quadrula, and other well-known genera. But a purely systematic work of this kind cannot fail to raise in the mind of an inquirer many interesting questions that it altogether fails to satisfy. For example, of the genus Difflugia alone no fewer than twenty-three species are described, varying in length from 15μ to 250μ. Is there really any satisfactory evidence to prove that the smaller forms, such as *D. penardi* and *D. globulosa*, are not the younger stages in the growth of the larger forms? In the closely allied genus Centropyxis, Schaudinn has proved that the zygote formed by the fusion of a megagamete and a microgamete forms a small shell, but no one has, at present, described in detail the characters of the shells of the different stages of growth from the zygote until the full size of the adult is attained. Until this has been carefully done by the culture method, with two or three examples, the real value of the specific characters used in systematic treatises must be accepted with very great hesitation. In the meantime, it might be of some assistance to zoologists if a naturalist endowed with the skill and patience of the late Mr. Cash would give us a census of the Difflugia varieties or forms that are found in a particular pond or Sphagnum bog once for every month during a year or two. Such a census might, at any rate, suggest certain coincidences of occurrence which would be worthy of further investigation.

A few figures are given of two individuals "in conjugation" (*e.g. Difflugia oblonga*, p. 13, *Cryptodifflugia oviformis*, p. 79, *Nebela collaris*, p. 96), but the recent researches of protozoologists render it extremely improbable that a true process of conjugation occurs at all under such conditions as the figures indicate. It may be plastogamy or it may be a late stage of fission that has been observed, the absence of any indication of the nuclear structures in the figures rendering it impossible to form an opinion on this point, but there is really no reason to suppose that it is conjugation.

The volume is, as usual with the Ray Society's publications, well printed, copiously illustrated, and, thanks to the labours of Mr. Hopkinson, provided with very complete lists of reference to literature, and an index.

TECHNICAL CHEMISTRY OF SUGAR AND STARCH.

Traité complet d'Analyse chimique, appliquée aux Essais industriels. By Prof. J. Post and Prof. B. Neumann. Deuxième Édition Française entièrement refondue. Tome seconde, deuxième fascicule. (Paris: A. Hermann et Fils, 1910.) Price 8 francs.

THIS edition of Post and Neumann's work is translated by MM. Pellet and Chenu from the third German edition. The particular fascicule now under notice deals with the chemical control of the manufacture of sugars and starches.

Beetroot sugar naturally claims the lion's share of attention in a Continental book dealing with sugar, and, by following the text in the case of this product, a good idea of the work as a whole will be obtained.

An outline of the process by which the sugar is extracted gives the reader in a page or two a general introduction to his subject. This leads to an exhaustive account of the various methods which are available for determining the quantity of sugar present in any solution of saccharine substances. Naturally, they are well-known processes—areometric, gravimetric, polarimetric, and volumetric; but they are well explained, both as regards theory and practice, and illustrated with figures of the requisite apparatus.

Coming next to the more specialised part of the work, we find, to begin with, detailed instructions for the testing of beetroot seed, and also specifications (German, Austrian, and French) of the conditions which the seeds are required to fulfil. Next follows a scheme for the analysis of the roots themselves, including full directions for those most important preliminary operations the sampling and pulping of the materials.

Having the pulp, what, precisely, is the best method of extracting the sugar from it? Much depends on this, and a full discussion of the *pros* and *cons.* of the various processes is entered into; namely, as to whether water or alcohol is the best solvent, whether it should be used hot or cold, and whether this or that *modus operandi* is to be given the palm for merit. Eventually the conclusion is arrived at, and supported by Dr. Herzfeld "*après de longues études,*" that extraction with cold water is in every way preferable to the use of alcohol for the purpose. It is simpler, easier, quicker, more economical, and more exact.

The samples of roots being analysed *secundum artem,* and the proportion of sugar duly determined, we pass to the *jus de diffusion* obtained in the actual manufacture. This is a weak aqueous solution of sugar and other soluble matter extracted from the roots by diffusion in water, and full directions are given for its examination. Next the syrups and massecuites are dealt with, modified processes of analysis being used, to suit their more highly saccharine nature; and eventually the finished products—the dry sugars and molasses—come under review. This, however, is not all; there is the question of by-products to be considered, including the best methods of utilising the residues from the pulp and molasses; and also there is the examination of the various materials, namely, water, chalk, carbonic acid, sulphuric acid, strontianite, and so on, that are used in the various stages of the manufacture.

These matters are all dealt with at length. Many figures of the necessary apparatus are given, and also several tables of numerical values which will much facilitate the analyst's work.

The remaining sections of the book, treating of cane-sugar, starch, dextrine, and glucose, are written in a similar practically useful manner. If in these industries, or in the future British beet-sugar production to which some hopeful eyes are turning, any chemist requires a laboratory handbook, he might do worse than study the one under notice. C. S.

PETROLEUM MINING AND OIL-FIELDS.

Petroleum Mining and Oil-field Development. A Guide to the Exploration of Petroleum Lands, and a Study of the Engineering Problems connected with the winning of Petroleum. By A. Beeby Thompson. Pp. xx+362. (London: Crosby Lockwood and Son, 1910.) Price 15*s.* net.

THE engineering part of the book contains a large amount of instructive information, especially in regard to customary procedure in Russian oil-fields, but the author betrays a lack of knowledge of recent practice in some of the American oil-fields. Thus, his remarks on steel wire cable drilling on p. 193 are misleading, for it is common knowledge that at the present time this system is certainly in favour in the United States, and may, in fact, be said to be generally used for deep wells in that country, often after a depth of 600 to 800 feet has been reached. Similarly, the statement made on p. 218, as to the method adopted when a dropped tool cannot be recovered by "fishing," ignores the usual practice of "side-tracking" by raising the casing and drilling off with a wedge. Again, on p. 238, the diameter of the last string of casing is understated, for American wells, started with a diameter of 12 inches or 14 inches, are frequently completed at a depth of 3000 feet, or even 4000 feet, with a diameter of 6 inches, and it is incorrect to state that in the United States the casing is always manufactured from mild steel, for wrought-iron casing is manufactured in that country and is readily obtainable. In the description of the process of cementing wells, on pp. 266–8, there is no mention of the latest and most effective system, which consists in pumping the fluid cement, without any admixture of sand, through tubing packed inside the casing, so that it circulates below the shoe and passes up on the outside of the casing, which is afterwards lowered and the packer withdrawn.

The description of fishing tools is a good and comprehensive account of these appliances, but generally the treatment of the engineering branch of the subject is unequal, and there is a predominance of the Russian practice, to which the author unconsciously

supplies the key-note by comparing some oil-sands with "fresh caviare" (p. 286).

In the chapter devoted to the geology, chemical composition and treatment of petroleum, the author is evidently less at home, and there are many statements to which exception might be taken. Thus the description of the structure of the Peruvian oil-fields (p. 53) is inaccurate, a series of anticlinals with intervening synclines being represented as a persistent monoclinal. The expression "concentration" (p. 59) for the flowing of oil to replace that which has been ejected with much solid matter in suspension is a novel one in this connection, and the same may be said of the terms "low density," "low resistance," and "high absorption," applied to the spaces vacated.

As the author fails to distinguish between benzene and benzine (pp. 132, 138), it is not surprising that he should assert that the frequency of association of petroleum with coal and lignite is "a source of speculation." Taking the Stock Exchange meaning of speculation this may be true, but the frequency, even of adventitious proximity, still less of any causal relationship, is an obsolescent fallacy which it is not worth while to controvert afresh.

As this purports to be a practical work on petroleum mining and oil-field development, it is regrettable that greater judgment has not been displayed in the selection of the illustrations. Many of the plates add, no doubt, to the attractiveness of the volume, but convey no instruction. Amongst these are the photographic illustrations of groups of specimens of oil-rocks, bitumens, &c., a "mud-volcano" showing a level surface on which walking is being cautiously attempted, and a cart laden with Trinidad pitch.

More care should have been exercised in proof-reading. Thus in the last line but one of p. 223 the word "for" should be "by," and, judging by the context, the word "not" has been omitted in the first line of the following page, the author being thus made to state the reverse of what he intended.

ESSAYS ON ANGLING.

Minor Tactics of the Chalk Stream, and Kindred Studies. By G. E. M. Skues. Pp. xii+133. (London: Adam and Charles Black, 1910.) Price 3*s.* 6*d.* net.

IT is long since we have read any book, written by an angler for anglers, with so much pleasure as Mr. Skues's "Minor Tactics of the Chalk Stream." The polemics of ardent advocates of the dry fly or the wet fly may instruct, and possibly convert, but they weary the reader; the object of the present book is to advance no theory, but to make the angler approach his subject (and his trout) with an open mind, and think out for himself the problems with which he is confronted. Herein, we conceive, lies the true value of the book. The scene is laid upon the banks of a chalk stream, or of some carrier in the water-meadows that holds dark, hog-backed trout; for setting we have the willows and lush herbage of a southern valley, while the reed warbler, the dabchick, and the corn-crake, are cast for minor parts; yet there is counsel which we would commend to those whose waters run through heather and bog-myrtle, where the trout are small, with fair golden bellies and ring-spotted sides, and the angler's music is the sweet spring cry of the curlew or the drumming of the snipe.

It is of the essence of Mr. Skues's teaching that the angler should cast aside the dogmas of his predecessors, and should study nature for himself; nature as seen in the trout, and on the banks of the stream, and, above all, in the life-histories of the insects eaten by the trout. There is no dogmatism here, but a pleasant didactic manner, instructing while it amuses, and amusing when it does not instruct; the moral is pointed by tales of full baskets or of bad days (our author's methods seem to have eliminated blanks), and there are constant reminders that bring the reader from his theories straight back to the river's bank. We may learn how to tie flies in imitation of the nymphs of Ephemerids, and how to fish with them, of an effort to reproduce the alder-fly lava and its results, and of the sad fate of the artificial fresh-water shrimp; we may further read of the undoing of trout that bulge or tail, of trout that live in strange and unapproachable holes, and of those gourmet trout whose tastes need humouring.

The temptation to quote from Mr. Skues is irresistible, the difficulty is to select; whether to reproduce his tale of the day on which there was no rise of fly but a strong rise of water-rats, or his comments on flies, or on human nature and its reluctance to jeopardise a shilling cast and twopenny fly for the sake of getting a fish out of some weedy or bushy hole. Here, for instance, is one comment with which we cordially agree:—"Indeed, why a trout should take any artificial fly is a puzzle to me. The very best are not really very like the real things. One thing is clear: It is not form which appeals to the trout, but colour and size." In the light of this passage, the flies shown on the frontispiece should be studied and compared with the actual flies and nymphs.

Throughout the book the same ruling idea is found; the preaching of no system, the upholding of no tradition, but a plea for "unfettered judgment, independence of tradition, and, above all, the inquiring mind." We wish Mr. Skues success in his campaign; incidentally we wish him many readers, and we wish his readers many more such books as this. But when these books come let them be indexed; good advice is elusive, and captions alone are not always sufficient guides.

L. W. B.

ZOOLOGICAL STUDIES.

Studies from the Zoological Department, University of Birmingham. Vol. ii. Edited by Prof. F. W. Gamble, F.R.S. (1910.)

THIS volume consists of reprints of sixteen papers from various journals, the outcome of work done in the years 1905–9 by the staff and students of the zoological department of the University of Birmingham. It is appropriate that the first paper in the volume should be one by the late head of the depart-

ment—Prof. T. W. Bridge—and that it should deal with a subject which he had made peculiarly his own, namely, the air-bladder of fishes. The main purpose of this interesting paper is to consider this remarkable organ, not from the points of view of morphology and function, though these aspects are not neglected, but as the source of isinglass. The author pointed out that, although there are 7000 or 8000 species of fishes with air-bladders, few are utilised for the supply of isinglass, and he suggested that the air-bladders of some of our larger British food-fishes, such as the cod, hake, gurnard, &c., might be of value for this purpose. Isinglass is apparently the only product of the animal body which can be used as a clarifying agent in brewing operations, and its mode of action does not seem to be at all clearly understood, but it is believed that it depends on the fibrous nature of the substance. The fibres swell out in the liquid, particles become entangled in their meshes, and are carried, with the settling of the isinglass, to the bottom of the barrel.

There is one other contribution from the pen of the late Prof. Bridge, probably his last published work, on the presence of a false acetabulum in a Bandicoot. Dislocation of the head of the right femur resulted in the formation of a false socket on that side of the pelvic girdle, dorsal to and closely resembling the normal acetabulum, which latter had undergone retrogressive modification as the result of the loss of function.

Half the remaining papers in this volume are concerned with fishes—Mrs. Merritt Hawkes records the presence of a vestigial sixth branchial arch in the Heterodontidæ, describes the cranial and spinal nerves, the abdominal viscera, and a vestigial seventh branchial arch of Chlamydoselachus, and gives a useful account of the theory of nerve components; Mr. A. D. Imms describes the gill-rakers of the spoonbill, and the oral and pharyngeal denticles of Elasmobranchs; and Mr. R. H. Whitehouse discusses the morphology of caudal fins, directing attention to the effects of specialisation, especially abbreviation, of the axis and restriction of the caudal fin in homocercal tails, and concluding that the present homocercal caudal fin is really a posterior anal which owes its present position to the great abbreviation of the axis coupled with excessive upturning of the end of the chorda.

There are further contributions from Mr. Imms on Anurida (being his L.M.B.C. memoir on this Collembolan), and on the occurrence at Port Erin of a pseudo-scorpion (*Obisium muscorum*) in the fissures of rocks in such positions that the specimens had to endure submersion twice daily. The studies also include papers on sex-inheritance in the moth *Abraxas grossulariata* and its variety *lacticolor*, and on animal parthenogenesis, by Mr. L. Doncaster; on the anatomy of the "green fly" of rose trees by Mr. A. J. Grove, and on the gonadial grooves of Aurelia by Mr. T. Goodey.

The studies bear testimony to the range of view of the late professor and to his stimulating influence on his pupils.

OUR BOOK SHELF.

Physiology of the Special Senses. By M. Greenwood, Jun. Pp. vii+239. (London: Edward Arnold, 1910.) Price 8*s.* 6*d.* net.

In trite phraseology, this book supplies a long-felt want, and supplies it in a manner which is altogether commendable. It is elementary, but not so elementary as merely to traverse the same ground as that covered inefficiently in so many text-books. In reading the chapters devoted to the special senses in many text-books of physiology, one feels irresistibly that the author is out of sympathy with the subject. In this book the physiology of the special senses is introduced to the reader with illuminating clearness born of thorough knowledge and judicial discrimination. The requirements of the student are catered for by a teacher who knows how to interest his audience, but at the same time demands an attentive application of intelligence. Thought is stimulated, and the desire for further knowledge evoked. Each chapter concludes with a short but well-selected bibliography, pointing out the path for further study.

After an introduction dealing with the laws of Müller, Weber and Fechner, cutaneous sensation, taste and smell, the sense of position and movement, hearing, vision, and the physiology of space come successively under review. The work of Head and his collaborators, Rivers, Sherren, Ham and Thompson, upon protopathic and epicritic sensibility is clearly described, whilst the subsequent researches of Trotter and Davies are discussed and criticised. Taste and smell, the sense of position and movement, and hearing are adequately treated, but, as was to be expected, the physiology of vision in its manifold and complex manifestations demands the major part of the book, more than half the pages being devoted to its consideration.

After a chapter on the comparative physiology of vision, retinal processes, electrical, phototropic and chemical responses are dealt with. The student is led on in logical sequence to visual adaptation, entailing a discussion of peripheral vision and total colour-blindness. The chapter on recurrent vision theories of adaptation gives the reader ample food for reflection, and in entering upon the thorny subject of trichromatic vision the author wisely quotes the warning words of Helmholtz:—"The confession of actual doubt is better than the delusion of dogmatic certainty."

The treatment of colour-vision and colour-blindness is admirable. Expanded and treated more exhaustively in the same judicial spirit it might form a valuable corrective to the obsessions which the subject seems almost inevitably to induce. Further chapters are devoted to after images, historical theories of vision, the Young-Helmholtz theory, Hering's theory, and simultaneous contrast.

Reminiscences of a Strenuous Life. By Prof. Edward Hull, F.R.S. Pp. iv+119. (London: Hugh Rees, Ltd., 1910.) Price 4*s.* 6*d.* net.

Though nothing appears in this simple record to justify the adjective in the title, it will afford to many a pleasant reminder of a life still keen and active, yet bridging the years between Thomas Oldham's lectures in Dublin and the Darwin celebration of 1909. Dr. Hull originally studied at Trinity College, Dublin, with the view of becoming a clergyman of the Church of Ireland, and it is interesting to note that a course in the Irish language then formed a part of the recognised curriculum. Having, however, been attracted by engineering, he came under Oldham's influence, and, with his aid, began work on

the staff of the Geological Survey of Great Britain. His chief was Sir Henry de la Beche; his first instructor in the field was J. Beete Jukes; and during the next fifty years he became acquainted with all the prominent geologists in our islands. His principal official work was in connection with the Irish branch of the Survey, of which he became director in 1869. Some of the controversies of the next twenty years may have been "strenuous"; but Dr. Hull gives only a bare hint of this. In a kindly spirit he dwells on the many friends he made, a large number of whom are fortunately still amongst us. There is an engaging *naïveté* about some of his anecdotes, as when he confesses (p. 27) that he was shocked to find that one of these friends was a Liberal; or when he mentions that he lectured on a biblical subject with an archbishop in the chair. But his reminiscences of scientific societies in Dublin will come home to all those who remember the old friendly gatherings, which have already grown a shade more formal, partly through the spread of suburban homes, and partly through the development of more "strenuous" and specialised activities.

Dr. Hull's geological expedition to Arabia Petræa and Palestine has been described elsewhere, and is here only lightly touched on. An abstract is given of his work on the submerged valleys of the European plateau (p. 105); but we miss a mention of the fact that, under his direction, the geological survey of Ireland was completed on the one-inch scale before his retirement in 1890, every sheet being accompanied, as Jukes had planned, by a descriptive memoir. These geological memoirs may vary a good deal in their degree of completeness, but their publication was very systematically carried on. We probably owe to Dr. Hull the delicate and artistic colouring of the northern sheets of the Irish Survey, which made them absolutely without rivals, until stronger tints were used in recent years. In spite of the evidence of the present reminiscences, it is hard to realise that Dr. Hull's official career ended, after full years of service, close on twenty years ago. A good portrait and a bibliography accompany the volume.

Catalogue of Bronzes, &c., in Field Museum of Natural History. Reproduced from Originals in the National Museum of Naples. By Prof. F. B. Tarbell. (Chicago: Field Museum of Natural History, 1909.)

THIS publication constitutes a fascicle of the seventh volume of the anthropological series of the Field Museum of Natural History, Chicago. The objects described in this "Catalogue" are reproductions in bronze of originals in the National Museum of Naples from the Campanian cities buried by the eruption of Vesuvius in 79 A.D. With a few exceptions "these objects constitute a fairly representative selection from among the bronze utensils, instruments, and articles of furniture in the great Neapolitan collection; and, while not exact in every particular, they do, nevertheless, give a fairly correct idea of the originals." As no complete and scientific account of the Naples bronzes "has ever been issued, it has seemed worth while to prepare a somewhat detailed catalogue, with illustrations, of these reproductions." The catalogue enumerates and describes with considerable detail some 300 different objects, of which seventeen are designated "pre-Roman," and illustrates almost the entire series in 117 excellent plates. To archæological students and such other Americans as may have no opporunity of visiting Naples, these reproductions will be almost as valuable as the originals, and from them the museum will receive grateful acknowledgment, both for having had the reproductions made and for this excellent account of them, of which European students will not fail to appreciate the value when in face of the original collection in Naples.

The Building and Care of the Body. An Elementary Text-book in Practical Physiology and Hygiene. By Columbus N. Millard. Pp. x+235. (New York: The Macmillan Company, 1910.) Price 2*s.* 6*d.*

As Mr. Millard says in his preface, teaching pupils how to develop strong, healthy bodies should be one of the chief aims of our schools. One of the objects of his book is to convince children that certain practices are likely to make them happier and more comfortable, abler in play and work, and so lead them to regard the study of the laws of health as worth while. The author has already made a favourable impression among teachers in this country by his earlier book, "The Wonderful House that Jack Has," and the present volume is likely to prove useful, since it provides brightly written and well-illustrated lessons on the simple facts of human physiology and hygiene.

The English Lakes. Described by A. G. Bradley. *Canterbury.* Described by Canon Danks. *Oxford.* Described by F. D. How. All pictured by E. W. Haslehurst. Each pp. 56. (London: Blackie and Son, Ltd., 1910.) Price 2*s.* net each.

THE first three volumes of a series designed to bring before readers the beauties of England are certainly very attractive books. The text is interesting, touching lightly history, geography, archæology, and any other subject able to contribute facts or fancies likely to arrest the attention. We imagine the volumes are not intended to serve any serious purpose; but though unsuitable for guide-books, they will certainly become favourites with lovers of the districts they severally describe.

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 Temperature Conditions within Clouds.

AT the meeting of the British Association for the Advancement of Science held in Winnipeg last August, a paper was read before the Physics Section by Prof. A. Lawrence Rotch, director of the Blue Hill Observatory, in which a rise of temperature was described as having been recorded by a *ballon-sonde* meteorograph in passing through a cloud. In the discussion which followed considerable doubt was expressed as to the possibility of such a condition existing. That there was an increase in temperature recorded by the meteorograph as it passed upward through the cloud there can be no doubt (see diagram in *Meteorologische Zeitschrift*, December, 1909, p. 554). Dr. John Aitken, in NATURE of November 18, 1909, says that he sees no reason to question the truth of the record, for he has on numerous occasions observed similar increases of temperature while enveloped in a cloud upon the summit of a mountain. He directs attention to the fact that great caution must be exercised in obtaining temperatures under these conditions, for, on account of the excessive radiation that occurs within the cloud, unless the instrument is sufficiently insulated from the heat rays, the thermogram will be vitiated. In the case of the ascent referred to, the increase of temperature was not unreal, for due precaution, in the form of an especially prepared insulator, had been taken to eliminate the effects of radiation, and the ventilation was sufficient.

In order to determine the temperature conditions within and about clouds for a large number of cases, an examination was made of the records obtained in the kite-flights

made at Blue Hill Observatory. These data are particularly valuable for such a study, since in each flight continuous records of temperature, pressure, humidity, wind-velocity and direction were obtained for all heights reached by the uppermost kite, below which the meteorograph is attached to the wire. In the kite meteorograph used, the thermometer and the hair-hygrometer are screened as much as is possible, thus rendering the heat received from radiation a negligible amount.

A total of sixty-four kite flights were found in which the meteorograph penetrated a cloud, and, since in six of these flights two cloud-sheets were encountered, the temperature conditions in seventy cloud-strata were obtained as a basis for the investigation. Of these, 63 per cent. showed a rise in temperature of 3·0° F. or more in the upper part of the cloud or immediately above it, 23 per cent. showed no apparent effect of the cloud on the temperature conditions, 7 per cent. showed an inversion below the base of the cloud, while the remaining 7 per cent. showed an isothermal condition prevailing from the base to the summit of the cloud. The flights in which the records

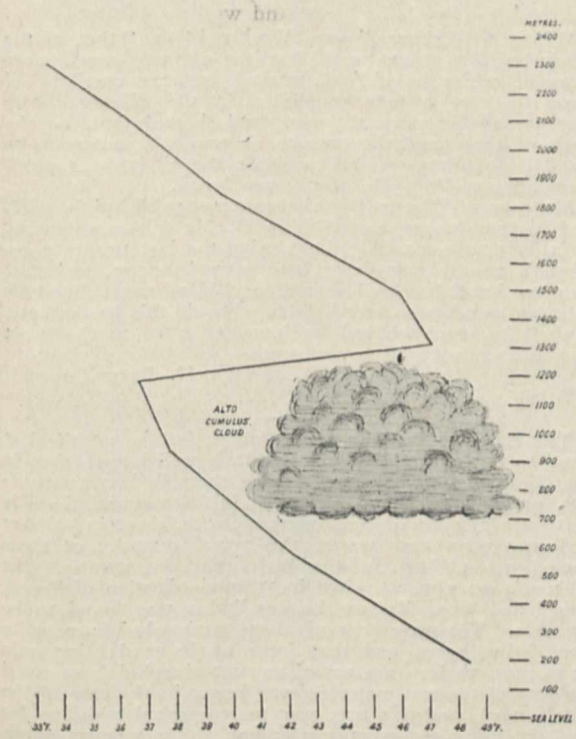


FIG. 1.—Curve of November 3, 1904, showing increase of temperature occurring within and above cloud.

were obtained were distributed with fair uniformity throughout the year, and the clouds encountered represent all kinds except cirrus and cirro-stratus, these having rarely been penetrated. Moreover, although by far the greater number of flights were made in the daytime, many flights at night are included.

In the largest of the four groups, namely, the one including the flights which showed a rise in temperature in the upper part of the cloud or immediately above it, the increase usually began about half-way between the base and the summit, and persisted until the maximum temperature for the inversion was reached a short distance above the uppermost part of the cloud. Beyond that point the usual rate of decrease, approximately the adiabatic rate for dry air, prevailed as high as the kite ascended. In the next largest group, that including flights in which the cloud had no apparent effect on the temperature conditions recorded, a fairly regular rate of decrease, somewhat similar to the adiabatic rate for saturated air, was found. In the next group, that including cases in each of which there was an inversion below the cloud, the increase in temperature persisted throughout the cloud and to various heights above it, where a decrease again began. In every one of these cases there were the characteristic cyclonic conditions of a shallow easterly wind at the ground overlaid by a warm south-west wind, with precipitation following. It is thus evident that the increase in temperature was caused by the importation of relatively warm air, and hence began at a height independent of the cloud, the latter only reinforcing the larger warming. In the smallest group, that including the five cases in which there was a practically isothermal condition throughout the cloud, the distinguishing characteristic was really that of the largest group, for, since the usual condition in the lower free air is that of a fairly uniform decrease of temperature approaching the adiabatic rate for dry air, an isothermal state is theoretically equivalent to an increase of temperature with increasing height, such as characterise the cases of the first group. If this be granted, 70 per cent. of the instances show an increase of temperature in the upper part of the cloud and beyond for a short distance.

This phenomenon of an increase of temperature is entirely independent of the difference in the adiabatic rates of dry and of saturated air, that for the latter being about one-half that of the former. The marked decrease in

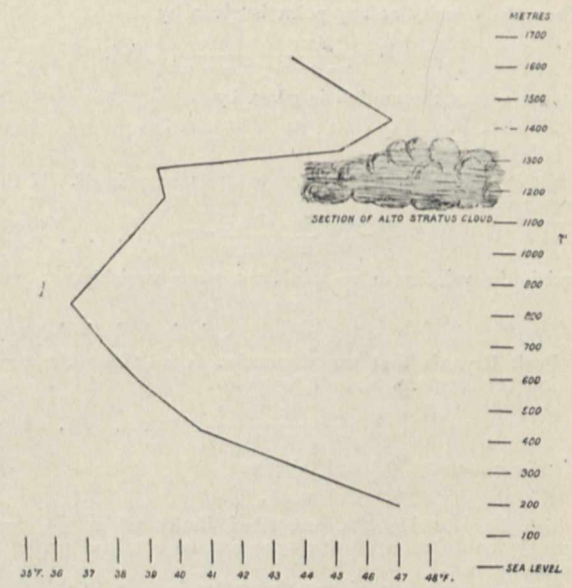


FIG. 2.—Curve of April 4, 1905, showing increase of temperature beginning below cloud.

relative humidity almost always occurring just above a cloud is probably simply the result of the increased temperature. Dr. Shaw, the director of the English Meteorological Office, in discussing the thermal relations of floating clouds, says:—"A floating cloud, a finite mass of air carrying water particles, is losing by radiation into space (at night) through the clear air above it more heat than it receives from the earth beneath; the water globules will, in consequence of this loss of heat, evaporate, and the cloud will vanish" (Quarterly Journal of the Royal Meteorological Society, vol. xxviii., 122, p. 95). It is also worthy of note that in a balloon voyage made in Germany recently, not only was there noted a "warming above the cloud, or at least above the lowest plane of formation," but an increased temperature was recorded in a stratum of ordinary haze (Elias and Field, Quarterly Journal of the Royal Meteorological Society, vol. xxxi., 134, p. 125).

ANDREW H. PALMER.
Blue Hill Observatory, Hyde Park, Mass., May 5.

Eddy Formation—A Correction.

IN Prof. Bryan's solution of the problems in eddy formation (NATURE, February 3, p. 408) no mention is made of the fact that a vortex in one plane at rest, when the method of conformal representation is used, does not in general lead to a solution in which the corresponding vortex is at rest.

Taking a single vortex at $z=z_0$ at rest, let

$$w=im\log(z-z_0).$$

Transform by putting $z=f(t)$, and let $z_0=f(t_0)$,

$$w=im\log\{f(t)-f(t_0)\}$$
$$=im\log(t-t_0)+im\log\left\{f'(t_0)+f''(t_0)\frac{t-t_0}{2}\ldots\right\}$$

expanding in the neighbourhood of $t=t_0$, and at the vortex

$$\frac{dw}{dt}=im\frac{d}{dt}\log(t-t_0)+\frac{imf''(t_0)}{2f'(t_0)},$$

the first part giving the velocity due to the vortex itself and the second the motion of the vortex. The vortex will not be at rest unless $f''(t_0)=0$.

Employing Prof. Bryan's method to obtain a solution giving a vortex at rest in the t plane in the cases considered by him, with the vortex in the z plane not necessarily at rest, we have

$$w=Uz+im\log\frac{z-a-ib}{z-a+ib}$$
$$z=f(t)$$
$$a+ib=f(t_0).$$

Then the velocity at any point is given by

$$\frac{dw}{dt}=\left\{U+\frac{im}{z-a-ib}-\frac{im}{z-a+ib}\right\}f'(t).$$

At the vortex the motion is given by

$$\frac{dw}{dt}=\left\{U-\frac{im}{zib}+\frac{im}{z}\frac{f''(t_0)}{[f'(t_0)]^2}\right\}f'(t_0),$$

omitting the infinite term due to the vortex itself. If the vortex is at rest,

$$U-\frac{m}{zb}+\frac{im}{z}\frac{f''(t_0)}{[f'(t_0)]^2}=0 \quad . \quad . \quad . \quad . \quad (1)$$

and if the velocity at $z=0$ in the z plane vanishes,

$$U-\frac{zmb}{a^2+b^2}=0 \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

Prof. Bryan's first transformation is $z=t^n$, so the condition (1) becomes, since $t_0^n=a+ib$,

$$U-\frac{m}{zb}+\frac{im}{z}\frac{n-1}{n(a+ib)}=0 \quad . \quad . \quad . \quad . \quad (1)$$

If n is not unity, (1) and (2) give

$$n=\tfrac{1}{4},$$

which lies outside the prescribed limits of n. Consequently no solution of this type can be obtained giving a vortex at rest.

Prof. Bryan's second transformation is

$$Z=\sqrt{c^2+t^2}.$$

Condition (1) becomes in this case, since

$$c^2+t_0^2=(a+ib)^2,$$

$$U-\frac{m}{zb}+\frac{im}{z}\frac{c^2}{(a+ib)\{(a+ib)^2-c^2\}}=0 \quad . \quad . \quad (1)$$

which gives

$$a(a^2-3b^2-c^2)=0 \quad . \quad . \quad . \quad . \quad . \quad (3)$$

$$U-\frac{m}{zb}+\frac{mc^2}{2b\{3a^2-b^2-c^2\}}=0 \quad . \quad . \quad . \quad (4)$$

Equations (3), (4), and (2) cannot be satisfied by any values of a, b, and m. A solution of the two-dimensional problem of liquid impinging at right angles on a plate of finite breadth with two stationary vortices at the back of the plate and finite velocities at the edges is impossible.

E. H. HARPER.

MR. HARPER is quite right. It would appear from his investigation that it is impossible to apply the transformations in question to fluid motions with stationary vortices, notwithstanding that a vortex transforms into a vortex, and a fluid particle *other than a vortex* which is at rest transforms into a particle also at rest. It is a pity that this fact was overlooked, and that results were consequently published which are of less interest than was supposed at the time.

G. H. B.

The Nutritive Value of Black Bread.

IT appears to me that the contributor of the article on this subject in NATURE of May 5 has overlooked one all-important question, viz. how much of the nitrogen present in each form of bread is actually digested.

I had occasion to look up this question last year, as I happen to be a politician who *is* "particular about his facts," and I agree with your contributor in detesting "allegations," political or otherwise, that are "wanting in scientific accuracy." I referred, accordingly, to Wynter Blyth's "Foods: their Composition and Analysis," and found on p. 173 a table showing "the amount of dry substance, &c., absorbed in percentages of" (*a*) North German black bread (*Pumpernickel*) made of whole rye meal with leaven; (*b*) Munich rye bread, which is a mixture of rye and coarse wheat meal, with leaven; (*c*) white wheaten bread.

The percentages absorbed were:—

	Dry substance	Nitrogen
(*a*)	80·7	57·7
(*b*)	89·9	77·8
(*c*)	94·4	80·1

"It is thus shown," says Wynter Blyth, "that of the black bread a person would have to eat very much more than of white bread." I worked out the corollary of these facts in a letter published in the *Western Daily Mercury* of February 18, 1909, and showed that, on the basis of these analytical results, it would be necessary to eat 8 lb. of *Pumpernickel* to obtain the nitrogenous nutriment afforded by 5¾ lb. of wheaten bread.

My copy of Wynter Blyth's book was published in 1888, and his results are quoted from G. Meyer's experiments. It is, of course, possible that during the last twenty years Meyer's results may have been proved wrong, and that pure rye bread has been proved to yield as much *digestible* nitrogen as wheaten bread yields. Should this be the case, I shall be much obliged by information as to the latest and most trustworthy experiments.

FRANK H. PERRY-COSTE.

Polperro, Cornwall, May 16.

THE criticism is quite to the point, but is not the last word to be said on the subject. It is well known that in the digestion of whole-meal breads there is larger waste; but, on the other hand, if in the initial material there is a greater amount of certain constituents, then, in spite of a larger percentage waste, the actual quantity of these ingredients utilised in the body may be greater. In Rubner's experiments, cited in "Standardisation of Bread. Bread and Food Reform League," this was found to be the case. The percentage of nitrogen absorbed from white flour being 79·93, and that from whole meal being only 69·53, nevertheless the actual amount absorbed from equal weights of the two materials was larger in the case of the whole meal, and this was even more marked with the fat and the inorganic constituents; but at the moment I am unable to find similar analyses relating to black bread itself.

THE WRITER OF THE ARTICLE.

Native Tantalum.

SINCE the communication by Mr. P. Walther regarding native tantalum from the Ural Mountains was published in NATURE of September 16, 1909 (p. 335), another small quantity of a few dekagrams of native tantalum has been recognised in the collection of the deceased mining director, having been collected from the Altai Mountains. It was found in very similar circumstances, and at about the same time, as the tantalum from the Ural Mountains. The difference is in the impurities; the Altai tantalum contains gold from a slight trace to 0·0095 per cent., but no trace of manganese, tin, and niobium could be detected; the latter three have been found in the Ural tantalum. The average percentage of tantalum is 98–99 per cent. The average measurement of the crystals is about 0·1 mm., and the crystals are of the regular system, as in the Ural tantalum. The hardness (between 6 and 7) and the specific gravity (11·2) are the same. The specific gravity mentioned in NATURE of September 16, 1909, has been found too low, the error being due to air bubbles.

Newcastle-on-Tyne. W. VON JOHN.

THE RECENT ERUPTION OF MOUNT ETNA.

EVERY eruption of Mount Etna since 1883 has taken place on its southern slope. The eruption of 1883, which was preceded and accompanied by very severe earthquakes, caused a radial fracture running roughly from north to south, from the central crater to an altitude of 950 metres on the aforesaid slope; but that eruption was abortive, only lasting three days, and forming very small craters and insignificant flows of lava.

The eruption of 1886 took place on the same fracture of 1883, without any severe earthquakes. A large crater was formed, a great mass of lava was expelled, and the eruption lasted twenty days.

The eruption of 1892, on the same fracture of 1883, was preceded and accompanied by a few slight earthquakes; it formed four large craters and other small craters, emitted still more lava than the eruption of 1886, and lasted six months. Thus during these two eruptions it appeared that the lava found a passage prepared, whence its emission was easy.

During the month of April, 1908, there was an eruption on the eastern slope of the Valle del Bove; it was accompanied by a few slight earthquakes, but no raised craters were formed, little lava was expelled, and the disturbance lasted less than twenty-four hours. Evidently this also was an abortive eruption, probably because (as it did not take place on the fracture of 1883) it found no free opening for the emission of the lava, and met instead the unyielding rocks of the higher parts of the Valle del Bove. If we consider only the eccentric eruptions, those which have taken place since 1883 (including the recent eruption, which, as will be seen, is on the same radial fracture as the others), we find the following figures approximately giving the altitudes of the middle of the eruptive areas:—

Eruption of 1883:	altitude	1050 m.		
,, 1886:	,,	1450 m.;	difference	400 m.
,, 1892:	,,	1850 m.;	,,	400 m.
,, 1910:	,,	2175 m.;	,,	325 m.

This suggests, therefore, that successive eruptions break out on the same fracture, but each higher than the last. This is easily explained by the fact that the lava of an eruption, tending to flow down, within and upon the fracture, closes it in the lower part, and leaves it more or less open in the higher, where, consequently, another eruption may be produced more easily.

We now come to the recent eruption. From the early hours of March 23 until 8h. 15m. a.m., the seismographs of the Observatory of Catania registered many slight shocks, which followed one another almost continually. Of those which in the large seismograph had an amplitude ($2a$) greater than 1 mm., there were twelve, the severest of which ($2a=13$ mm.) took place at 2h. 55m. a.m. But even this last shock was not felt by the inhabitants of the villages nearest the place of the eruption, so that it did not raise any alarm. These circumstances, together with the fact of its being night and everyone asleep, prevented anything abnormal being observed on the volcano until 8h. 15m. a.m. At this hour, rising above the mist and above the Piano del Lago, a thin column of steam was seen, widening at the top and taking the characteristic form of a pine (*Pinus italicus*). In fact, a large fracture had been formed, having a length of almost 2 kilometers, from Monte Castello to the western base of the Montagnola, in the direc-

FIG. 1.—Eruption of Etna seen from the heights N.-N.E., April 4, 1910. Photograph by Assistant L. Taffara.

tion of N.N.W., between the height of 1950 metres and 2400 metres, and on the old fracture of 1883.

In the new fracture were a great number of craters, which emitted lava, bombs, incandescent lapilli, and clouds of steam and dust (Fig. 1). At first the lava issued from the highest point, and formed a small stream going towards the south, which had the length of nearly two kilometres, but afterwards the principal emission was from the lower craters, from which a perfect river of molten rock, fifty metres wide, rapidly descended towards the south (Fig. 2). When it reached the east side of Monte Faggi, at a distance of two kilometres from these craters, having found a narrow passage between the above-mentioned mountain and the first lava of 1892, it formed a magnificent fiery cascade, ten metres wide and twenty metres in height (Fig. 3). Then it flowed on towards S.S.W., passing Mount Sona on the east, then towards the south, going through a gorge between Mount San Leo and Mount Rinazzi. Beyond the obstacle formed by this gorge, the rate of movement of the lava-stream diminished, owing in part to the fact that the slope of the ground is less, but the lava spread out considerably; in fact, from the lower craters to the cascade the lava-stream is no more than 100 metres wide, but from the cascade to the gorge above mentioned its width reaches half a kilometre; below the gorge the width even reaches one kilometre.

The depth of the lava varies from a few metres to a hundred metres in some places. The lava reached the lowest point near the Cisterna della Regina, ten kilometres from the new craters, on April 6.

FIG. 2.—Lava flowing from lower craters on Etna. Photograph by Mr. W. Schlatter.

The higher streams continued to flow and extend until April 20, when the flow of lava ceased, and the eruption was at an end. It had, therefore, lasted twenty-nine days. A. RICCÒ.

FIG. 3.—Eruption of Etna on March 29, 1910. Lava fall from S.E. Photograph by A. Riccò.

THE ETHNOGRAPHY OF SOUTHERN INDIA.[1]

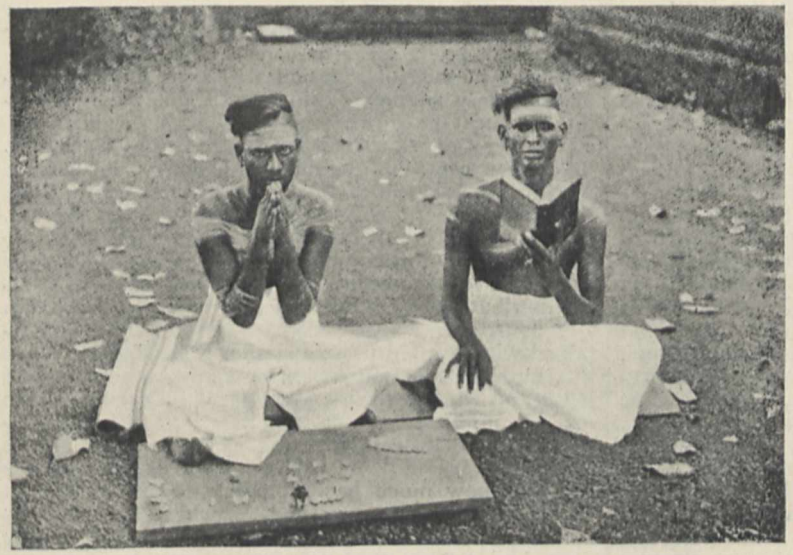
COCHIN has now followed the good example of the neighbouring South Indian States, Mysore and Travancore, in carrying out a survey of its population. The account of the survey, conducted by Mr. L. K. Anantha Krishna Iyer, will ultimately consist of three volumes. The first, devoted to an account of the forest and other low-caste tribes, has now appeared, to be followed by a second describing the higher castes, and a third dealing with physical anthropology. The work is, on the whole, a creditable performance, and it is illustrated by a good series of photographs. More precision in the matter of quotations and references is to be desired. With the last census report of the State the student will now possess ample information regarding the people.

The work is introduced by Dr. J. Beddoe, who discusses recent contributions to Indian ethnology. His note is followed by an essay from Dr. A. H. Keane, in which he propounds his views on the origin of the races of India. Criticising the conclusions of Sir H. Risley, he lays down four principles. First, that there is no fundamental unity in the people, "the superficial uniformity of physical characters being far less than is commonly supposed, and due not to a fanciful primordial unity, but to secular interminglings of several originally distinct ethnical groups superinducing surface resemblances." Secondly, that the assertions of

[1] "The Cochin Tribes and Castes." Vol. i. By L. K. Anantha Krishna Iyer. Pp. xxx+366. (Madras: Higginbotham and Co.; London: Luzac and Co., 1909.)

classical Hindu writers, claiming racial unity, are worthless, being mainly in the interest of the "twice-born" and priestly class. Thirdly, that there are five primary stocks out of which the present population has been formed—Negrito, probably derived from Malaysia; Kolarian, Dravidian, and Aryan, who arrived in the order named from beyond the northern mountain ranges; lastly, the Mongol, now mainly confined to the Himalayan slopes. Fourthly, that three groups, Kolarian, Dravidian, and Aryan, are represented by distinct linguistic stocks, and that hence compound terms, like the Indo-Aryan, Dravido-Munda, and Scytho-Dravidian of Sir H. Risley, are meaningless, if not actually misleading. It is needless to say that, perhaps with the exception of the second, these principles will be disputed by various Indian ethnologists. The fact is that the collections of physical measurements in India itself, and still more from border lands, are at present insufficient for a settlement of these tangled problems.

Among the many interesting topics discussed by Mr. Iyer, perhaps the most valuable is his account of the Oti black magic of the Parayans, by which the adept believes that he can acquire the power of transformation into an animal, of causing and curing disease, and so on. It is, however, unlikely that the sorcerer, being here both priest and intercessor, settles the relation of magic to religion.



The Kanizans' Prayers before Prediction. From "The Cochin Tribes and Castes."

Much information is provided on the subject of the social relations of these outcast tribes. Probably owing to their protection from the inroads of foreign invaders, the Hindus of South India, whose example has been followed by the outcasts, surround themselves with a number of tabus in regard to the pollution by touch, the use of common food, and the like, much more stringent than those which are in force among the northern races. For instance, the Kadars, primitive dwellers in the forests, are contaminated by the touch of a Malayan, a cognate tribe. The educated Madrasi is prone to accuse the Anglo-Indian of race insolence in restricting social intercourse with him, while he himself, in his dealings with the lower tribes, is much more restrictive. Thus even the presence of a Pulayan in a town or market is considered a source of defilement, and "they are shunned as if infected with plague"; the Valan, when on a public road, has continually to call out so that the higher castes may avoid him; a Nayadi pollutes a Brahman by approaching within a distance of three hundred paces, and a priest can purify himself only by renewing his sacred thread, bathing, and consuming the five products of the sacred cow. Mr. Iyer, with some regret, admits that this policy is naturally driving the outcasts into the arms of the Christian missionary, conversion immediately elevating them in the social scale, and placing them on a level with their new brethren. It is clear that if Hindus desire to secure Anglo-Indian sympathy, and retain these people within their religious organisation, they must set their own house in order, and must lose no time in joining the new association, which has received the patronage of the Guicowar of Baroda, and aims at more considerate treatment of the depressed races, of which the present book gives a comprehensive description.

SHEFFIELD MEETING OF THE BRITISH ASSOCIATION.

AS announced already, the British Association will meet this year in Sheffield under the presidency of Dr. T. G. Bonney, F.R.S. Members of the association who have not seen the city since the last meeting there thirty-one years ago will find themselves now quite at sea, so great have been the changes in streets, buildings, growth, and, it may be added, public spirit during that time. It has now been found possible not only to provide ample accommodation for the sectional work, but to do so compactly, all the sections except one being within a few minutes' walk from the reception room. The reception, smoking, writing, and general committee rooms will be housed in the suite of assembly rooms belonging to the Cutlers' Company, which were used in 1879 for the evening soirées. The reception room of that date is now allotted to Section E. The Cutlers' Hall is also close to the tramway centre, and so is easily accessible from all parts of the city.

The evening discourses are to be given in the Victoria Hall, a place easy to speak in and easy to hear in. The Lord Mayor (Lord Fitzwilliam) will give a soirée at the Town Hall, and the Chancellor of the University (the Duke of Norfolk) one at the University. The latter is to be associated with an evening garden-party in the Weston Park, which surrounds the University, to be given by the local committee. A series of garden-parties is being arranged, of which one will be given by Lord and Countess Fitzwilliam at Wentworth. Among others, excursions are already arranged to Chatsworth and Haddon, The Dukeries and Birchinlee, in the heart of the wild Peak country, where huge reservoirs are being constructed for the water supply of Sheffield, Derby, Nottingham, and Leicester. The latter are a portion of the development which is rapidly transforming the district round the Peak into a lake country, the valleys running down from the high moors being dammed to form, in many cases, extremely picturesque sheets of water.

The various committees engaged in making the arrangements are determined to make the meeting a success so far as they are concerned. The scientific success will depend on the association itself. A large attendance of members is expected, not only because

of the local attractions, but because a meeting in the colonies has generally been followed by a large meeting at home. Few places have industries the operations of which afford such interest to visitors. To see an armour-plate rolled or the forging of some huge mass of red-hot metal is a sight for a lifetime, whilst the variety of the industries engaged in some form of steel-making or silver-plating is very great. Arrangements are being made whereby a large number of the more important works will be open for inspection by members.

It is generally supposed that Sheffield is a sort of city of dreadful night, and that it and smoke are convertible terms. This is, however, a complete delusion. Few cities of its size have more delightful suburbs or such picturesque scenery in the neighbourhood. The city stands at the confluence of five valleys, with contributory streams to the Don. The ridges between rise sharply to 900 feet above it, and then run up to the grouse moors, the valleys being each distinctive and well wooded. The near neighbourhood is full of historic and archæological interest. Sherwood Forest is on one side and Little John's grave on the other. The Peak caverns, the beautiful Derwent valley, with Chatsworth and Haddon and the gorge of Matlock, are close at hand, and the whole district is a pedestrian's paradise. It is hoped no member of the association will be deterred from coming by what he has seen from the railways, which in many cases actually pass through some of the large works.

PROF. ROBERT KOCH, For.Mem.R.S.

BY the death of Prof. Robert Koch there goes from amongst us one of the most remarkable men of his time, a man of tremendous determination, great capacity, and indefatigable energy, who has left an impress on the science and practice of medicine such as is made by a few exceptional men only. It would be affectation to say that all his work is of equal value, for although under his hand and mind no subject could remain unaltered, his pioneer work on the isolation and cultivation of bacteria in solid media, his studies in anthrax, and his work on tuberculosis and cholera, must always stand out above any other that he did. The controversial methods of his earlier years, as exemplified by his controversy with Pasteur in 1883, were succeeded by methods of a less pungent, but equally vigorous, character, but his arguments were always respected, even by those who did not agree with him, as those of a man thoroughly in earnest, whilst his utterances could always be accepted as those of a man who had every right, by reason both of experiment and experience, to give full and free expression to his opinions, opinions that must be carefully weighed and considered, especially by those who differ most widely from him.

Born in Klausthal, Hanover, on December 11, 1843, Robert Koch was a member of a large family. His father held some official position in the Department of Mines and Forests. At nineteen Koch commenced his medical studies in the University of Göttingen, at which he worked for five years. After passing his State examination and taking his degree, he became assistant medical officer in the General Hospital in Hamburg. He then engaged in private practice, first at Langenhagen, near Hanover, moving thence to Rackwitz, where he remained until he went as a volunteer surgeon with the army in the Franco-Prussian war. In 1872 he again started private practice, this time in Wollstein, in Posen, where he commenced his investigations and studies on the isolation of pure cultures of bacilli, studies which led to the method of cultivation of bacteria on solidifying media, a method to the use of which we owe many of the most important advances made in the bacteriology of disease.

Up to Koch's time, Salomonsen's and Cohn's methods of isolating single bacteria were the only methods available. Salomonsen mixed a very small number of organisms with a large quantity of blood, and drew the mixture into a series of long, fine glass tubes; then as the organisms grew and used up the oxygen in the blood, little black points made their appearance along the course of the tube. Blood taken from the tube broken at one of these black points was often found to contain a pure culture of a single organism only. This method, of course, could not receive very general application, but as the blood might coagulate in the tube, the organisms could not move about at all readily until the clot was broken down or decomposed by the organisms themselves. Cohn's method consisted in diluting the culture containing the organisms with very large quantities of broth, and then taking a single drop and transferring it to a flask or tube containing broth; in this case the observer trusted to the dilution being so great that a single drop would contain only a single organism. These methods, imperfect as they were, were used by Pasteur and Lister in their investigations, and were brought by them to considerable efficiency.

Koch's method of isolation was exceedingly ingenious but very simple. Taking a nutrient medium containing meat juice or sugar along with certain saline constituents to which had been added from 5 per cent. to 10 per cent. of gelatin, he boiled or heated the mixture several times to 70° C. or 80° C. in order to destroy any germs that might already be present. The material to be investigated was then added to this sterilised nutrient medium whilst still in a fluid condition. The mixture was then well shaken, so as to distribute any organisms that might be present, and poured over a glass plate sterilised by heat contained within glass vessels similarly sterilised. When this nutrient medium cooled down it became a solid jelly and the organisms were fixed in position, each organism giving rise to a colony, so that each organism with its progeny was isolated and could be studied separately. At this date we are apt to lose sight of how much bacteriologists owe to Robert Koch for this simple method, which was devised by him in order that he might study more thoroughly than had yet been done the anthrax bacillus, the bacillus that gives rise to splenic apoplexy in cattle, and to one form of malignant pustule in the human being. By means of this method, too, he was able to isolate and study various organisms found in wound infection and in septicæmias of certain animals, the results of which are given in a paper translated and published in 1880 in the Transactions of the New Sydenham Society. His studies on the production of immunity against anthrax in cattle and sheep were, however, anticipated by Pasteur, who, in 1881, gave his marvellous and striking demonstration at Chartres.

In 1880 Koch was appointed Government adviser to the Imperial Board of Health, and in the laboratories in the Louisenstrasse carried out that series of investigations which ended in the demonstration of the presence of the tubercle bacillus in the diseased tissues of tuberculous animals and in the sputum and tissues of human beings suffering from tuberculosis. Here again his ingenuity and mastery of methods enabled him to do what so many others had failed to accomplish—to stain the tubercle bacillus in the tissues and to isolate and study this organism on artificial media outside the body. As the tubercle

bacillus would grow luxuriantly only at the body temperature, Koch found it necessary to obtain some solid medium that would not melt at that temperature, and, going on the principle that the fluids of the body would probably afford the best nutrient medium for an organism that grows so readily in the tissues, he took the blood serum of sheep, calves, &c., which not only contained the necessary nutrient elements for the bacillus, but was consolidated by heat, and he found that if the consolidation were effected at a sufficiently low temperature, the medium retained most of its nutrient properties. Here again was a tremendous advance, and his paper, read on March 24, 1882, before the Berlin Physiological Society, and published in the report of the Imperial Board of Health, was received with acclamation on every hand, and although criticism of all kinds was directed against his findings, Koch maintained his thesis against all comers. After this work on tuberculosis, Koch was naturally looked to, not only by his own countrymen, but by scientific men of all countries, as the man most likely to solve the questions bound up in the causation of cholera. In 1883 he went out to Egypt on a quest for the *causa causans* of cholera, and in 1884 acted as chairman of the German Cholera Commission, which carried out much of its work in India. His works on cholera, one volume published in 1884 and a second in 1894, must be looked upon as classical monographs, and from 1884 onwards the cholera vibrio, or comma bacillus, became indissolubly associated with cholera as its prime etiological factor.

In 1885 Koch was appointed professor of hygiene in the faculty of medicine in Berlin University, and his classroom and laboratory became the resort of students from all parts of the world, as they had already been at the Gesundheitsamte, though on a smaller scale. His pupils there trained took up many of the problems for the consideration of which he had neither time nor energy. In 1890, at the tenth International Medical Congress, he announced the discovery of tuberculin, and, in a series of admirable experiments, demonstrated the action of tuberculin as an immunising agent, an aid to diagnosis, and even as a curative when injected into animals already suffering from tuberculosis. The announcement of this treatment seemed to give hope of prolonged life to thousands of tuberculous patients, many of whom clamoured to be treated. The method, however, had not been sufficiently fully developed, and there can be little doubt that it fell into disrepute, not because it failed to accomplish what had been claimed for it by Koch, but because it failed to give such results as had taken form in the imagination, alike of patients and of medical men, who could not understand the limitations of such a method of treatment—a method still in its infancy. Those, however, who really studied the tuberculin treatment never lost heart, and in 1897 Koch reported a new tuberculin, with which much more satisfactory curative results have since been obtained. There can be little doubt that some modification of this method must form the basis of any specific curative treatment.

In 1891 Koch was appointed director of the magnificent new Institute for the Study and Treatment of Infective Diseases, and here, with his band of workers, in which were men whose reputation is now world-wide, continued to work out some of the problems in which he was now interested. In 1896 he was called to South Africa to study rinderpest, a disease which, with the assistance of Kolle and Turner, he traced to its cause and for which he devised a method of immunisation. As the result of these observations, on which were built up investigations by later workers, rinderpest has become a manageable disease. At this time Koch first took up the question of sleeping sickness, but, like most other observers, he failed at the outset to find any organism that he could associate causally with the disease. From this he turned his attention to the bubonic plague, studying it in India and German East Africa. Following up the observations of Yersin and Lowson, and tracking down the bacillus of plague, he found that it was really conveyed by rats, and that, however, it was endemic in Mesopotamia, in Hunan in China, in Tibet and Mecca, and in Kissiba, Victoria Nyanza. As a result of his observations, he expressed the hope and assurance that in time these plague centres might be cleansed, and when the reservoirs and carriers of the disease could be localised, plague might gradually be exterminated. How far these prognostications may be realised it is still early to state, but the continuation of this line of research and the tracking down of the flea as a further carrier have undoubtedly brought this period nearer.

In 1901 Koch exploded his great bombshell at the International Congress on Tuberculosis in London when he said, "I feel justified in maintaining that human tuberculosis differs from bovine and cannot be transmitted to cattle." That he wished further evidence, however, is evident from the fact that to this statement succeeds the following:—"It seems to me very desirable, however, that these experiments should be repeated elsewhere in order that all doubts as to the correctness of my assertions may be removed." As regards infection of the human subject by the material from tuberculous cattle, he said:—"I should estimate the extent of infection by the milk and flesh of tuberculous cattle and the butter made of their milk as hardly greater than that of hereditary transmission, and I therefore do not deem it advisable to take any measures against it." It was this last statement to which special objection was made, as it involved such a complete alteration in our method of procedure in connection with milk and milk products from tuberculous cattle. It is not necessary here to repeat what has been now before the public for so long in the Interim Reports of the Royal Commission on Tuberculosis and of the German Commission on Tuberculosis, the Transactions of the International Congress on Tuberculosis at Washington, and many papers by individual workers. Moreover, there seems some reason to believe that latterly Koch had modified his views somewhat, in so far that in his interview with the *Times* correspondent in Berlin during the early part of last year he stated that the "Differences still unsolved between my critics in the Royal Commission and myself have been greatly reduced by further examination, and are now very slight." As shortly before his death Koch was making a very thorough search for the bacillus of bovine origin in cases of pulmonary tuberculosis, it is to be hoped that his colleagues and literary executors will give the world the results of his investigations.

In 1903, still in search of fresh fields to conquer, he returned to South Africa to study on the spot coast fever (allied to Texas fever), a condition due, apparently, to the presence of protozoal parasites in the blood. At this period his investigations were occupying so much of his time that in order to devote himself to them more thoroughly he retired from his position as director of the Institute for the Study and Treatment of Infectious Diseases. In 1905 he was awarded the Nobel prize in recognition of his great services to medicine, an award approved by all.

In 1906, returning to East Africa, he continued his studies on sleeping sickness, especially in relation to its treatment by atoxyl. At one time it appeared as though he had obtained a drug specific for this

disease. It was found, however, that although there was amelioration in the condition of the patient in the early stages of the treatment, the drug soon lost its effect, whilst certain sequelæ, *e.g.* blindness, the results of the action of the drug, led men to be exceedingly chary of using it. In connection with sleeping sickness, Koch, following up Bruce's theory of a living reservoir in which certain parasites might exist without giving rise to any definite and appreciable disease, instancing the wild buffalo, where the parasite is kept alive in its host without apparently doing any damage, but ready to attack non-immunised animals when carried to them by the tsetse fly (*Glossina morsitans*), Koch suggested that the crocodile might be the reservoir host of the trypanosome that gives rise, when carried to the human being by another tsetse fly (*Glossina palpalis*), to sleeping sickness, and he then made the suggestion, afterwards carried out, that the infective zone around certain waters should be cleared of its underwood, and the crocodiles lurking there and in the neighbouring waters killed. Koch also worked at malaria in Java and in the Malay Peninsula. He studied blackwater fever and tried to determine its relation to malaria, or, alternatively, to quinine poisoning contracted during the treatment of malaria.

Koch's last great public appearance was at the Washington Congress on Tuberculosis in 1908, when he announced that he intended to devote the remaining years of his life to the settling of the question that he had raised in London eight years earlier, and everyone hoped that he had some years of useful work before him. These years have been all too few, and we cannot expect that the work he then undertook is finished.

The record of a man's work is his best obituary notice—and in such a case as that now under consideration the writer is relieved of an enormous responsibility—but this notice would be very incomplete did it not contain some record of the honours accorded to him by his fellows, especially those who followed and appreciated his work. Robert Koch was an honorary member of a very large number of learned associations, amongst them of the Prussian Academy and of the Royal Society of London. He had been invested with the Prussian and French Orders of Merit, and with orders of various kinds awarded by the rulers of almost every State in Europe. In some cases these distinctions might mean but little to those who come after us, but, associated with Koch's name, they must ever retain their significance as associated with one of the names on the imperishable roll of the great in science. The death of Robert Koch involves a loss not to Germany only —all mankind is the poorer.

MAJOR PHILIP CARDEW, R.E.

MAJOR PHILIP CARDEW, whose death we record with deep regret, combined a fine mathematical mind with careful scientific training, and a remarkable natural ability in grasping the principles involved in any practical question. He passed through Woolwich Academy with every honour, and started a brilliant career in the Royal Engineers in 1871. He was appointed, in 1883, instructor in electricity at the Military School of Engineering at Chatham, and threw himself with great energy into those innumerable electrical problems which were being so rapidly developed in telegraphy, telephony, electric lighting and power. In 1888 he was selected as the first electrical adviser to the Board of Trade, and he inaugurated the rules and regulations for the use of electricity for public supply and for electric tramways and railways. These rules have formed a model for all countries, and there is very little doubt that the freedom of water and gas pipes in England from electrolysis due to stray tramway currents is the result of the wise restrictions which Major Cardew initiated. The standardisation of electrical units was part of his work.

When Major Cardew retired from the Board of Trade his energies were diverted into the execution of various lighting, power, and traction schemes. Under his personal guidance, every Government dockyard in the British Empire has been equipped with electric power, and numerous electric railways, tramways, and lighting systems originated. He was a prolific inventor, and his vibrator is largely in use in connection with military telegraphs, while the hot-wire voltmeter which bears his name was for years one of the few trustworthy electrical instruments. The Cardew safety earthing device has also been of great value in connection with the public supply of electricity.

Major Cardew contributed a number of papers on electrical subjects to the Royal Society and the Institution of Electrical Engineers.

His death, at the early age of fifty-eight, is greatly to be regretted. He was intimately associated with all the modern developments of electricity, and his experience and advice were much in demand.

NOTES.

IN consequence of the death of King Edward VII., the usual ladies' conversazione of the Royal Society will not be held this year.

AT a meeting of the council of the Royal Society, held on Thursday, May 26, at Burlington House, an address of condolence and homage to His Majesty King George V. was adopted, and the society's seal affixed. At the ordinary meeting of the society, which followed, the address was communicated to the fellows present by the president, Sir Archibald Geikie, who spoke as follows:—"Since the last meeting of the society a great calamity has unexpectedly befallen the country, and under the shadow of that mournful event we now resume our duties. The death of King Edward is a national loss, the full effect and meaning of which cannot yet be appreciated. We, fellows of the Royal Society, share in the universal sorrow that a life so revered, so full of achievement, and with the promise of still many fruitful years, should have been cut short in its prime. But we have also a more personal ground for regret. The late King had been for nearly half a century one of our fellows, and on his accession to the throne had become our patron. Among the many claims which His Majesty had to our regard, not the least was the interest which he always took in the furtherance of that natural knowledge which the Royal Society was founded by Charles II. to promote. In our annals the name of King Edward VII. will always hold an honoured place. The council has approved and sealed an address to His Majesty King George V. in which, while expressing our condolence in the deep grief of the Royal Family, we offer our respectful congratulations on his accession to the throne of his ancestors, and our confident hope that his reign may be long and prosperous." The address was then read from the chair, and was adopted in silence, the fellows present all standing.

AS we go to press, the *Terra Nova* is starting on her journey with the British Antarctic Expedition, and, after calling at a number of places, is expected to arrive at Lyttelton, New Zealand, about October 13. Hitherto Antarctic expeditions have sailed to the south in the latter

part of December, but with the *Terra Nova* it is hoped to penetrate the pack ice at an earlier date than it has been possible for previous expeditions to do, and accordingly the ship will leave New Zealand towards the end of November, and probably reach McMurdo Sound about the end of December. On arrival in McMurdo Sound the western party will be landed, and as soon as the winter station has been established the greater number of the party will proceed to the south to lay depôts. It may be possible to start this party off not later than the third week in January. At the same time, the ship will leave McMurdo Sound and proceed to the eastward to explore King Edward's Land. A small eastern party will probably be left with full supplies and some transport facilities. After landing the eastern party the ship will return to McMurdo Sound, and then proceed to the northward. At the latest this will probably be in the third week of February. If there is coal enough the *Terra Nova* will be directed to investigate the pack in the region of the Balleny Islands, and to proceed to the westward or to the south of these islands. These objects will occupy the ship during the month of March, after which she will be directed to return to New Zealand. The western party, it is hoped, will by the month of April be safely established in the hut, with suitable depôts laid well south of the barrier. During the winter, preparations will be made for an effort to reach the South Pole in the following season. Captain Scott states that he does not propose to start upon the southern journey until the month of October. That month and the following will be spent traversing the Barrier and ascending the glacier. He hopes to reach the upper plateau fairly early in December, and an ideal day for reaching the South Pole would be December 22. Captain Scott will be accompanied by, among others, Lieut. E. R. G. R. Evans, R.N., second in command; Dr. E. A. Wilson, chief of scientific staff; Lieut. H. L. L. Pennell, R.N., magnetic and meteorological work in *Terra Nova*; Surgeon G. M. Levick, R.N., doctor and zoologist; Surgeon E. L. Atkinson, R.N., doctor, bacteriologist, parasitologist; Dr. G. L. Simpson, physicist; Mr. T. Griffith Taylor, geologist; Mr. E. W. Nelson, biologist; Mr. D. G. Lillie, biologist; Mr. W. G. Thompson, geologist; and Mr. C. S. Wright, chemist.

SIR DAVID GILL, K.C.B., F.R.S., has been appointed a Knight of the Prussian Order of Merit. The honour was conferred on Tuesday through the German Ambassador in London, by order of the German Emperor.

DR. W. THOMAS, assistant lecturer in the Liverpool School of Tropical Medicine, has been appointed director of the new laboratories at Manaos, in the State of Amazonas.

THE death is announced, in his sixty-third year, of Prof. W. Rose, emeritus professor of surgery at King's College, London, and author of a number of works on various surgical subjects, including the standard text-book "A Manual of Surgery," of which he was joint author with Mr. A. Carless.

THE Harben lectures will be delivered by Sir W. B. Leishman, F.R.S., professor of pathology in the Royal Army Medical College, London, in the Royal Institute of Public Health, on June 8, 15, and 22, the subject being "Anti-typhoid Inoculation."

THE *Pourquoi Pas?* having on board Dr. Charcot and other members of his expedition to south polar regions, arrived at Guernsey on Tuesday. Dr. Charcot expressed satisfaction with the journey, and said that he had accomplished all that he had expected, and had brought back valuable scientific results, including a large collection of animal remains. Among the geographical results is the charting of land south of the Adelaide Islands.

THE council of the Royal Society of Arts has elected the Hon. Theodore Roosevelt a life member of the society under the terms of the by-law which empowers it to elect annually not more than five persons who have distinguished themselves by the promotion of the society's objects. The first American member of the society was Benjamin Franklin, who was elected in 1755.

THE annual general meeting of the Research Defence Society will be held on Friday, June 3, at 5 o'clock, in the library of the Royal College of Physicians, Pall Mall East, S.W. The chair will be taken by the Earl of Cromer, president of the society. The other speakers will be Sir Richard Douglas Powell, Bart., K.C.V.O., Sir David Bruce, K.C.B., F.R.S., Mr. Anthony Hope Hawkins, and Mrs. Scharlieb.

THE *Times* Geneva correspondent reported that on May 26, at 7.12 a.m., a violent earthquake shock traversed the whole of Switzerland from north to south, touching Bâle, Zürich, Berne, and Geneva. Messages from Paris and Berlin showed that the shock was felt at Belfort, Mühlhausen, Upper Alsace, and parts of Baden. At Freiburg the shock lasted for some seconds. During the previous evening violent thunderstorms visited some parts where the earthquake was recorded.

THE annual meeting of the Selborne Society will be held in the theatre of the Civil Service Commission, Burlington Gardens, on Friday, June 17. After business has been transacted an address will be delivered by Mr. J. Buckland on the traffic in feathers and the need for legislation. The Selborne Society, of which the late Lord Tennyson was, and Lord Avebury now is, president, has recently been developing its work and increasing its activities. During last year it acquired new offices at 42 Bloomsbury Square, in order to form a home for its library and to provide reading and committee rooms.

THE council of the Institute of Metals has appointed a committee to investigate the causes of the corrosion of non-ferrous metals by sea-water, acids, &c., and by other chemical and electrolytic reactions. The members of the committee are:—Sir Gerard Muntz, Bart. (chairman), Prof. H. C. H. Carpenter (secretary), Captain G. G. Goodwin, R.N., Prof. A. K. Huntington, Mr. J. T. Milton, Mr. A. Philip, Mr. L. Sumner, Prof. T. Turner, and Sir William H. White, K.C.B., F.R.S. The committee has decided, in the first instance, to confine its attention to the question of the corrosion of condenser tubes in marine engines and in stationary engines using foul water, or being subject to violent electrolytic action, such as often occur in electric power stations.

MANY members of the British Association will learn with regret of the death of Mr. Alfred Colson, who was chairman of the executive committee and local honorary secretary for the meeting of the association at Leicester in 1907. Mr. Colson was a past-president of the Institution of Gas Engineers, and also of the Leicester Literary and Philosophical Society. His work as the gas and electric light engineer of the Leicester Corporation will remain a permanent memorial to his adaptability and technical knowledge, and his great organising powers will be remembered by all who were present at the Leicester meeting of the British Association.

THE Board of Education has been informed through the Foreign Office that the second session of the seventeenth International Congress of Americanists will be held at Mexico City on September 8–14. The sessions will be held in the lecture hall of the National Museum in Mexico City. An organising committee has been formed, the president of which is Sr. Lic. D. Justo Sierra, Secretary of Public Instruction and Fine Arts for the Government of Mexico. Communications to the congress, which may be either oral or written, may be made in English, French, German, Italian, Portuguese, or Spanish. The congress will deal with questions relating to the ethnology, archæology, and history of the New World. For further information application should be made to the general secretary of the organising committee, Sr. Lic. D. Genaro Garcia, Museo Nacional, Mexico, D.F.

WE regret to see the announcement that Prof. Emil Zuckerkandl died on May 28, in his sixty-first year, at Vienna, where he had occupied the chair of anatomy for nearly thirty years. He was well known to anatomists for his many and varied contributions to human and mammalian morphology. He was trained under Hyrtl and Carl Langer, and acted as prosector in the University of Vienna until he was called to fill the chair of anatomy at Gratz in 1887. His best known work, on the anatomy and diseases of the nasal cavities (1882–92), is one which will remain an authoritative memoir for many years to come. His numerous monographs on the arterial system and on the morphology of the brain, especially of the ape and marsupial, are based on elaborate and patient observation, but somewhat prolix, and unrelieved by wide and happy generalisations. It is rather his contributions to the more medical and practical side of human anatomy that will prove of permanent value. He was successful in maintaining the world-wide reputation which Hyrtl and Langer and other previous occupants of his chair had won for the Anatomical School of Vienna.

MR. MICHAEL CARTEIGHE, whose death occurred at Goring-on-Thames on May 30, was for fourteen years president of the Pharmaceutical Society of Great Britain. He received his pharmaceutical education at the School of Pharmacy, and also studied at University College, London, where he became demonstrator in chemistry under Prof. Williamson. While at University College he took part in some important chemical and physical researches, one of the most notable being an investigation of the electrical conductivity of alloys, wherein he was associated with Drs. Matthiessen and Holzmann; the results of the work were embodied in a paper which was read before the Royal Society. Circumstances decided him not to pursue a scientific career, and he joined his brother, who was a partner in the pharmaceutical business of Messrs. Dinneford and Co., and on the death of his brother he became sole proprietor. He first became a member of the council of the Pharmaceutical Society in 1866, and assisted in the drafting of the Pharmacy Act of 1868, by which the sale of poisons was restricted to registered chemists and druggists, and the practice of pharmacy placed on a more or less regular basis. For many years he was a member of the society's board of examiners. From 1882 to 1896 he held the office of president, and his endeavour throughout that period was to place the educational standard of pharmacists on a higher plane, for he realised the force and wisdom of the policy of the founders of the society, namely, that the foundation of effective organisation was education in its widest sense; his efforts were largely devoted to securing for the society a position among the recognised technical and scientific institutions of the country. With his period of office are associated radical improvements in the society's school, the development of the library and museum, and the foundation of the research laboratory. Notwithstanding the amount of time he devoted to the Pharmaceutical Society, Mr. Carteighe found opportunities for work in other directions; he was one of the founders of the Institute of Chemistry, of which he was for many years a vice-president. He was also a vice-president of the Society of Arts during several years, was one of the most prominent members of the British Pharmaceutical Conference, and was for forty years a member of the Royal Institution. Mr. Carteighe was in his sixty-ninth year.

A DESCRIPTION of the Mitsu-Bishi Dockyard and Engine Works appears in *Engineering* for May 20. These works are among the oldest and largest in Japan, and are situated at Nagasaki and at Kobe. The completeness of the equipment will be understood from the fact that the company is capable of producing, without subcontracting, not only every type of ship, machinery, and boilers for land and marine use, but also of steel girders, steel buildings, electrical machinery, Parsons marine steam turbines and turbo-generators, Stone's manganese-bronze castings, and Morison's "Contraflo" condensers. The company is one of the most important exhibitors at the Japan-British Exhibition at Shepherd's Bush. It is of interest to note that, both in the Nagasaki and Kobe works, the specification and wording in drawings, books, forms, orders, &c., in fact, every writing in the establishment, are in English, besides a greater portion of the correspondence. It is curious to notice a workman carrying out the work to the letter with a drawing worded entirely in English, although he is not able to quote a simple intelligible sentence.

IN a paper on steel testing read at the Institution of Mechanical Engineers on Friday, May 27, by Mr. B. Blount, Mr. W. G. Kirkaldy, and Captain H. Riall Sankey, comparisons are made of the tensile, impact-tensile, and repeated bending methods of testing. In the impact-tensile method the specimens were not notched, as is more usual in other impact tests, and were attached to a tup arranged to fall freely through a height of 30 to 40 feet. The tup was of adjustable weight, and was attached to the lower end of the specimen, a cross-head being fixed to its upper end. After falling a measured height the cross-head is arrested by coming into contact with the top faces of a split anvil; the specimen is broken, and the tup continues its fall between the two parts of the anvil. The breaking of electrical contacts during the fall enables the energies at impact and after impact to be deduced, and hence the energy utilised in breaking the specimen. In this method the whole of the material in the cross-section under observation is brought simultaneously under the influence of the impact stress. Three test-pieces of each type of steel were broken by this method, and the readings agree fairly well as regards the energy absorbed by the rupture. The average disparity from the mean is about 6 per cent. The readings of elongation and contraction of area are also in good agreement.

THE old myth of the occurrence of live frogs and toads enclosed in blocks of stone or of coal is not yet dead, but ever and again shows signs of life in the way of vigorous assertion of supposed cases of the phenomenon. We have received a communication from a resident in Leicestershire in which the writer states that, while recently breaking a lump of coal, "from the centre a live half-grown toad fell

out on its back. I called the attention of my neighbours to it, and I thought it was dead; but in a few minutes it began to move about, so I took care of it, and have it now as well as the piece of coal. There is the cavity in the coal where it laid. I can vouch for its genuineness. Is it of any value as a curio to naturalists or geologists? I have had several amateurs to see it" It matters little to tell the reporters of such occurrences that the thing is absolutely impossible, and that our believing it would involve the conclusion that the whole science of geology (not to speak of biology also) is a mass of nonsense. Why that is so it would be difficult to make them understand, for at present, with the exception of the comparatively few professional and amateur geologists, the general public, even some of the most educated, are as ignorant of the most elementary facts of geology as they are of the Chinese language. All popular beliefs, however, rest upon some basis of fact, though the facts may be imperfectly observed and erroneously interpreted. The true interpretation of these alleged occurrences appears to be simply this—a frog or toad is hopping about while a stone is being broken, and the non-scientific observer immediately rushes to the conclusion that he has seen the creature dropping out of the stone itself. One thing is certainly remarkable, that although numbers of field geologists and collectors of specimens of rocks, fossils, and minerals are hammering away all over the world, not one of these investigators has ever come upon a specimen of a live frog or toad imbedded in stone or in coal. Why are these alleged occurrences testified to only by those having no knowledge of geology, and, indeed, for the most part by uneducated workmen? It would indeed be an epoch-making event in the history of science if, for instance, a member of the Geological Survey should lay before us a genuine case of a live frog enclosed in stone!

To the May number of the *Psychological Review* Miss June E. Downey contributes a paper on the determination of sex from handwriting. She concludes from her investigations "that it is possible to determine sex from handwriting in perhaps eighty cases out of a hundred." She finds that "the presence or absence of the so-called sex-signs is . . . influenced largely (1) by the amount of writing done; (2) by age and consequently, to a certain extent, by practice; (3) by professional requirements such as shown by the conventional writing of grade teachers and the rapid hand of bookkeepers." The writing of two hundred persons was examined in this investigation, being submitted to "two professional graphologists and to fifteen persons ignorant of the art of graphology. . . ." A considerable number of the two hundred persons whose writing appears in the series are known to have been educated wholly in co-educational schools in America.

MR. G. W. LAMPLUGH, F.R.S., sends us an interesting article (reprinted from the *Naturalist*) entitled "Man as an Instrument of Research," which formed his recent presidential address to the Hertfordshire Natural History Society. We quote the following paragraphs:—". . . first, to learn rightly to understand the evidence of the senses; and next, to learn to convey what has been gathered from them in unmistakable terms, are the indispensable qualities in the equipment of man as an instrument of research. . . . Unless . . . we qualify not only as observing, but also as recording instruments, the new knowledge we may have acquired remains merely personal. . . . I suppose that one of the chief difficulties experienced by everyone using language for the description of phenomena is that the observed facts form, as it were, an entangled mass, with innumerable threads, interlacing, converging, diverging around their common centre in all directions; whereas their expression in language necessitates that the corresponding ideas shall be spun off in linear sequence on a single plane."

IN a paper recently read before the Royal Philosophical Society of Glasgow, Prof. G. Elliot Smith discusses the evolution of the practice of mummification in Egypt. It originated from the experience gained of the desiccation of the corpse in hot dry sand. The activity of the grave-plunderer even in pre-dynastic times necessitated adoption of precautions to secure the safety of the remains, and the discovery of the use of copper led to the invention of the coffin, the sarcophagus, and the rock-cut tomb. The abundance of salt and soda, and the use of resin by women for cosmetics, suggested the custom of embalming. The difficulty of accepting this explanation has hitherto lain in the late date assigned to most existing mummies, none of those in the Cairo Museum being older than the last king of the seventeenth dynasty (*circa* B.C. 1580); but much older mummies have recently been traced. One of the time of Snefru was found by Prof. Flinders Petrie near the Medum Pyramid in 1891, and was examined by Prof. Keith (NATURE, 1908, p. 342). The date of this specimen has now been fixed by Dr. G. A. Reisner about 2700 B.C. (NATURE, March 31, p. 136). It is thus more than eleven centuries older than the other examples, and justifies the belief in the early adoption of the practice of mummification in Egypt.

THE *Zoologist* for May is largely devoted to the habits of animals, Mr. B. F. Cummings contributing the first portion of an article on the formation of useless habits in British newts, as observed in specimens in captivity, and Mr. E. Selous continuing his observations on the nuptial habits of the blackcock.

DR. W. E. HOYLE has sent us a copy of a list of the generic names of the dibranchiate cephalopods, with their typical species, published in vol. xxxii. of the *Abhandlungen der Senckenbergischen Naturforschenden Gesellschaft*, forming the "Festschrift zum Siebenzigsten Geburtstag von Wilhelm Kobelt."

TO vol. xxxii., Nos. 2 and 3, of *Notes from the Leyden Museum*, Dr. E. D. Van Oort contributes a long list of birds from western Java and Krakatau, among which a Gerygone is described as new. Later on Dr. E. Hartert expresses the opinion that Passerina, in place of Plectophenax, should be used as the generic title of the snow-buntings, while Dr. Van Oort maintains precisely the opposite. This scarcely looks like the attainment of that uniformity in nomenclature of which so much is from time to time heard.

ACCORDING to the *Field* of May 21, a correspondent of the *Baltische Waidmannsblad* states that before the Russians came to the province of Ussuri the tiger was literally king of the forest in that district. The natives, Chinese and others, as well as the immigrant Coreans, looked upon the animal as a god. If any of them met a tiger there was no question of resistance or fighting; the man threw himself on his knees and allowed himself to be killed if the animal attacked him. When domestic animals were seized, the owner looked quietly on. Generally it was the Chinese who risked their lives when they went to the forest to collect shed deer antlers or roots of the gusing plant for medicinal purposes. They fell easy victims to the tigers, which at that time frequented the immediate neighbourhood of Vladivostok, where the primeval forest remained dense and almost impenetrable. Gradually the Russians settled in these tracts, and the first thing they

did was to clear away the trees in order to cultivate the land. This checked the tigers, and not only did the white man defend himself with courage when attacked, but became the aggressor. The tigers came to distinguish between Chinese and Coreans on the one hand and white men on the other, and, unless circumstances prevented, avoided the latter.

A USEFUL "Catalogue of Nearctic Spiders," by Mr. Nathan Banks, has lately been issued as Bulletin 72 of the United States National Museum. It includes more than 1300 species, and the author anticipates that at least 2000 will be recognised "when the west and south are explored as thoroughly as New England now is." The arrangement followed is on the whole that of Simon's "Histoire naturelle des Araignées." It is of interest to note that a large proportion of genera and a small proportion of species are common to the European and North American faunas. The inclusion of the southern States in the "Nearctic Region" leads to the appearance of some characteristically tropical spiders, such as the large Theraphosidæ, but there is no information as to the distribution of northern species in Canada.

OF the various agricultural students' publications, few are more interesting than the Proceedings of Armstrong College Agricultural Students' Association. The current issue (part ii., vol. ii.) contains a paper by Dr. Stevenson on Aberdeen Angus cattle, their breeding and management, and a very readable essay by Mr. Walling on a typical north Devonshire farm. The association encourages its members by the offer of prizes to prepare papers on agricultural subjects, and to carry out agricultural experiments. The membership during the past year is stated to have been 130.

THE prospects of vanilla-growing in the West Indies are discussed in a recent issue (No. 204) of the *Agricultural News*, the problem having arisen because of the recent rise in price of vanilla. Hitherto there has been some fear, not altogether unfounded, that the synthetically prepared vanillin would drive the natural product out of cultivation, but since the passage of the American pure-food law has necessitated a declaration of the materials used, it has been found that people prefer the natural vanilla, the sale of which is said to have increased in consequence. It appears that the general production and consumption are both increasing, but only in the French colonies is there any immediate likelihood of over-production. The reports from various markets which are summarised in the article seem to be favourable on the whole.

MR. J. W. SMALL has recorded in the *Ceylon Observer* the occurrence of a cocoa-nut palm at Jaffna, Ceylon, with sixteen branches arising near the base of the plant. A similar instance, but with only five branches, is described by Dr. S. Pulney Andy in the Transactions of the Linnean Society, Botany, xxvi., 661. A list of branched specimens of Cocos is given by Morris in the Journ. Linn. Soc., xxiv., 1892, 294, in a paper on the occurrence of branching and forking in palms. Ridley, in the *Annals of Botany*, xxi., 45, and xxiii., 338, enumerates nineteen genera of palms in which branching of the stem takes place, and states that this occurs most commonly in *Cocos nucifera*, although the percentage of branched trees is not large. In most cases the branching appears to be due to the development of lateral buds, and the rapidly growing shoots so produced soon equal in size that from which they originated. It has been stated, though not clearly proved, that the destruction of the terminal bud by insect or other agency may be followed by the production of lateral buds. No instance of branching in monocarpic palms has been recorded.

A PAMPHLET on the origin of typhoons has been prepared by Mr. J. I. Plummer, chief assistant, Hong Kong Observatory. The author points out that although his paper has not received the imprimatur of scientific opinion, it is at least the outcome of twenty years' experience of typhoons, with exceptional means for their examination. Much still requires to be known about the tracks followed by such storms, the cause of their re-curvature, rate of translation, and frequency. They have been under special observation in the vicinities of Mauritius, Bay of Bengal, Eastern Archipelago, south-east of China, and West Indies. Their frequency varies considerably in these localities; in the Bay of Bengal and the West Indies the storms, the author states, appear to be more noted for their severity than for their number, while the northern part of the China Sea appears to be more troubled by them than any other portion of the globe. Among the main conclusions drawn are, (1) that although the open sea is the point where they become appreciable, the earliest beginnings of typhoons must be sought for on land; (2) that one typhoon is never the cause of another; if several proceed from a limited area within a few days, they are caused by separate impulses; (3) that a typhoon, once formed, does not tend to coalesce with another, but rather repels it, with the result that one becomes intensified at the expense of the other.

IN the second number of the Bulletin of the Calcutta Mathematical Society (1909), recently received, Prof. C. E. Cullis continues his discussion of Möbius's cubic surface, the nature of which was explained fully in the first number. In addition to several other original papers, a translation is given of the late Prof. H. Minkowski's address on space and time, and the notes, abstracts, and lists of current literature render this second number as valuable a book of reference to the mathematician as its predecessor.

AN interesting new "record" in connection with the possibilities of microscopic vision is mentioned in the Journal of the Royal Microscopical Society (April) by Mr. Edward M. Nelson. In 1898 Mr. Nelson observed, for the first time, tertiary markings on the diatom *Coscinodiscus asteromphalus* mounted in realgar in a slide of "Nottingham" deposit. Although he has tested hundreds of objectives with a balsam mount of the same diatom, it has been found impossible to resolve the tertiaries in this medium until a month or two ago, when a new Zeiss's long tube $\frac{1}{8}$ apochromatic of numerical aperture 1·4 rendered them conspicuous. A comparison of this test with the previous ones leads the author to assert that the new lens marks a distinct advance on its predecessors.

UNDER the title "The Most Curious Craft Afloat," Dr. L. A. Bauer gives in the March number of the *National Geographic Magazine* (Washington) an interesting popular account of the work of the non-magnetic yacht *Carnegie*. The article is well illustrated from photographs taken by various expeditions sent out by the Carnegie Institution of Washington, and some of the illustrations enable one to appreciate very thoroughly the difficulties of magnetic survey work in the remote parts of Canada, India, and China.

SEPARATE copies have reached us of several papers which the staff of the Reichsanstalt at Charlottenburg have communicated to the "Annalen der Physik" during the last six

months. Amongst them are two which deal with the saturation pressure of water vapour at temperatures outside the range 50° C. to 200° C., covered by the experiments of Drs. Holborn and Henning in 1908. The first paper, by Drs. Scheel and Heuse, deals with temperatures between 0° C. and 50° C. They use the static method, measuring the temperature by a platinum thermometer and the pressure by the modified mercury manometer we noticed in these columns some time ago. The second paper, by Drs. Holborn and Baumann, deals with the range from 200° C. to 376° C. Temperatures were measured by the platinum thermometer, pressures by a weighted piston moving in a brass cylinder. Except at the highest temperature the three sets of measurements can be represented by formulæ of the type suggested by Thiesen,

$$i.e.\ (t+273)\log\frac{p}{760}=a(t-100)-b\{(365-t)^4-265^4\},$$

where a and b are constants.

MR. W. P. SEXTON informs us that the value of the specific heat of the first four molecules of water of crystallisation in copper sulphate given by him in his note to the Faraday Society, referred to in NATURE of May 5 (p. 292), should have been 0·449, and not 0·499, as stated in our report.

THE issue of *The Central* for April is a memorial number dealing with the life and work of the late Prof. W. E. Ayrton, F.R.S. The number contains two memoirs by Mr. Maurice Solomon and Prof. T. Mather, F.R.S., respectively, and is illustrated by four portraits of Prof. Ayrton at various ages. A list of Prof. Ayrton's scientific publications completes the number.

THE first parts of two new works dealing, respectively, with "Our Canaries" and "Cage-bird Hybrids," have been received from the office of *Cage Birds*. The works will be published in monthly parts, price sixpence each, and will provide keepers of canaries and breeders of canary mules and British bird hybrids with full details relating to the selection, breeding, and general management of these cage birds, either for pleasure or profit. Coloured plates and other illustrations add to the attractiveness of each work.

THE Sleeping Sickness Bureau, under the direction of its honorary managing committee, has issued a revised edition of its brochure entitled "Sleeping Sickness: How to avoid Infection." The pamphlet is for the use of travellers and residents in tropical Africa, and gives an account of *Glossina palpalis* and illustrations of this and other biting flies. Much useful information is provided as to places where persons are liable to be bitten, and the steps to be taken to abolish and to prevent the spread of the fly.

A COPY of the report of the Indian Association for the Cultivation of Science for the year 1908, which was published in Calcutta last year, has just been received. One of the chief activities of the association is the arrangement of lectures on scientific subjects, and we notice that 286 were given under the auspices of the association during 1908. The association also conducts a chemical laboratory, where students are encouraged to follow systematic courses of work, and arranges for regular meteorological observations to be taken at its observatory and for their publication. The finances of the association appear to be in a flourishing condition. In fact, the officers may be congratulated upon the useful work which is being accomplished under their guidance.

OUR ASTRONOMICAL COLUMN.

THE SOLAR CONSTANT.—In No. 4, vol. xxxix., of the *Memorie della Società degli Spettroscopisti Italiani* Dr. Gorczynski discusses the pyrheliometric observations of the solar constant made at Ursynova (Polonia) during 1909. The value obtained was 2·05 gr. cal./cm.^{2} min., and, from a discussion of the values obtained at various observatories by different methods, Dr. Gorczynski concludes that this value is very near the truth.

ORIGIN OF BINARY STARS.—In No. 3, vol. xxxi., of the *Astrophysical Journal* Prof. H. N. Russell discusses the origin of binary stars from the point of view that they are produced by the fission of rotating masses. He deduces the conditions of such a mass which would precede and follow the process of fission, and also shows that the available data derivable from existing systems are in accordance with the theory. Finally, Dr. Russell concludes that whilst the development of nuclei in the original nebula must be invoked to account for the formation of star clusters, it is more reasonable to suppose that binary systems have been produced by fission.

THE ASTRONOMICAL SOCIETY OF ANTWERP.—The annual report, for 1909, of the Société d'Astronomie d'Anvers contains a record of much, extremely useful, service performed in the popularisation of astronomy. Popular lectures in French and Flemish were given by various members of the society, and were free to all; further, they were well attended. There is a project on foot to obtain facilities from the town authorities for the erection of a larger observatory, and it is expected that the object will be attained during the present year; the society could then do more than ever to spread the study of the heavens.

The interest in, and general ignorance concerning, Halley's comet displayed by English crowds during the past few weeks engender the wish that more could be done for popular astronomy in England, and the present moment seems favourable; but it could probably only be done by the private munificence of some friend of science. There can be no two opinions as to the urgent need for popular instruction in the oldest of the sciences.

OBSERVATIONS OF HALLEY'S COMET.

THERE is little more to record of Halley's comet yet; as a popular spectacle, in England, its appearance has been somewhat of a failure, and we shall have to wait some little time before the results obtained by astronomers in different countries are available. Some amount of resentment has been expressed in the popular Press at the feeble appearance of the famous comet, but it should be clearly understood that it is our hazy summer skies and the brightness of our northern twilight that are to blame. In a letter to Prof. Turner Mr. Knox Shaw, of the Helwan Observatory, describes it as really a glorious sight, about May 11, far exceeding in its glory comet 1910*a*; it then had a straight tail 38° long. Yet at Helwan there were only three fine nights during the first fortnight in May.

With his note in No. 20 of the *Comptes rendus* (May 17) M. Esclangon gives four diagrams showing the progressive development of the nucleus and its appendages between February 13 and May 11. On the former date the nebulous head was nearly circular, but the ill-defined nucleus had already two embryo extensions, which gave it a triangular appearance. On April 27 the head was parabolic, with the nucleus a little behind the focus, and two jets forming a broad **V** streaming behind; there was also a bunch of rays issuing in the shape of a fan towards the sun. On May 10 this aigrette was larger and better defined, having an angle of 70° and a length of about 30″, but the two rear streamers were not so definite. Up to this time the aigrette had appeared to be symmetrical with regard to the axis of the comet, but on May 11 it was appreciably displaced, the angle between the axes of the aigrette and of the comet being some 20° or 30°. M. Esclangon suggests that this observation might indicate an oscillation of the aigrettes such as was noted during the apparition of 1835. He also remarks upon the great length of tail, which on May 16 was about 65°, corresponding to an actual length of 0·20 astronomical unit.

The observations of M. Borrelly, recorded in the same number of the *Comptes rendus*, indicate what a splendid object the comet has appeared to those situated in a favourable atmosphere. "Very beautiful," "superb," and "magnificent" are the descriptions applied to it as seen at the Marseilles Observatory. The observations extended from April 16 to May 13, and many changes were noted; on April 23 it was seen that the nucleus had a very pronounced red tint. On May 4 the comet was as bright as Markab, and the tail was 15° long. A sudden transformation took place on May 13, when, for the first time, a bright, straight streamer was seen to issue from the rear of the nucleus, dividing, medially, the rectilinear tail, which then had a length of 43°; the extremity of this tail was about as bright as a sixth-magnitude star, and was situated, approximately, in the position R.A. 22h. 6m., dec. +6°; the comet was still visible in daylight.

In order to escape the disadvantageous conditions obtaining in Britain, Prof. George Forbes took a sea trip from Swansea to Savona, and was rewarded by some splendid views of the comet, which he describes in the *Times* for May 31. The observations commenced on May 15, and the head of the comet was never seen, but on May 18 a tail extending for 100° was watched from 2 a.m. until 5 a.m.; this was in long. 9° 38′ W., lat. 38° 54′ N. On May 15 the 30° tail was about as bright as the Milky Way, but the next morning it was fainter; at times, however, it appeared to brighten. The morning (3 a.m.) of May 17 found it again much brighter for fully 50°, and it could be distinctly traced for a distance of 70°. The tail was perfectly straight, and narrowed down towards the extremity furthest from the sun; across its width its brightness appeared to be quite homogeneous, there being no dark shade along the axis and no rifts. As compared with the tails of Donati's and Coggia's comets it was, so far as Prof. Forbes's memory goes, much brighter and of a much greater length. On May 18 the tail was much widened at the root, where the brightness appeared to be concentrated; the narrowing from root to tip appeared to be more accentuated, and the position of the axis among the stars had not altered from the previous day.

According to Prof. Forbes, the earth was in the tail of the comet on May 19, and, from 2.30 to 3 a.m., a brightening near the horizon and an illumination of the dark edges of dense, black, cumulus clouds were seen by him and by the ship's officers. This was long before any trace of dawn could appear, and all the observers agreed that these peculiar phenomena must be due to light from the comet's tail; the ship was then in long. 7° 54′ W., lat. 36° 36′ N. The same phenomena were repeated on the following morning. It should be noted that at the time of writing his notes (May 24) Prof. Forbes had not seen any reports, concerning the cometary observations, since the S.S. *Kinsale* left Swansea on May 13.

In a letter received from Mr. G. W. Grabham, dated Khartoum, May 19, the writer remarks how feeble the accounts of British observations of the comet appear to one who has observed it in lat. 15° 36′ N. He first saw it on April 19, when it was a conspicuous object, with a tail broad in proportion to its length. With field-glasses he could make out some 2½° or 3° of tail, and beyond that there was a faint glow extending about 2° further. A letter sent by Mr. Grabham to the *Sudan Times* caused a number of people to wait up for the comet, and it was easily seen by many on subsequent mornings, until it became more difficult owing to bright moonlight. After the moon waned it was quite a striking object, and, on the mornings of May 12 and 13, its tail stretched halfway to the zenith. An article on the comet, written by Mr. Grabham, appears in the *Sudan Times* in both English and Arabic.

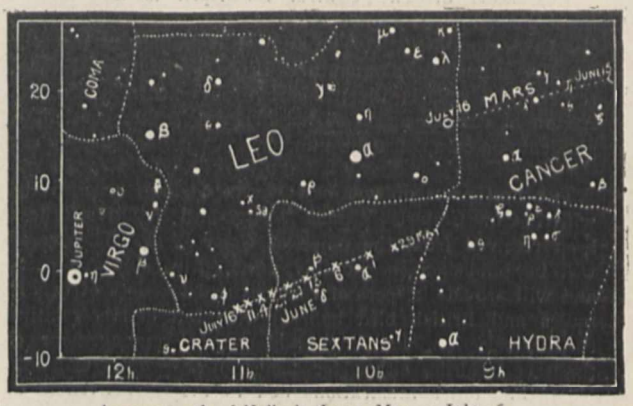
Mr. Leach also sends us a further report and a drawing of the comet as seen with field-glasses on May 20, at 7.45 p.m., at Malta. On May 17 and 18 the comet was well seen, except the head, which was eclipsed by a searchlight beam from the forts; but the tail was seen, and, on the latter date, extended to a distance of about 95°. The sketch made on May 20 shows the nucleus surrounded by a misty halo which has the shape of a pair of horns, with the nucleus on the forehead. On May 21 about 20° of tail was seen, but this faded as the moon got brighter, and on May 22, 23, and 24 the comet was seen without any signs of a tail.

A number of notes on the comet appear in No. 21 (May 25) of the *Comptes rendus*. M. Eginitis records the observations made at Athens on May 18 and subsequent days. On the morning of May 20 the tail was seen in exactly the same position as the previous night, and in the evening was seen, in the telescope, as turned towards the sun. On account of its curvature it was not seen in the east on Saturday morning (May 21), but in the evening was seen turned towards the east. M. Eginitis is of the opinion that the earth's passage through the tail was either greatly retarded or did not take place; nor were any signs of the head apparent as it transitted the sun's disc.

M. André reports that the preparations for astronomical observations of the passage were rendered nugatory by clouds, and that the electrometers and magnetometers recorded no abnormal action.

Acting upon M. Guillaume's suggestion, M. Georges Claude attempted to trace cometary matter among the residual inert gases left from the liquefaction of air. With his apparatus at Boulogne-sur-Seine he is able to treat 350,000 litres of air per hour, and to detect the presence of one-millionth part of any extraordinary gas. Experiments carried out on May 17 (4 hours), 19 (9h. to 12h., Paris M.T.), 20, and 23 failed to reveal any difference of density in the residue greater than the probable error of observation.

MM. Angot, Lebel, and Limb and Nanty, all report slight electric and magnetic disturbances registered at their observatories during the computed time of the earth's passage through the tail of the comet; but in no case was the disturbance extraordinary, nor could it be attributed to any abnormal condition produced by the comet.



Apparent path of Halley's Comet, May 29–July 16.

The following is a further extract from the daily ephemeris published by Dr. Ebell in No. 4411 of the *Astronomische Nachrichten*:—

Ephemeris for 12h. Berlin M.T.

Date	α (true) h. m.	δ (true) ° ′	Date	α (true) h. m.	δ (true) ° ′
June 2 ...	10 0 4 ...	+1 34·2	June 26 ...	10 43·0 ...	−2 20·1
,, 6 ...	10 13·7 ...	+0 23·1	,, 30 ...	10 46·7 ...	−2 41·8
,, 10 ...	10 22·6 ...	−0 25·4	July 4 ...	10 50·1 ...	−3 2·6
,, 14 ...	10 29·2 ...	−1 1·8	,, 8 ...	10 53·3 ...	−3 22·8
,, 18 ...	10 34·5 ...	1 31·5	,, 12 ...	10 56·4 ...	−3 42·8
,, 22 ...	10 39·0 ...	−1 57·0	,, 16 ...	10 59·5 ...	−4 2·9

The estimated magnitudes decrease from 1·0 on June 2 to 4·6 on July 16, while the distance from the earth increases from 52 to 197 millions of miles.

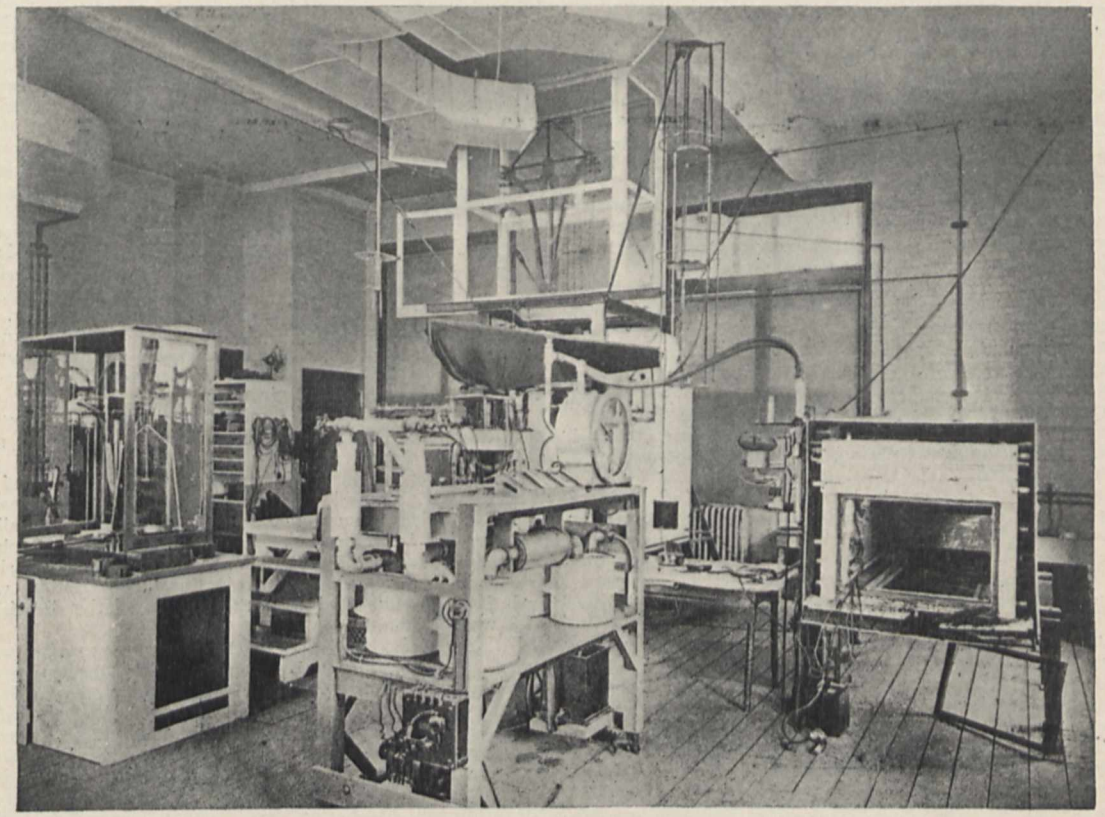
The apparent path among the stars is shown on the accompanying chart, but owing to its increasing apparent proximity to the sun and its decreasing magnitude the comet will be observed with difficulty during the later part of the ephemeris. The planets Mars and Jupiter are also shown, but Mars will set at about 10 p.m. on June 25 and about 2½ minutes earlier each succeeding day, whilst Jupiter sets at about midnight at the end of June.

A NUTRITION LABORATORY.

ATWATER'S development of apparatus for the exact measurement of the heat given off by the human body under varied conditions of food-supply and activity is well known. Prof. F. G. Benedict, who cooperated with Atwater, has continued similar observations as director of the Nutrition Laboratory in Boston, which is devoted exclusively to work of this type, and is well endowed by the Carnegie Institute for that purpose. The calorimeter equipment of this new laboratory, as described by Benedict and Carpenter in a recent publication,[1] affords remarkable evidence of the value that may be secured by giving a mature investigator a free hand in the organisation of means for furthering standard research of the type in which he is most interested.

Two "respiration calorimeters," shown in the accompanying photograph, have been constructed, and are in use for observations upon subjects of different physiques and different conditions of health continued over periods of several hours. Others are being constructed for more prolonged observations, occupying days, under varied conditions of rest and work. In their construction a rare amount of successful attention to minute detail has secured perfect instruments showing at every point substantial improvements upon the original pattern. As tested by the combustion of known quantities of ethyl alcohol within these chambers, the errors in estimating the amount of oxygen consumed, the carbonic acid and water vapour given off, and the output of heat, have been reduced to less than 0·5 per cent. The tests were made with the apparatus arranged as for an actual experiment, and the difficulties surmounted may be gathered from the fact that, through the "closed circuit" formed by the calorimeter chamber and a series of water and carbonic acid absorbers, 75 litres of air are driven per minute over periods of hours without leakage of material or of heat. The heat issuing from the subject is carried out of the chamber along one definite channel by a stream of water traversing a "radiator system" within the chamber, and is accurately measured by weighing the escaping water and observing its temperature increment. The ingenuity displayed in modifying known thermometric methods in the interests of these observations, and in obtaining continuous records of temperature differences, is in itself remarkable.

In the accompanying illustration are shown some of the internal fittings of the large constant temperature room in which the calorimeters are housed, the "oven-like" structure on the right being the "bed-calorimeter" into which a recumbent patient is inserted upon a stretcher. In the background is the "chair calorimeter," into which the subject enters by the roof, and in the foreground are placed the absorber systems and large balances used in measuring their increments of weight.



General View of the Calorimeter Room in the Nutrition Laborato y in Boston.

1 "Respiration Calorimeters for Studying the Respiratory Exchange and Energy Transformations of Man." By F. G. Benedict and T. M. Carpenter. Pp. viii+102. (Washington: Carnegie Institution, 1910.)

SEWAGE DISINFECTION.[1]

IN view of the prominence at present given to the question of the disinfection of sewage and sewage effluents, the publication of the results of Prof. Phelps's latest investigations on the subject is undoubtedly of great interest to those engaged in public-health work.

It is stated in the introduction that the investigations on which the report is based were conducted by the author at the Sanitary Research Laboratory and Sewage Experimental Station at Boston, Mass., and in collaboration with the author by Mr. Francis E. Daniels at the sewage disposal works at Red Bank, N.J., and by Mr. Ezra B. Whitman at

1 "The Disinfection of Sewage and Sewage Filter Effluents, with a Chapter on the Putrescibility and Stability of Sewage Effluents." By E. B. Phelps. Pp. 91; 39 tables, 1 plate. (Washington: Government Printing Office, 1909.)

the Walbrook testing plant at Baltimore, Md., under co-operative agreement with the Massachusetts Institute of Technology, the State Sewerage Commission of New Jersey, and the City Sewerage Commission of Baltimore.

After considering the various possible methods of disinfection, and referring to numerous investigations made in America, England, and on the Continent, the author concludes that, in the absence of further information in regard to the possibilities of heat (with consequent recovery of ammonia) and of organic compounds, chlorine compounds are most applicable in the case of the disinfection of sewage and sewage effluents. The authors' large-scale experiments were therefore confined to the disinfection, by means of chloride of lime, of sewage, septic sewage, and effluents from trickling filters.

In common with other workers, Prof. Phelps finds that whereas treatment with comparatively small quantities of chlorine fairly readily eliminates 95 per cent. or more of the total organisms present, complete sterilisation can only be obtained with difficulty and at relatively very much greater cost, which he concludes would render it impracticable for regular adoption. Pages 39 to 46 and 56 to 60 deal with the disinfection, by means of chloride of lime, of effluents from trickling filters at Boston and Baltimore respectively.

The experiments at Boston refer to the disinfection of the total effluent (5000 gallons in twenty-four hours) from two trickling filters 50 feet square and 8 feet deep. The work extended over a period of seven months, including both winter and summer months, so that the results obtained may be taken as average results under working conditions.

It was found that with two hours' storage the addition of 3·5 parts per million of available chlorine (in the form of bleaching powder) was sufficient to effect a reduction, on the average, of 96·8 per cent. and of 99·2 per cent. of the total organisms at 20° C. and of *coli* organisms respectively present.

In consequence of the greater purity of the Baltimore filter effluent, similar results to the above were obtained with the addition of less chlorine, viz. 2·2 parts of available chlorine per million.

As a result of the experiments on the disinfection of Boston sewage and of septic sewage at Red Bank, N.J., the author concludes that an average of 7 or 8 parts per million of available chlorine is sufficient to disinfect the sewage, whereas the septic sewage requires from 10 to 15 parts per million, this increased amount being mainly due to the presence of sulphuretted hydrogen.

On this account it is stated in the conclusions that where no purification is required beyond that given by septic action and by disinfection, it is advantageous to reverse the process by disinfecting the crude sewage before it enters the tank.

In this connection it is interesting to note the author's remarks on p. 56:—"There would be a great multiplication of bacteria in the tank, so that the number in the final effluent would probably be as great as in the raw sewage, and perhaps even greater. Nevertheless, the disinfection could be as effective on the pathogens as if it were applied as a final process. The subsequent development of saprophytes would have no sanitary significance, and would doubtless be of real value in the subsequent self-purification of the organic matter after it had been discharged into the stream."

The available evidence is favourable to this assumption, but further information is required in regard especially to the significance of the further development of organisms.

It is also interesting to observe that the investigations of the author have led him to revise his earlier views in regard to the use of electrolytic hypochlorites, and to conclude that, taking all things into consideration, it is preferable to use bleaching powder as a source of chlorine rather than to instal an electrolytic plant at the works. For many reasons this conclusion will meet with general approval on the part of those in charge of sewage works.

A table of carefully considered costs is given, on the basis of disinfecting 5,000,000 gallons per day by means of bleaching powder, from which it will be seen that the author estimates the total cost of treatment at from 2*s.* 2*d.* per million gallons (1*s.* 3*d.* cost of bleaching powder) for the addition of 1 part of available chlorine per million, to 21*s.* per million gallons (18*s.* 9*d.* cost of bleaching powder) for 15 parts of available chlorine per million.

These costs include the cost of chloride of lime, storage tanks, labour, &c., and are much lower than those given for treatment with electrolytic hypochlorites produced at the sewage works by Digby (the *Surveyor*, vol. xxx., No. 778, p. 687) and Shenton in 1906, and recently repeated by Shenton (the *Sanitary Record*, vol. xliii., No. 1013, 1909, p. 392), which vary from 3*s.* 9½*d.* per million gallons for the addition of 1 part available chlorine per million to 19*s.* for 5 parts available chlorine per million, exclusive of charges for plant, storage tanks, and labour.

This difference in cost is accounted for by the fact that the latter investigators estimate the cost of available chlorine produced electrolytically at the works at 10*d.* per kilogram, whereas, using bleaching powder, it should not exceed 3½*d.* per kilogram.

While Prof. Phelps's investigations afford very valuable information and add considerably to the literature on the subject of sterilisation of sewage and sewage effluents, his suggestions in regard to the degree of disinfection are open to objection, especially when applied to English conditions.

In considering this matter, the difference between American and English conditions must be borne in mind, not only in regard to the chemical composition and bacterial content of the sewage or effluent, but also to the probably more important point of the conditions of discharge.

Speaking generally, from both points of view American conditions are the more favourable, as not only is the sewage more dilute, but also, as a rule, the relative volume of the river into which the effluent is discharged is much greater than in the majority of English cases.

In the case of the Boston sewage experimented upon, the bacterial content was only 5,000,000 per c.c. as compared with from 20,000,000 to 30,000,000 per c.c. in the case of an average English domestic sewage.

Further, it has been found that English effluents of satisfactory chemical composition may contain as many as 100,000 *coli* organisms per c.c.

It is therefore doubtful whether such a degree of disinfection as proposed by the author might not in certain cases give rise to an undue sense of security, especially as no reference is made to the treatment of the large volumes of storm-water which are discharged direct to the rivers, from numerous storm-water overflows, a question which is intimately connected with the subject of the disinfection of sewage effluents.

In the final chapter is described some very interesting work carried out in connection with the methylene blue test proposed by Spitta. With preliminary standardisation for any particular effluent, this test would appear to afford, in a very simple manner, valuable information in regard to the stability of sewage effluents. As carried out by the author, the test allows finer distinctions to be drawn between stable and unstable effluents than is the case with the ordinary incubation test, which classes an effluent either as non-putrefactive or putrefactive, without reference to the degree of putrefaction. It would be interesting to know how far such a colour test is applicable to the effluents from trade sewage.

EDWARD ARDERN.

OCEANOGRAPHICAL INVESTIGATIONS IN THE ATLANTIC AND MEDITERRANEAN.

WE are informed that a Danish expedition has just set out from Copenhagen with the intention of carrying out renewed investigations along the Atlantic Slope and in the Mediterranean. The leader of the new expedition, as of the earlier Danish expeditions, will be Dr. Johs. Schmidt, who is well known for his previous Atlantic work, especially on the eel, and he will be accompanied by the following men of science:—J. W. Nielsen, hydrographer; C. H. Ostenfeld and O. Paulsen, plankton specialists; Sven Palitsch, specialist in chemistry from the Carlsberg Laboratory in Copenhagen; and a biological assistant. The vessel is the research steamer *Thor*, of the Danish Government. During the first part of the cruise,

in the waters of Iceland and the Færöes, the investigations will have a more official character, being carried out at the expense of the Danish Government and as part of the international scheme of work. The second part of the cruise will set out in the beginning of July from some English port. The expenses of this portion of the expedition will be defrayed partly by the Carlsberg Institution of Copenhagen, which does so much for the promotion of science in Denmark, partly from private sources.

Both in the Atlantic and Mediterranean the expedition will work over waters which have been already, for a great part, investigated by the *Thor*. It is not proposed to devote much time to the Atlantic region south of Ireland, and there is the less reason for doing so as previous workers, especially the Prince of Monaco, Schmidt, and the Irish investigators, have already done so much there. Nevertheless, a series of deep-sea hydrographical observations from the south of Ireland to the coast of Morocco, continuous with similar series from Iceland to Ireland and through the Mediterranean, will be of extreme interest, both in biological matters and as a further contribution towards understanding the circulation of the waters of the Atlantic and the adjacent seas.

In the Mediterranean, on the other hand, the hydrographical and biological conditions are only imperfectly understood. As is well known, the Mediterranean is an almost completely land-locked and independent ocean, with an average depth of more than 1000 fathoms, descending at places to 2000 fathoms. This huge basin is connected with the Atlantic at the Straits of Gibraltar by a narrow sill or threshold, which is only 200 fathoms deep. Any mixing of the Atlantic water with the Mediterranean water can therefore only proceed on the surface, and the renewal of the deeper layers, which is necessary for the development of an abyssal life, and which actually does take place, can only be due to the conditions, evaporation, convection currents, but mostly wind influence, prevailing in the Mediterranean itself. On the other hand, it seems certain from earlier investigations that the deep water of the Mediterranean, which is much more saline than the Atlantic, occasionally or normally wells up over the threshold at the Straits and flows out into the Atlantic as a deep-water current with a northerly direction. A further interesting topographical feature of the Mediterranean is that it is divided into two deep-water basins by a submarine ridge, which stretches across between Sicily and Tunis, and is only about 150 fathoms deep. The circulation of the waters within the two deep basins west and east of this ridge must therefore be for the most part independent. The determination of the character of the water in the two basins, in all layers from the surface to the bottom, promises results of more than usual interest.

The hydrographical observations will be of two kinds, physical and chemical. The temperature and salinity will be determined, as also the direction and strength of the currents, in all depths from surface to bottom, in accordance with the most modern methods employed by the international investigations. Entirely new methods have also been recently worked out by Danish men of science at the Carlsberg Laboratory in Copenhagen for the determination of the chemical composition of sea water, for example, the dissolved gases (O, N, CO_2) and the alkalinity (concentration of H-ions). It is probable that these new methods will throw fresh light upon the factors determining the differences in the occurrence and appearance of the organic life at different depths and in different waters, differences which the salinity and temperature by themselves cannot explain. It is obvious that the waters mentioned in the Atlantic and Mediterranean offer exceptional opportunities for such an investigation.

On the biological side, the investigations will be on the lines followed by the International Council for the Study of the Sea, and will be directed, in the first place, to the elucidation of the life-histories and biological conditions of the principal fishes. The advantage of making investigations over a wide area, as from Iceland to Morocco and the Mediterranean, is just that the differences in the physical conditions are marked on a large scale, and can be connected directly as cause to effect with the very distinct differences in the occurrences and biological phenomena of all organisms, from the floating plankton to the fishes. One of the most interesting problems here will thus be to determine the relation between the Atlantic and Mediterranean faunas, how far the latter is dependent, if at all, on the former, and the differences in the abyssal life of the two regions, all in connection with the physical and chemical differences.

A NEW AMPEREMETER.

A NEW aperiodic millivolt and amperemeter for continuous and alternating currents has been brought to our notice by Messrs. Isenthal and Co. The operation of the instrument is based on methods already described by Drude and Klemenčic, in which the current to be measured is caused to heat up thermojunctions, thus setting up indirectly a current which actuates the movement of the instrument. The novelty in the present instrument consists in the arrangement adopted for combining the action of a number of thermojunctions in such a manner that thermocurrents are produced of sufficient magnitude to deflect an ordinary pivoted moving-coil instrument.

The thermocouples are placed in the four arms of a Wheatstone's bridge, the movement being connected to two opposite corners of the bridge, and the leads carrying the current that is to be measured to the remaining corners. The polarities of the thermocouples are so chosen that when the bridge is warmed up by the passage of a current the electromotive forces set up in the four arms conspire so as to send a current through the movement. The arms of the bridge are adjusted so that the thermoelectric current passes through the movement without entering the external circuit, and the current from the external source passes through the thermocouples without affecting the galvanometer.

As the deflections of the instrument depend on the heating effect of the current to be measured, it should give correct readings for direct current or alternating current of any wave-shape or frequency. It seems that sources of error might be introduced by Peltier effects and changes of temperature of the surroundings, and it would be interesting to learn to what extent such errors are appreciable, and in what manner they have been compensated for.

The sensitiveness of the meter is 225 millivolts with a current of 1 ampere, and its range as an amperemeter can be increased to any extent by the use of shunts.

GEOLOGY OF THE LONDON DISTRICT.

THE Geological Survey cannot well be charged with neglect of London, except in the matter of six-inch maps, a want that will probably be soon seen to. From 1864 to 1906 various memoirs were issued which deal, though sometimes only partially, with the geology of London and the neighbourhood. Two of these, however, treat of the whole district and the whole of its geology, and now we have a third, in which the results reached by many workers are given up to date.

This memoir may be said to have been done by Mr. Woodward to celebrate his retirement from office, more than a year ago, and a remarkably good celebration it is. From its very low price it is within the reach of all students, and we may hope that its author may live to edit many editions.

The area described is that covered by the lately published four sheets of the new geological map of London, some errors in which are duly noted on p. v. After a general account of the area, five pages are given to an account of the various beds beneath the Chalk, which do not come to the surface here, their presence underground having been proved only by borings. These consist of Devonian rocks, at the base, Red Rocks of doubtful age,

[1] Memoirs of the Geological Survey. The Geology of the London District. By H. B. Woodward, F.R.S. Pp. viii + 142 + plate. (London: His Majesty's Stationery Office: E. Stanford: Edinburgh: W. and A. K. Johnston, Ltd. Dublin: Hodges, Figgis and Co., 1909. Price 1s.

Great Oolite beds, possibly some Lower Greensand, and in every boring Gault and Upper Greensand. The omissions in the series are notable; we have no certain Carboniferous rocks, only a possibility of Trias, no Lias, only one division of the great Jurassic series, and no Wealden beds, a perfect succession being reached only with the Gault.

To the description of the Chalk nine pages are given, and as the Middle and Lower divisions are found only underground, in borings, these are concerned chiefly with the Upper Chalk. The zones of the whole formation, with the distinctive fossils, are noted.

The Eocene Tertiaries, which form so large a part of the district, take twenty-five pages for their description, which are followed by four pages on faults and disturbances, after which the various members of the great Drift series, so greatly in evidence in the district, are described at some length, the Older Drifts with eleven pages to their credit, the Glacial (and allied) Drift with thirteen, whilst the description of the Valley Drifts, with their flint implements, extends to twenty-three pages.

The stratigraphic series ends with Recent beds, the Alluvium of the rivers being described in eight pages, after which the remaining ten pages of the chapter treat of some other matters, namely, a description of the Thames, its tributaries and its buried rivers, floods, fords, old trackways, a short account of the growth of London, and a summary of the physical changes in the district from the time of the deposit of the Chalk to the formation of the Alluvium.

The question of water-supply from the various beds is discussed in nine pages, and various other economic questions in other ten, which conclude the work, except for the lengthy index.

The plate is a contour-map of the district, with a geologic section from the valley of the Gade, on the north-west, to beyond that of the Darent, on the south-east.

At the end of the various subjects a list of the chief works relating to each is given, and this will be of much use to those who want further detail. But with this memoir in hand nearly everyone may know as much about the geology of London, using that name in a wide sense, as he needs to know.

ECONOMIC ENTOMOLOGY.

IN the last number of the *Journal of Economic Biology* (vol. v., pp. 9–17) Mr. W. E. Collinge gives some interesting notes on the form of the egg of the horse bot-fly (*Gastrophilus equi*), its attachment to the horse's hair, and the method of its hatching. The narrow end of the subconical egg is not simply glued to the hair; it clasps the hair by means of a pair of ridges or lips, so that the area of attachment is like that of the ox warble-fly (*Hypoderma bovis*), only less specialised. With regard to the mode of hatching, Mr. Collinge's observations and experiments confirm, in the main, the statements of Bracy Clark and Osborn. He found that the eggs were most readily induced to hatch, by the application of moisture, from sixteen to twenty days after hatching; none could be induced to hatch after thirty-six days.

Mr. R. Newstead describes in the same part (pp. 18–22) a couple of new species of Coccidæ from the Congo, which live as guests of ants (Cremastogaster and Sima) in their nests in the hollow shoots of plants. It is very rarely that insects of this family are found in the hollow stems of their food-plants. One specimen contained a minute lepidopterous larva which had partly destroyed its host.

It is well known that economic entomologists in North America are much troubled by the ravages of insects purposely or accidentally imported into their country from Europe; one of the most famous of these is the gipsy moth (*Porthetria dispar*). Dr. L. O. Howard has lately (U.S. Dept. Agric. Bur. Entom., Tech. Ser., 19) described some parasites reared from the eggs of this insect. It is remarkable that the parasites—various species of minute Hymenoptera—all come from Hungary, Russia, and Japan. From Gipsy-moth eggs imported from western Europe no parasites could be reared, and, though the moth has been in the United States for more than forty years, no American species is known to attack its eggs. "Non-parasitism of *P. dispar* by native species," writes Dr. Howard, "is probably due to the character of its egg-mass, which is so compact and so thoroughly protected by the scales of its parent as possibly to disguise its character from species unacquainted with it." G. H. C.

ALTERATIONS OF THE DEVELOPMENT AND FORMS OF PLANTS AS A RESULT OF ENVIRONMENT.[1]

THE fungus Saprolegnia is chosen as an example among the lower plants. This fungus lives on dead insects, and shows three distinct stages of its development:—(1) vegetative growth of the mycelium; (2) asexual reproduction by motile zoospores; (3) sexual reproduction by male and female organs. Under ordinary conditions these three stages follow one another quite regularly until, after the ripening of the resting spores, the fungus dies; but, according to the special conditions of every stage, it is possible to produce them as we desire, and also to alter their succession. Under very favourable conditions of nutrition the fungus must continuously grow, without being propagating and without dying. Numerous other lower plants, as fungi and algæ, show the same relations to environment.

Flowering plants present far more difficulties, in consequence of their very complicated structure. *Sempervivum Funckii* is taken to show how far the development of such a plant depends on environment. Sempervivum appears as a short stem covered with thick sappy leaves; we call this form a *rosette*. The rosettes produce in an asexual way new daughter-rosettes, of which each comes to flower under suitable conditions, and dies after the ripening of seeds. The state of a plant, destined to flower but without recognisable rudiments, is called *ripe to flower*. The formation of the inflorescence consists of three essential stages:—(1) the lengthening of the stem; (2) the production of several branches at the top; (3) the birth of flowers.

Under very favourable conditions of nutrition, a rosette ripe to flower can be transformed again into a vegetative one, which must always grow without sexual reproduction. In blue light, during March and April, a lengthening of the rosette ripe to flower takes place, but without flowering. Such a lengthening of the stem is wholly independent of flowering, because all rosettes, also the youngest ones, are able to lengthen in red light. On the other hand, the flowers can result without lengthening when the rosettes are exposed to a high temperature. The production of flowering branches can be prevented, the inflorescence at the end having but a single flower. In other conditions numerous branches are to be found on the whole stem, even in the axils of the old leaves, particularly as the result of injuries.

We come to a new series of forms by replacing flowers by leaf-rosettes, which can be produced on all parts of the inflorescence, even on the flowering branches, alone or mingled with flowers. The plants, of which the inflorescence bears rosettes, do not die at the end of summer as is normal, but live another two or more years, appearing in peculiar forms. It can be shown that flowers vary in an exceedingly high degree under certain conditions. The number and arrangement of all members as sepals, petals, stamens, and carpels can be altered. Further striking variations of the normal forms appear in such artificially modified flowers by the transformation of sepals into petals, of petals into stamens, of stamens into petals and into carpels. Experiments were made to answer the question whether alterations of flowers can be transmitted. For such researches *Sempervivum acuminatum*, which produces easily ripe seeds, was used. The seeds of flowers artificially altered and self-fertilised gave rise to twenty-one seedlings, among which four showed surprising deviations in their flowers. With two seedlings all the flowers were greatly altered, and presented some of the alterations of the mother plant, especially the transformation of stamens into petals. The experiments are being continued.

[1] Abstract of the Croonian Lecture delivered at the Royal Society on May 26 by Prof. G. Klebs.

PLANTS OF SCOTTISH LOCHS.[1]

AN interesting account of the lochs of Kirkcudbrightshire, Wigtownshire, Fife, and Kinross, and the plants that grow in them and on their shores, is given by Mr. G. West in a paper recently published by the Royal Society of Edinburgh. This is the author's second paper on the botanical aspects of Scottish lochs, and includes many valuable details relating to the districts investigated. The systematic list of plants shows the distribution of each plant in all the areas studied, and other particulars. Details are given respecting the physical characteristics of each loch and its surroundings, and everything of interest is described from a botanical point of view, especially the plant associations.

FIG. 1.—An example of a wind-exposed highland loch—Loch Grennoch (by Cairnsmore of Fleet). View from the north-west end, looking south. The sandy bays are not well shown as the scale is so small. This loch has scarcely any littoral vegetation.

The lochs of north-west Kirkcudbrightshire are chiefly of the highland type, *i.e.* having considerable elevation above sea-level, water more or less peaty, barren sandy or stony shores, scarcity of those plants having leaves that float on the surface, and having such marsh vegetation as may exist chiefly on the western side, because, owing to the prevailing westerly winds, the erosive power of the waves on the eastern shores prevents the development of a littoral flora there, besides which many plants associated with the richer food supply of the lowland lochs are absent.

In south-east Kirkcudbrightshire there are comparatively few lochs, and these are mostly of the lowland type, *i.e.* having a relatively small elevation above sea-level, non-peaty water, muddy or marshy shores which are frequently covered with marsh plants, an abundance of plants with floating leaves, and, although large lowland lochs usually have their marsh vegetation chiefly on the western shores, such is not the case with small lowland lochs, besides which certain plants such as *Isoetes lacustris, Lobelia Dortmanna*, &c., which are usually associated with peaty water, are absent.

Wigtownshire, which is remarkable for its great tracts of treeless peat-moor, affords examples of both kinds of lochs. Those sheets of water that are situated on the open moors resemble highland lochs in their general features. Those lakes that are within the zone of active agriculture are decidedly of the lowland type.

In Fife and Kinross a few lochs of a semi-highland character may be found on the higher hills. The greater number of the lochs in this district, however, are distinctly of a lowland type, and many of them have a very rich flora, comparatively rare plants often occurring in great abundance; the greater number, however, have had their natural features considerably altered by the hand of man. In some parts new lochs have been created by the construction of dams, &c. In other places shallow sheets of water that could be put to no useful purpose have been drained, and the sites utilised for agriculture, whilst in a few cases lochs are used as receptacles for sewage. The only lochs of this area that retain their natural conditions are the smaller ones on the Cleish Hills.

On account of the comparative lack of knowledge respecting the ecology of aquatic and semi-aquatic plants, the author considers that it is premature to attempt at present the grouping and generalising of sets of observed phenomena relating to their distribution.

In the seven areas investigated, about 175 lochs have been visited; these vary in size from what are practically inland seas, such as Loch Ness, to mere ponds, like Lochan Diota. These lochs have to a considerable extent their individual floristic peculiarities, and this fact inhibits the process of condensation of such features into a short summary. The lochs may, of course, be grouped in accordance with their striking physical characteristics, such as elevation above sea-level, exposure to wind, nature of shore, depth of water, condition of the bottom, whether rocky, stony, sandy, clayey, muddy, &c., kind of water,

FIG. 2.—An example of a large loch the wind-sheltered western margin of which has an abundant vegetation—Loch Ken. View near New Galloway from the west shore looking north, showing a large association of *Nymphaea lutea* extending along the loch for about a quarter of a mile outside a zone of *Scirpus lacustris*. The water over the Nymphæ area is from 2 to 7 feet deep.

[1] "A Further Contribution to a Comparative Study of the Dominant Phanerogamic and Higher Cryptogamic Flora of Aquatic Habit in Scottish Lakes." By George West. With 62 plates. Proc. Roy. Soc. Edin., session 1909-10, vol. xxx., part ii., No. 6. Pp. 65-181. Price 14*s.* 3*d.*

whether peaty or non-peaty, rich or poor in plant food-salts, &c.; and these characters very largely depend upon the physiographical features of the surrounding country. When the combination of such factors respecting any loch is known, the plants likely to be found there may be roughly indicated, but this apparent simplicity is frequently modified by other agencies.

FIG. 3.—An example of a small, somewhat wind-sheltered semi-highland loch the western margin of which has a zone of marsh vegetation—Loch Dow, Cleish Hills. View of the west side from the south end, looking north-west, showing *Carex rostrata* bordering the west side of the loch. The darker patch standing out of the water on the right is an association of *Equisetum limosum*.

The laws which govern the geographical distribution of aquatic plants cannot be fully understood until science has revealed more facts regarding the ecology of the plants than it at present possesses; it is therefore futile to attempt the deduction of general laws, with only an inadequate knowledge of the phenomena to be generalised. During the last great Glacial epoch it is certain that all forms of the higher plants were banished from the greater portion of Scotland. Towards the end of that era, as the mantle of ice and snow began to retreat, so would plants encroach again over the country from the region to the south, where its influence had been less severe. What precise causes influenced most this gradual northward march of aquatic and terrestrial plants cannot now be determined, but probably they were such as affect the distribution of plants at the present day. The plants no doubt followed the lines of least resistance and greatest traction, not only in their geographical advance, but also in their adaptations of structure and function to the varying environments. These lines must necessarily be ramified and involved, perhaps to an insoluble degree; yet on them are the secrets of plant geography to be discovered, on the basis of physiological anatomy and plant psychology.

By such methods a most interesting inquiry would be, What is the equilibrium that has been attained between the forces of resistance and traction that has caused certain species to arrive at, and remain in, restricted areas? This is a subject bristling with difficult chemical and physical complications, combined with the various influences resulting from the never-ceasing action and reaction, not only between the different members and associations of the flora, but between the flora and fauna as well; and it is at present impossible to set down a complete satisfactory statement of the ecology of any single group of aquatic plants. We must, therefore, for the moment leave the final generalisation of the causes which govern the distribution of plants, and content ourselves with the routine work of taking evidence of that which occurs, not being too eager to surround ourselves with metaphysical hypotheses which seek to explain the observed phenomenon by a noumenon, nor to cloak our ignorance and delude our senses with vague concepts that transcend actual demonstration, and, when analysed, explain to our intelligence nothing whatever.

Again, the restriction of certain plants to particular localities may be accounted for by observing that they are ill adapted for any mode of dispersal to which they are likely to be subjected; it is then difficult to understand their introduction to their present situation. It is not easily explained why *Equisetum limosum*, *Carex rostrata*, *Phragmites communis*, and others, should be so widely distributed about the margins of all kinds of lochs, whereas *Cladium Mariscus*, an equally dominant species, should be restricted, in the areas under discussion, to a few places in Wigtownshire. When the subscience of plant-ecology has taught us the full facts regarding the relationship existing between organism and environment, then shall we be able to generalise sets of phenomena regarding the geographical distribution of water plants to some useful purpose.

The study of the plants of the lochs suggests that aquatic plants have not always had their origin from terrestrial forms that had been forced into the water by more robust competitors on the land, as is sometimes stated, but, more probably, because certain mutable forms have exhibited a tendency, as some do even now, to take on the aquatic habit, that mode of living being more agreeable to their requirements. Some plants form themselves into dense associations consisting of one species only, which spread over considerable areas, and not only prevent others from growing amongst them, but year by

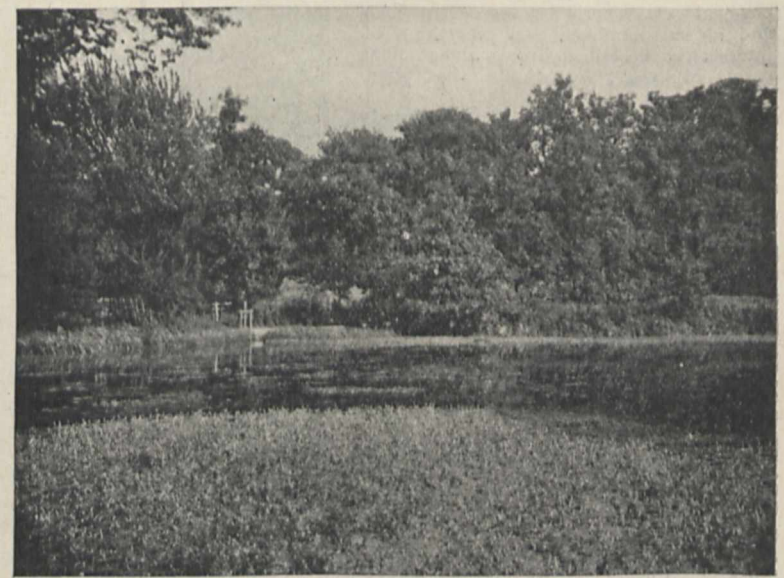


FIG. 4.—An example of a small and shallow lowland loch having an abundant vegetation—Otterston Loch, showing a portion of a large association of *Polygonum amphibium* on the water in the foreground, and the bank below the trees covered with marsh plants, such as *Carex rostrata*, *C. paniculata*, *Phalaris arundinacea*, &c.

year extend their borders at the expense of neighbouring plants. In the vanguard of such colonies there is doubtless very keen competition for the space, and the weaker or less suitably adapted species will be slowly driven before the stronger. This, however, is unlikely to go on continuously, because the stronger species will sooner or later meet with physical or chemical barriers which it is ill adapted to overcome, but to which the weaker species may be better adapted. Quite commonly, it is not that competition for available space is so great, but that the local conditions favour the dominant growth of a few individual species. One frequently finds normal terrestrial or marsh species taking on the aquatic habit: instance *Ranunculus Flammula, Juncus supinus, J. acutiflorus, Peplis Portula*, &c., but always of their own free will, so to speak, *i.e.* by the exercise of the subtle power of adaptability, which is more or less the common possession of all plants.

From another aspect of this interesting subject it appears that other causes for variation, with the consequent production of new forms, lie in the fact that although the conditions for plant life are so often remote from the ideal, yet the plastic power possessed by plants, enabling them to adapt themselves to the various combinations of edaphic and climatic conditions, is so great that there are comparatively few spots, where existence is possible, in which some plant or other is not able to thrive and carry on its metabolic activities. Now in order to maintain a proper tone of health, a plant has of necessity to respond in suitable ways to all the varying external impressions. A plant is therefore in a constant and continual state of change, owing to the never-ceasing mechanical, physical, and chemical changes of its unstable environment. The plastic nature of many plants enables them to modify their organs in reciprocation to any fairly constant set of environmental conditions, and it is in this endeavour to accommodate themselves for the maintenance of healthy existence in places that are either inhospitable or too luxurious that certain deviations, either fixed or transient, from the usual forms of more normal environments are to be accounted for, and such variations occur in almost every loch. That some of such variants may doubtless be concerned in the origin of new species and varieties is the impression received, but other causes also contribute towards that process.

The rapid increase of aquatic and marsh plants in reservoirs that are used for the public water supply is occasionally a matter of anxiety and expense to the owners. Enormous sums of money are frequently paid by public bodies for advice respecting the construction of reservoirs to persons wholly unacquainted with the local geological features, as well as with the flora and fauna of the district. Whilst it is very unwise to construct a reservoir over a geological fault and expect it to hold water (and this has been done), it is equally vain to make a shallow reservoir in the line of the constant migration of water-fowl (*i.e.* between their resorts) and expect it to maintain a freedom from water plants. The greatest depth at which aquatic plants will flourish in Scottish waters is about 40 feet. It is very unlikely, however, that the species capable of growing at such a depth will ever become a nuisance in a reservoir; but at a depth of 20 feet it will be found that, in suitable water, many species capable of giving trouble will flourish. Upon consideration of these facts, it seems advisable, as a prevention against the development of water plants, to construct reservoirs with sides so steep that a minimum depth of from 20 to 25 feet will be maintained within a few yards of the margin. Moreover, the sides, unless of natural rock, should be faced with stonework, which will further impede the growth of plants, as well as prevent discoloration of the water by wave-erosion.

The 124 figures contained in the present paper, together with the 110 which illustrate the author's previous publication on the same subject, form an interesting and instructive series of views of the vegetation of Scottish lochs from an ecological aspect.

In a comparative table the plants are arranged in seven ecological groups, in each of which the species found in peaty and non-peaty lochs are indicated with the depths at which they grow. The list of plants contains some new records for the districts.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The Vice-Chancellor has published to the Senate a minute of the council of Trinity College supporting the plea for the establishment of a professorship of bio-chemistry, and stating that, with the view of making increased provision for higher teaching and research in that subject, pending the establishment of a professorship, the college has appointed Mr. F. G. Hopkins, at present reader in chemical physiology, to a prælectorship in bio-chemistry, and proposes to elect him to a fellowship.

The General Board of Studies will shortly proceed to appoint a university lecturer in mathematics in succession to Dr. Hobson. The appointment will be for five years from October 1, 1910. Candidates are requested to send their names, with testimonials if they think fit, to the Vice-Chancellor on or before Saturday, June 4.

Mr. R. H. Lock has been approved by the general board of studies for the degree of doctor in science.

Mr. A. J. N. Tremearne has been approved for the diploma in anthropology. This is the first time a diploma has been granted in this subject.

The board of agricultural studies, in consultation with the president of the Royal Agricultural Society, has nominated Mr. F. R. Salter to be the Gilbey lecturer on the history and economics of agriculture for one year from October 1, 1910.

AT the closing ceremony of session 1910–11 of the University College of North Wales, Bangor, to be held on Friday, June 24, Dr. J. J. Dobbie, F.R.S., principal of the Government Laboratories, London, will deliver an address on "Museums: their Aims and Methods."

ON Monday evening, May 23, on the invitation of the Rector of the University of Berne, Prof. Schäfer, of Edinburgh, gave a lecture on the functions of the pituitary body in the aula of the University before a large and appreciative audience. The lecture formed one of a series which was designed to commemorate the seventy-fifth anniversary of the re-founding of the University. In proposing a vote of thanks the Rector announced that the University had conferred the honorary degree of M.D. upon the lecturer, who was thereupon duly presented with the diploma.

STEPS are being taken by the Government of Queensland to invite applications in London for the professorial staff of the university shortly to be opened in that State. The chairs to be filled are classics, mathematics and physics, chemistry, and engineering. Applications will shortly be invited by Major T. B. Robinson, the Agent-General in London, from gentlemen competent to fill the positions. The salary of each professor is to be 900*l.* a year. The Government of Queensland will contribute 10,000*l.* a year for the next seven years to the University. Arts, science, and engineering will be the three great faculties, and the proposal in the first Bill that commerce was to be a faculty, with a lecturer and a degree of B.Com., has disappeared.

PROF. RUDOLF TOMBO, jun., of Columbia University, contributes to *Science* of May 6 some interesting statistics of certain Continental universities. During the winter of 1909–10 there were 58,342 students in attendance at German universities, 93·5 per cent. of these being men and 6·5 per cent. women. The matriculated students constituted 90·8 per cent. of the grand total, the remainder being auditors. The largest number of German students were to be found at Berlin, which had a total of 10,319; the next six out of the 21 German universities with their number of students were Munich, 7321; Leipzig, 5630; Bonn, 3880; Breslau, 2759; Halle, 2660; and Göttingen, 2342. Berlin attracted the largest number of matriculated women, and was followed by Munich, Göttingen, Heidelberg, and Bonn. Vienna is by far the largest of the Austrian universities, being surpassed in point of attendance (9580) only by Berlin among German institutions, while the University of Berne (2507) is the most largely attended of Swiss universities. If the attendance at the German universities during the winter of 1909–10 be compared with that of 1893–4, it is found that the number of matriculated

students has more than doubled during this period, the gain being one of 113 per cent., that is, from 27,424 to 58,342. There has been a marked change, too, in the relative position of the various German universities since 1893–4, when the largest universities were, in order, Berlin, Munich, Leipzig, Halle, Würzburg, Bonn, and Breslau. The only university that shows a decrease in the attendance of matriculated students as against 1894 is Würzburg, and there the loss is very slight.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, May 5.—Mr. A. B. Kempe, treasurer and vice-president, in the chair.—Colonel Sir David **Bruce**, Captains A. E. **Hamerton** and H. R. **Bateman**, and Captain F. P. **Mackie**: The development of trypanosomes in tsetse-flies. Until the end of 1908 it was believed that tsetse-flies acted merely as mechanical agents in the transference of trypanosome diseases. The parasite was supposed to be carried by the fly in the same way that vaccine lymph is carried—on the point of a lancet from one child's arm to another. The limit of time of infectivity of the fly was placed at forty-eight hours, and it was believed that if an infected area were emptied of its sleeping-sickness inhabitants for a couple of days, it would then be quite safe for healthy persons to enter it. At the end of 1908 Kleine made the discovery that a tsetse-fly could convey a trypanosome for some fifty days after the fly had fed on an infected animal. The experiments were carried out on these lines in Uganda. Both lake-shore and laboratory-bred flies (*Glossina palpalis*) were used, and various trypanosome diseases besides sleeping sickness were experimented with. Tsetse-flies are numerous on the lake-shore, 500 or more being caught every day by a few fly-boys. The flies brought up from the lake-shore were found to be naturally infected with at least two species of pathogenic trypanosomes, so that it was afterwards found necessary to use flies bred in the laboratory from pupæ gathered on the lake-shore. At first it was difficult to find these pupæ, but after some time the supply was more than sufficient, as many as 7000 being brought up in one day by a few natives. These experiments go to show that a late development of trypanosomes takes place in about 5 per cent. of the flies used. This development of trypanosomes in the inside of a fly renders the fly infective and capable of giving the disease to the animals it feeds on. The shortest time which elapsed before a fly became infective after feeding on an animal infected with sleeping sickness was eighteen days, the longest fifty-three days, and the average thirty-four days. An infected fly has been kept alive in the laboratory for seventy-five days, and remained infective during that time. It is not known how long the tsetse-fly may live under natural conditions on the lake-shore. Experiments made to test directly the duration of the infectivity of tsetse-flies show that they can retain their infectivity for at least two years after the native population has been removed from the fly area.—Dr. H. G. **Chapman**: The weight of precipitate obtainable in precipitin interactions.—Miss Ida F. **Homfray**: The absorption of gases by charcoal. The experimental portion of the work here summarised consisted in determining the volumes of gas absorbed by a known weight of charcoal, 3 grams, at definite temperatures, varying from that of liquid air to that of boiling aniline, and at pressures up to 80 cm. of mercury. The gases used were He, A, N_2, CO, CH_4, C_2H_4, CO_2, O_2, and mixtures of N_2 and CO. After making all necessary corrections, the isothermals were constructed, and from them points of equal absorption were read off, the family of curves so obtained being termed the isosteric diagram. The concentration for each isostere was calculated in the form

$$C = \frac{w \times 100}{W + w},$$

where w is the weight of gas absorbed and W that of the gas-free charcoal. The concentration of pure gas when W = 0 thus becomes 100 per cent. Two relations have been obtained which hold, within experimental accuracy, for all these gases:—(1) each isostere follows Ramsay and Young's rule for saturated vapours,

$$\frac{T_0}{T_1} - \frac{T'_0}{T'_1} = R\,(T_0 - T'_0),$$

and is expressible by Bertrand's vapour-pressure formula; (2) at constant pressure $dT/d\log C = K$. Also, in all cases at low pressures, and in some cases at all pressures, when these straight lines are produced to $\log C = 2$, *i.e.* 100 per cent., the corresponding temperature is found to be the recognised boiling point of the liquefied gas at that pressure. By means of a simple formula the heats of absorption at various concentrations were calculated, and the thermodynamical relations are comparable to those of concentrated solutions. Calorimetric measurements were made in the case of CO_2, and found to agree well with the calculated values. The suggestion put forward, as a result of the experimental work, is that a homogeneous solution phase is formed in equilibrium with the gas phase, the presence of a large concentration of charcoal greatly raising the equilibrium temperature of the volatile component at a given pressure. This rise is not constant, as in the case of dilute solutions, but is itself inversely proportional to the gas concentration. If any other function of the quantity of charcoal, such as its surface area, were substituted for the mass in calculating the concentrations, the relations between the absorption results and the constants for the liquefied gases would be lost. For mixtures of two gases in charcoal the phase rule holds, and the relations can be deduced from those of the components.

Royal Meteorological Society, May 25.—Mr. H. Mellish, president, in the chair.—W. C. **Nash**: The daily rainfall at the Royal Observatory, Greenwich, 1841–1903. From the statistics given in this paper it was shown that the average annual rainfall for the sixty-three years was 24·19 inches with 157 rain days. The day with the maximum number of rain days to its credit is December 5, while the days with the least number of rain days are April 18, 19, June 27, and September 13. There were ninety-four occasions during the whole period on which the rainfall exceeded 1 inch in the day. The greatest fall was 3·67 inches, on July 26, 1867.—L. C. W. **Bonacina**: Low-temperature periods during the winters 1908–9 and 1909–10. It is often observed that if a given week, month, or other period in one year is marked by some very special meteorological character with respect to one or more elements of weather, the corresponding period the following year shows exactly the opposite character. Dealing with the last two winters, the author directed attention to four very remarkable frosts which stand out prominently, viz.:—(1) December, 1908, in the south of England; (2) March, 1909, in the south of England; (3) November, 1909, in Scotland and Ireland; and (4) January, 1910, in Scotland and the north of England.—R. **Corless**: The rate of rainfall at Kew in 1908. A method was described of obtaining information about the rate of fall of rain from the records of a self-recording rain-gauge, which yields a continuous trace showing, by the position of the pen, the amount of rain fallen.

PARIS.

Academy of Sciences, May 25.—M. Émile Picard in the chair.—Remarks by the president on the forthcoming meeting of the International Association of Academies at Rome.—H. **Deslandres**: The influence of comets on the terrestrial atmosphere according to the kathodic theory. The study of Morehouse's comet showed that the whole of the light emitted by the tail was of kathodic origin, and it is highly probable that the tails of comets emit penetrating rays analogous to the γ rays of radium. These rays could ionise the atmosphere and cause the immediate condensation of supersaturated water vapour. Hence a connection is at least possible on this theory between Halley's comet and the weather.—P. **Villard** and H. **Abraham**: The existence of two explosive potentials. For a given system of electrodes two explosive potentials exist. The first is the potential of the brush discharge; the second appears to be the normal explosive potential, and is more definite. Between these two limits there is a continuous silent discharge.—A. **Haller** and A. **Comtesse**:

The action of the bromides of *ortho-* and *para*-anisylmagnesium upon anthraquinone and β-methylanthraquinone. In these reactions substitution derivatives are formed in all respects analogous with those obtained with phenylmagnesium bromide and quinones. The reduction products of the diols obtained are also described.—Ch. **André**: The passage of the earth through the tail of Halley's comet. Observations with both the electrometer and magnetometer gave negative results.—M. **de Kerillis**: The aurora borealis. Laws and heliodynamical theories. Observations are discussed tending to prove the accuracy of the heliodynamical theory of the aurora.—A. **Blondel**: Observation of Halley's comet made at the Toulouse Observatory with the Brunner Henry equatorial of 38-cm. aperture. The apparent position of the comet and the comparison star are given for May 8.—Léopold **Fejer**: The partial sums of Fourier's series.—G. **Sagnac**: The interference of two beams superposed in the inverse sense along an optical circuit of large dimensions. The arrangement figured resembles that of Michelson in using half-silvered plates, the path of the rays being 30 metres. Some of the inconveniences of silvered glass interferometers are discussed.—A. **Chassy**: The absorption of energy by the passage of an alternating current through a gas at atmospheric pressure. The energy has been measured by the amount of heat developed; above a certain potential the heat developed is proportional to the intensity of the current.—Paul **Jégou**: A very sensitive electrolytic detector working without an auxiliary electromotive force. One of the platinum electrodes is replaced by a mercury-tin amalgam. The detector has a sensibility of the same order as the ordinary form, is invariable with the time, and is unaffected by vibrations.—Pierre **Sève**: A new model balance for the determination of magnetic fields. The apparatus described and figured is an improved form of the instrument designed by Cotton and made by Weber.—Georges **Claude**: The composition of the atmosphere after the passage of Halley's comet. A determination of the proportion of (helium+neon) showed no variation.—A. **Lafay**: A modification of the resistance of the air produced by roughnesses suitably arranged on the surface of a body. The experimental results given have a bearing on the problem of aërodynamics.—Georges **Meslin**: The structure of the lines of the spectrum.—C. **Chéneveau**: The precision of the measurement of magnetic susceptibilities. A discussion of a method recently proposed by M. Pascal.—Louis **Malclès**: The effect of penetration in dielectrics.—M. **Barre**: The solubility of silver sulphate in alkaline sulphates.—E. **Briner** and A. **Wroczynski**: The chemical action of high pressures: the compression of nitrous oxide and a mixture of nitrogen and hydrogen: the decomposition of carbon monoxide by pressure. No change was observed for nitrous oxide after compressing to 600 atmospheres at a temperature of 420° C. Negative results were also obtained with a mixture of hydrogen and nitrogen up to pressures of 900 atmospheres. Carbon monoxide showed clear evidence of chemical change after exposure to a temperature of 320° C. under a pressure of 400 atmospheres.—Daniel **Berthelot** and Henri **Gaudechon**: The chemical effects of the ultra-violet rays on gaseous bodies. On exposure to the ultra-violet rays a mixture of cyanogen and oxygen was nearly quantitatively converted into carbon dioxide and nitrogen. Ammonia mixed with oxygen gave as a final product water, nitrogen, and hydrogen. Hydrogen does not combine with oxygen under these conditions. Formic acid was identified amongst the products of the reaction with a mixture of acetylene and oxygen.—Georges **Denigès**: The presence of tartaric residues of wine in an ancient flask. The flask dated from the first century. Tartaric acid was detected in the deposit on the sides, proving that wine was originally placed in the flask.—P. **Clausmann**: The action of ozone upon carbon monoxide. The interaction of carbon monoxide with ozone produces carbon dioxide. The oxidation is increased by exposure to light and by the presence of moisture.—H. **Cousin** and H. **Hérissey**: Dehydrodicarvacrol.—J. B. **Senderens**: Ketones derived from benzoic and phenylacetic acids. The properties of a series of ketones prepared by the general catalytic method described in a previous paper.—N. **Chercheffsky**: The determination of the place of origin of a naphtha or of substances derived from it.—H. **Gault**: The condensation of ethyl oxalate with ethyl tricarballylate.—H. **Pariselle**: A new synthesis of natural and racemic erythrite.—W. **Louguinine** and G. **Dupont**: The heat of fixation of some ethylenic compounds. The hydrobromic acid was used in xylene solution, as much more concordant results were obtained with this than with aqueous hydrobromic acid.—Ernest F. L. **Marchand**: *Plasmodiophora brassicae*, a parasite of the melon and of celery.—J. **Capus** and J. **Feytaud**: A method of treatment against Cochylis and Eudemis. These Microlepidoptera are parasitic to the grape, and in recent years have caused great damage. The results of two modes of treatment are given.—R. **Robinson**: Re-section of the affluent veins.—M. **Hallopeau**: General considerations on the evolution of the treponeme in the human organism.—E. **Fauré-Frémiet**: Physico-chemical study on the structure of the nucleus of the granular type.—C. **Gerber**: Comparison between the mode of action of certain retarding salts and of the proteins of milk coagulable by heat on the caseification by ferments of boiled milk.—M. **Javillier**: The migration of the alkaloids in grafts of Solanaceæ.—M. and Mme. M. **Rosenblatt**: The influence of the concentration in saccharose on the paralysing action of certain acids in alcoholic fermentation.—H. **Bierry** and Albert **Ranc**: The diastatic hydrolysis of some derivatives of lactose. The lactase contained in the gastro-intestinal juice from *Helix pomatia* possesses unusual powers of hydrolysis, as it splits up, not only lactose, but several lactose derivatives, including lactobionic acid, lactosazone, lactose-amidoguanidine, lactose-urea, and lactose-semicarbazone. Galactose is in all cases one of the products, and this agrees with the views of E. Fischer, who regards lactose as a galactoside of glucose.—M. **Smoluchowski**: The mechanical theory of glacial erosion. A criticism and development of the theory put forward by M. de Martonne.—Alfred **Angot**: The magnetic and electric variations on the nights of May 18 and 19, 1910. None of the variations noted can be regarded as exceptional.—J. A. **Lebel**: Observation of the ionisation of the air in a closed vessel during the passage of Halley's comet.—C. **Limb** and T. **Nanty**: Observations of the magnetic variometers of the Observatory of Fourvière, at Lyons, during the night May 18–19. The variations were of the same order as those usually observed.—F. **Garrigou**: The presence of metalloids and metals in potable waters.—J. **Thoulet**: The measurement of the colour of marine vases.

GÖTTINGEN.

Royal Society of Sciences.—The *Nachrichten* (physico-mathematical section), part i. for 1910, contains the following memoirs communicated to the society:—

December 4, 1909.—W. H. **Perkin** and O. **Wallach**: Researches from the Göttingen University laboratory, xxiii.; on Δ^3-menthenol.

January 15, 1910.—W. **Schnee**: The formula representing the coefficients in the theory of Dirichlet series.

January 29.—E. **Madelung**: Molecular free-vibrations (supplementary paper).

February 26.—P. **Kolbe**: Hilbert's method of uniformisation.—L. **Bieberbach**: The movement-groups of the n-dimensional Euclidean space with a finite fundamental region.—O. **Haupt**: Remarks on oscillation-theorems, a letter to Prof. Klein.

FORTHCOMING CONGRESSES.

JUNE 19–23.—International Congress of Mining, Metallurgy, Applied Mechanics and Practical Geology. Düsseldorf. General Secretaries: Dr. Schrödter and Mr. Löwenstein, Jacobi-strasse 3/5, Düsseldorf, Germany.

JULY 4–8.—International Congress in Naval Architecture and Marine Engineering. London. Secretary: 5 Adelphi Terrace, London, W.C.

JULY 10–25.—International American Scientific Congress. Buenos Aires. Address for inquiries: President of the Executive Committee, c/o Argentine Scientific Society, 269 Calle Cevallos, Buenos Aires.

JULY 27–31.—International Congress on the Administrative Sciences. Brussels. Secretary of British Committee: Mr. G. Montague Harris, Caxton House, Westminster.

AUGUST 1–6.—International Congress of Entomology. Brussels. Chairman of Local Committee for Great Britain: Dr. G. B. Longstaff, Highlands, Putney Heath, S.W.

AUGUST 1–7.—French Association for the Advancement of Science. Toulouse. President: Prof. Gariel. Address of Secretary: 28 rue Serpente, Paris.

AUGUST.—International Congress of Photography. Brussels. Correspondent for United Kingdom: Mr. Chapman Jones, 11 Eaton Rise, Ealing, W.

AUGUST 2-7.—International Congress on School Hygiene. Paris. General Secretary: Dr. Dufestel, 10 Boulevard Magenta, Paris. Hon. Secretaries for Great Britain: Royal Sanitary Institute, 90 Buckingham Palace Road, S.W.

AUGUST 15-20.—International Zoological Congress. Graz (Austria). President: Prof. Ludwig von Graff. Address for inquiries: Präsidium des VIII. Internationalen Zoologen-Kongresses, Universitätsplatz 2, Graz (Österreich).

AUGUST 18-26.—International Geological Congress. Stockholm. General Secretary: Prof. J. G. Andersson, Stockholm 3.

AUGUST 29 TO SEPTEMBER 6.—International Union for Cooperation in Solar Research. Mount Wilson Solar Observatory. British Member of Executive Committee to whom inquiries should be addressed: Prof. A. Schuster, F.R.S., Victoria Park, Manchester.

AUGUST 31 TO SEPTEMBER 7.—British Association. Sheffield. President: Prof. T. G. Bonney, F.R.S. Address for inquiries: General Secretaries, Burlington House, W.

SEPTEMBER 6-8.—International Congress of Radiology and Electricity. Brussels. General Secretary: Dr. J. Daniel, 1 rue de la Prévôte, Brussels. Correspondents for United Kingdom: Prof. Rutherford and Dr. W. Makower, University of Manchester, and Dr. W. Deane Butcher, Holyrood, Ealing, W.

SEPTEMBER 18-24.—German Association of Naturalists and Physicians. Königsberg. Secretaries: Prof. Lichtheim and Prof. F. Meyer, Drummstr. 25-29, Königsberg.

SEPTEMBER 27-30.—International Physiological Congress. Vienna. President: Prof. S. Exner. General Secretary for United Kingdom: Prof. E. B. Starling, University College, London, W.C.

OCTOBER 6-12.—Congrès International du Froid. Vienna. Correspondent for United Kingdom: Mr. R. M. Leonard, 3 Oxford Court, Cannon Street, E.C.

DIARY OF SOCIETIES.

THURSDAY, JUNE 2.

ROYAL SOCIETY, at 4.30.—The Influence of Bacterial Endotoxins on Phagocytosis (Preliminary Report): Leonard S. Dudgeon, P. N. Panton, and H. A. F. Wilson.—The Origin of Osmotic Effects. III., The Function of Hormones in Stimulating Enzymic Change in Relation to Narcosis and the Phenomena of Degenerative and Regenerative Change in Living Structures: Prof. H. E. Armstrong, F.R.S., and E. Frankland Armstrong.—On the Direction of Motion of an Electron ejected from an Atom by Ultra-violet Light: Dr. R. D. Kleeman.—On Scandium. Part II.: Sir William Crookes, For.Sec.R.S.—The Flow of Water in Curved Pipes: Prof. J. Eustice.—On the Occurrence of a Mesocœlic Recess in the Human Brain and its Relation to the Sub-commissural Organ of Lower Vertebrates; with special reference to the Distribution of Reissner's Fibre in the Vertebrate Series and its Possible Function: Prof. A. Dendy, F.R.S., and G. E. Nicholls.

ROYAL INSTITUTION, at 3.—Malaria: Major Ronald Ross, F.R.S.

INSTITUTION OF MINING ENGINEERS, at 11 a.m.—Presidential Address: Dr. J. B. Simpson.—A Storage-battery Extension to a Three-phase Colliery Power-plant: W. Maurice.—On Measurements of the Downward Increase of Temperature in Bore-holes, their Technics and their Practical Importance for Geological Prognosis: Prof. J. Koenigsberger and Dr. Max Mühlberg.

LINNEAN SOCIETY, at 8.—A Contribution to our Knowledge of the Flora of Gazaland: Dr. A. B. Rendle, F.R.S., and others.

RÖNTGEN SOCIETY, at 8.15.—Practical Observations on Every-day X-Ray and Electrical Work: Filtration of Rays, Measurement of Rays, Rapid Stereoscopic Method: Dr. Howard Pirie.—Recent Improvements in Radiographic Technique: Dr. R. Knox.

FRIDAY, JUNE 3.

ROYAL INSTITUTION, at 3.—The World of Plants before the Appearance of Flowers: Dr. D. H. Scott, F.R.S.

ROYAL INSTITUTION, at 9.—Renaissance Monuments in the Roman Churches, and their Authors: Sir Rennell Rodd, G.C.V.O., K.C.M.G.

INSTITUTION OF MINING ENGINEERS, at 10 a.m.—Experiments illustrative of the Imflammability of Mixtures of Coal-dust and Air: Prof. P. Phillips Bedson.—Testing for Fire-damp: Prof. J. Cadman.—Some Memoranda concerning Coal-dust: H. W. G. Halbaum.

GEOLOGISTS' ASSOCIATION, at 8.—A Preliminary Account of the British Fossil Voles and Lemmings; with some Remarks on the Pleistocene Climate and Geography: M. A. C. Hinton.—Notes on some Igneous Rocks from North Devonshire: H. Dewey.

SATURDAY, JUNE 4.

ROYAL INSTITUTION, at 3.—Electric Heating and Pyrometry: Prof. J. A. Fleming, F.R.S.

MONDAY, JUNE 6.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—The Yolo-Cross River Boundary Commission, Southern Nigeria: Major G. F. A. Whitlock, R.E.—Journeys in Southern Nigeria: P. A. Talbot.

VICTORIA INSTITUTE, at 4.30.—Determinism: Archdeacon Potter.

ARISTOTELIAN SOCIETY, at 8.—The Nature of Propositions: Sydney Waterlow.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—The Accuracy obtainable in Fuel Calorimetry: G. N. Huntly.—Differential Distillation: J. L. Foucar.—The Production of Formic Acid by the Atmospheric Oxidation of Turpentine: C. T. Kingzett and R. C. Woodcock.—Proposed Method for the Estimation of Butter Fat, Cocoa Nut Oil, Palm Kernel Oil and the Determination of their respective Proportions in Mixtures: S. H. Blichfeldt.—The first Synthesis of Ethyl Alcohol: Prof. R. Meldola, F.R.S.

TUESDAY, JUNE 7.

ROYAL INSTITUTION, at 3.—Heredity in Tudor and Stuart Portraits: C. J. Holmes.

MINERALOGICAL SOCIETY, at 5.30.—On the Occurrence of Phenakite in Cornwall: A. Russell.—(1) Phacolite from near Belfast; (2) Crystalline Form of Nitrogen Sulphide: Dr. G. F. H. Smith.—On a new Arsenate and Phosphate of Lime and Strontia from the Indian Maganese Deposits: Dr. G. F. H. Smith and Dr. G. T. Prior.—A (fifth) List of New Mineral Names: L. J. Spencer.

THURSDAY, JUNE 9.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: The Distribution of Velocity in the β-Rays from a Radio-active Substance: J. A. Gray.—The Decrease of Velocity of the β-Particles on Passing through Matter: W. Wilson.—Rate of Emission of α-Particles from Uranium and its Products: J. N. Brown.—The Effect of Small Traces of Water Vapour on the Velocities of Ions produced by Röntgen Rays: R. T. Lattey.—On the Variation with Temperature of the Viscosities of the Gases of the Argon Group: Dr. A. O. Rankine.—The Effect of Pressure upon Arc Spectra. Part II., No. 4, Gold: Dr. W. G. Duffield.

MATHEMATICAL SOCIETY, at 5.30.—A New Method in the Theory of Integration: Dr. W. H. Young.—The Composition of Finite Screw Displacements: G. T. Bennett.—Note on the Theory of Linear Differential Equations: Prof. M. J. M. Hill.—The Generation of Cubic Curves by Apolar Pencils of Lines: W. P. Milne.—On Semi-integrals and Oscillating Successions of Functions: Dr. W. H. Young.

ROYAL INSTITUTION, at 3.—Malaria: Major Ronald Ross, F.R.S.

FRIDAY, JUNE 10.

ROYAL INSTITUTION, at 9.—The Progressive Disclosure of the Entire Atmosphere of the Sun (in French): Dr. H. Deslandres.

PHYSICAL SOCIETY, at 8.—A Galvanometer for Alternate Current Circuits: Dr. W. E. Sumpner and W. C. S. Phillips.—The Positive Electrification due to Heating Aluminium Phosphate: A. E. Garrett.

ROYAL ASTRONOMICAL SOCIETY, at 5.

MALACOLOGICAL SOCIETY, at 8.—A Revision of the Species of the Family Pyramidellidæ occurring in the Persian Gulf, Gulf of Oman, and the North Arabian Sea: Dr. J. Cosmo Melvill.—The Anatomy of *Hemiplecta foullioyi* from New Guinea: R. H. Burne.—Further Notes on the Dates of Issue of Sowerby's "Conchological Illustrations": A. Reynell.

SATURDAY, JUNE 11.

ROYAL INSTITUTION, at 3.—Electric Heating and Pyrometry: Prof. J. A. Fleming, F.R.S.

CONTENTS.