THURSDAY, OCTOBER 17, 1895.

RECENT ORNITHOLOGY.

The Land Birds in and around St. Andrews. By George Bruce. (Dundee: John Leng, 1895.)

The Migration of British Birds, including their Post-Glacial Emigration, as Traced by the Application of a New Law of Dispersal. By Charles Dixon. (London: Chapman and Hall, 1895.)

Heligoland as an Ornithological Observatory, the Result of Fifty Years' Experience. By Heinrich Gätke. Translated by Rudolph Rosenstock, M.A. Oxon. (Edinburgh: David Douglas, 1895.)

A Hand-book to the Game Birds. By W. R Ogilvie-Grant. Vol. i. Sand-grouse, Partridges, Pheasants. (London: Allen and Co., 1895.)

The Land-birds and Game-birds of New England, with Descriptions of the Birds, their Nests and Eggs, their Habits and Notes. By H. D. Minot. With illustrations. Second edition. Edited by William Brewster. (New York: Houghton and Co., 1895.)

Wild England of To-day, and the Wild Life in it. By C. J. Cornish. (London: Seeley and Co., 1895.)

The Pheasant: Natural History. By the Rev. H. A. Macpherson. *Shooting.* By A. J. Stuart-Wortley. *Cooking.* By Alexander Innes Shand. (*The Fur and Feather Series.*) (London: Longmans, Green, and Co., 1895.)

NO section of vertebrate zoology has in this country attracted more amateur disciples than ornithology; and the literature of perhaps no other group has been burdened by so many useless contributions by writers who, possessing not only little literary qualification for the task, but a very superficial knowledge of the subject, rush into print, assuming that, because they are able to see, they are capable of observing, which are two very different things. Among the number of such contributions must be included a volume of 563 closely-printed octavo pages on "The Land Birds about St. Andrews," by Mr. George Bruce. On the book opening of its own accord at p. 44, the heading of "The Griffon Vulture" caught the eye and surprised us not a little; for the addition of this majestic bird to the avifauna of Fifeshire was quite new to us. On consulting the title-page, however, we discovered that the work was of wider scope than indicated on the cover, and included "a condensed history of the British land birds, with extracts from the poets and observations and anecdotes on natural history." "The single occurrence of a solitary specimen" in Ireland, recorded by Yarrell, is apparently sufficient excuse for this page of padding. A carefully-written account of the birds of Fifeshire would have been welcomed to our lists of local faunas; but with so many excellent histories of British birds in existence (such as that by Mr. Howard Saunders, to mention only one), there was hardly a call, one would have thought, for another, except it were commended by some special feature or novel method of treatment. The special features of this book appear to consist in the superabundant extracts from the poets—more or less, generally less, *à propos*—cuttings from the local newspapers, and quotations from many other sources equally authoritative. Although the "history," such as it is, is very condensed, and not always to be taken on trust, and the anecdotes poor and pointless, there are, nevertheless, in the book not a few observations which we are confident will prove new to most ornithologists. Of these we cull a few, and refer our readers, who desire to dig deeper, to the book itself for others.

"The Isle of Man has proved one of the best stations in Scotland for migration observations."

"The species means every individual bird in creation; for instance, a lark is one species. . . . A genus is a group of these birds so closely resembling each other as hardly to be mistaken, as the raven, the carrion crow. . . . These combined form the genus called *Corvus*, which means in British [*sic*] crow. The plural of *Corvus* is *Corvinæ*, as genera is the plural of genus."

"Among those naturalists who have recently [!] done so much for the advancement of this branch of science Temnick [!] and Montague [!] deserve to be ranked amongst the first."

Mr. Bruce records the occurrence of the nightingale as far north in Scotland as Paisley and Uddingston, upon the unquestioned authority of one James Anderson in a letter to a local newspaper, apparently. The *Struthionidæ*, we find here, are represented in the British Isles by the genus *Otis*, and that the author of the species *Ulula stridula*, *Salicaria arundinacea*, and *S. phragmites* is Mr. George Bruce, of St. Andrews! According to the title-page he is also the author of "Destiny and other Poems," of which we must confess our ignorance. We trust, however, that the doom of "The Land Birds of St. Andrews" may have no prejudicial effect on his earlier volume.

"The Migration of British Birds" is the new work by Mr. Charles Dixon, which was heralded a short time ago by an article in the *Fortnightly Review* from his own pen. This author's previous volume on a similar subject was exhaustively discussed in NATURE for December 1892. On that occasion the deliberate conclusion was expressed "that Mr. Dixon, author of so many works as he may be, is no authority on the subject of migration, which he has left exactly as he found it." The same verdict must be passed on the present volume, and we might have dismissed it without further discussion but for two reasons. The first is the fact that in one or two important daily journals, whose scientific reviews in general command our entire respect, Mr. Dixon has been rather prematurely elevated to the rank of a Moses in ornithology, and the other is that he declares that his present views are now opposed to those he has expressed in previous works. Whether the abandonment by Mr. Dixon of his former views is due to the criticism to which they were subjected in NATURE, we have not the satisfaction of being informed.

This "new Law" here promulgated to the world—not yet accepted by it—is the "undiscovered principle" which is to solve all the difficulties of geographical distribution, and the dispersal of life, and clear up "the greatest mystery which the whole animal kingdom presents," to quote the words of one of our foremost ornithologists—"a mystery which attracted the earliest writers, and can in its chief point be no more explained by the

modern man of science than by the simple-minded savage or the poet or prophet of antiquity." When writing these pregnant words it was not given to this erudite biologist to foresee the revelation of "this Our new law" of dispersal to Charles Dixon, of which the volume under notice is the first proclamation. This great new "law forbids retreat." To Mr. Dixon it has been revealed that the effect of the slow oncoming of a glacial epoch in either hemisphere was not to cause bird-life to retreat in front of the increasing cold, but really to exterminate all those birds having a range of distribution entirely within the refrigerated areas, and to contract the range of such as were migratory. Those birds alone survived, therefore, whose former range extended beyond the glaciated areas (the unglaciated portions of their range the author calls "refuge areas"); while all those birds which had no refuge area were totally exterminated, and have since been lost to science. The "law," moreover, forbids species in the northern hemisphere ever to increase their range in a southerly direction, and species in the southern hemisphere ever to increase theirs in a northerly direction; and only those northern birds or those southern birds whose refuge areas extended on both sides of the equator are permitted by the "law" to extend their breeding range to regions towards the opposite pole, which presented the most favourable conditions for reproduction. Now "this Our law," we are told, applies not only to birds, but to all life, and is a universal explanation never thought of by any other "biologist of note," of the migration and geographical distribution of species. To show that this is so, Mr. Dixon applies his law to the distribution of "arctic" types in the flora of the southern hemisphere. Sir Joseph Hooker long ago explained the presence of the "Scandinavian" element in that flora, by indicating its migration routes along the meridional highlands of the great continental land masses. Hooker, Huxley and Wallace, and doubtless all those other ornithologists and geologists—among whom are Sharpe and Geikie—who have, according to Mr. Dixon, gone "beyond their last," have been quite misguided by reason of their ignorance of this law. Our latest authority, however, declares with all the emphasis of certainty that "there can have been no emigration of plants from north to south"; "it could never have taken place"; Our "law forbids it." The true solution of the question by Mr. Dixon is, that all the "arctic" plants in the southern as well as in the northern hemisphere, spread from an equatorial centre. Let us take, for example, an "arctic" species common, say, to high northern latitudes, and to New Zealand, and the Southern Andes or South Africa. This species must, in the first instance, have arisen in some part of the equatorial regions from a tropical form, by ascending to the cool arctic zones of one of the mountains—suppose in South America. It must then have followed one of two routes of dispersal. After multiplying it must either have spread right round the equator—the absence of continuous land notwithstanding—crossing again and again the torrid interspaces separating it from other equatorial altitudes, which served it as stepping-stones, till it attained those longitudes whence it could extend its range, as best it might, to its present northern and southern habitats—a migration-route too remarkable to be easily credited. The alternative route, so far as regards the southern hemisphere, at all events, would be for the species to spread southwards on one of the continents (say South America), till reaching a then-existing Antarctic land, over which it must have gradually dispersed, and in order to reach South Africa or New Zealand, it would have to travel northwards in the very face of Mr. Dixon's inexorable law, which it would thus entirely upset, and with it all the conclusions in the present treatise. How would Mr. Dixon explain, for instance, the distribution of *Petræa arborea* in South America, in West Java, and East Timor? Another method of dispersal may perhaps be predicated as possible by some, namely, the *independent* origin from equatorial ancestors of identical arctic species in high northern and southern latitudes; but any such occurrence is too improbable to be seriously entertained.

This law, which seems to us to fail most lamentably to explain the dispersal of plants, fails not less in regard to the migration of birds. It surely requires no pointing out that during every winter we have numberless boreal species—birds, whales, seals—visiting our shores in retreat south into more genial climes; the sheep feeding on any high hill, and overtaken at the beginning of winter by storms, hasten for food and shelter to lower levels, where they would continue to remain if there came no moderation in the weather of the uplands; and our resident redbreasts for the same reason retreat from the woods before the first snows to the neighbourhood of our homes, and if the winter be specially severe they retreat still further in search of more genial conditions—they do *not* dare the storm and die on the snow. What takes place in miniature during the winter would simply be enacted, there is little doubt, on an extensive scale during a glacial epoch. The migration, to be seen to-day in Western Europe, we are told by Mr. Dixon, was undoubtedly initiated with the passing away of the third glacial period, is undertaken expressly for purposes of reproduction, and is "the constant endeavour of what we must now regard as but the relics of such exiled life to regain and repeople the area that it once occupied during pre-glacial time." Had the migration of pre-glacial times a different cause or motive than that of to-day? Why is migration necessary for the purposes of breeding? Is there not space enough, food enough, and a better climate in the regions where the migrants winter, and to which the parents, indeed, return reinforced by their young, to be dependent on the supplies of that area? How, we may also ask, can the birds which occupied the southern and non-glaciated portion of their range be inspired by "a constant endeavour to regain" an area their parents had never occupied, and had never even known; for those of their species which had occupied and known the northern part of the range, we are assured rather than retreat a step, chose to die under Dixon's "law." The new Commandment which forbids a southern extension of breeding area, "renders," according to Mr. Dixon, "a flight south in spring impossible"; and "all species do not breed [more grammatically, no species breeds] anywhere south of their [its] point of entrance." Yet the penguins defy this law, and though southern hemisphere birds, they migrate equator-wards to breed. In the spring of this year the present writer witnessed, in

the middle of the Irish Sea, a flock of migratory birds crossing (the weather having been specially fine for some time) to England, from Ireland apparently, on a *south-east* course. Before crediting this lob-sided partially-radiating dispersal, we must have more convincing proofs that birds and plants are so peculiarly constituted that an invisible parallel of latitude athwart a congenial region, is, in a particular compass bearing, as impassable to them as an ocean or a sahara. We cannot affect to believe that Mr. Dixon's is a more satisfactory explanation of the mysterious season-flight of birds, than the cause—among others—long ago assigned, that the migrant species come north in spring to breed, impelled by a hereditary impulse at that season (and probably guided by a direction-sense with which they are specially endowed), to return to their old nurseries from the regions whence their ancestors were compelled by geologic and climatic causes to retreat, and in which they were so long acclimatised as to be now unable to withstand the cold winter, with its meagre fare, of their ancestral *patria*, which consequently they forsake again in the autumn.

We cannot afford space to touch on many other points in Mr. Dixon's book in which we believe he has gone astray. We feel no nearer a solution of the mystery of migration than before its publication. Writers on this subject "should thoroughly understand not only the rudiments of the higher philosophy [whatever that may mean] of the geographical distribution of life before they attempt to theorise upon it, or endeavour to demonstrate it." We offer Mr. Dixon his own advice, which we have copied from a paragraph in which a charge of *ultra crepidam* is ill-naturedly levelled at some of the foremost workers in the science with which he is dealing, and to which their lifetime has been unremittingly devoted—a charge which surely comes ill from one who is purely an amateur, and a young man compared with the veterans at whom he sneers.

Mr. Dixon's style is cumbrous and not always easy to comprehend, while his English is often very ungrammatical. It is only justice to admit that the book, with the *theories* of which we so entirely disagree, contains much interesting information collated and condensed from many sources.

It is refreshing to turn from these airy speculations to the stable ground of pure and unadulterated fact with which the pages of "Heligoland as an Ornithological Observatory" are so lavishly filled. This is the English translation by Mr. Rosenstock of Herr Gätke's celebrated volume published in German in 1890. Ornithological students in England owe their heartiest thanks to the translator, as well as to Mr. Harvie Brown, to the publishers, and to all who have given a forwarding hand to the task of presenting them with this great and important work in their own language. The labours of its venerable and distinguished author are too well known in this country to require us to do more than recommend his book—corrected by the author down to May last—in its new garb. Binding, printing, paper, and illustrations are all that can be desired. In turning over its pages we recognise anew the trustworthy observer, and are reminded of the story told of an old woman in a northern county of Scotland, who, on being taken to task by her minister for invariably paying the closest attention to any stranger who occupied the pulpit, and of as persistently sleeping in unbroken repose throughout his own sermons, replied, "Hoot minister! wha's to ken fat kin' o' doctrine they youngsters may be gi'in'; we a' ken fine that we can lippen to yoursel'." Herr Gätke's book can be perfectly "lippen"-ed to. It is divided into three parts, the first of which—on the migration of birds—is perhaps the most important and interesting. This subject is discussed in nine chapters, dealing with the course of migration in Heligoland; the direction, altitude and velocity of the migration flight; the meteorological conditions influencing it; the order of migration; exceptional phenomena; what guides the birds, and the cause of the movement. In regard to the last, we quote the conviction of this patient observer and recorder after fifty years' experience, "that what at present has been ascertained in reference to the migration of birds furnishes us with no clue, by the aid of which we are enabled to penetrate the depths of this wondrous mystery." The second part deals with changes which he has observed to occur in the colour of the plumage of birds without moulting. This subject has also been studied by Mr. Ogilvie-Grant, of the British Museum, who has not only corroborated the truth of Herr Gätke's observations, but thrown much new light on the subject. The final section of the book gives an account of the birds observed in Heligoland, which number 398. The volume is illustrated by a number of charming vignettes, and by two excellent portraits of Herr Gätke.

The latest addition to the naturalist's library, edited by Dr. R. B. Sharpe, and published by Messrs. Allen and Co., of Waterloo Place, is a "Hand-book to the Game-birds," by Mr. W. R. Ogilvie-Grant, who is well known to be an authority on this group. This is the first of two volumes, and contains an account of the sand-grouse, partridges and pheasants. The second volume (which will be issued shortly) will deal with the American partridges, the megapodes, curassows and hemipodes. The hand-book is founded on the author's British Museum catalogue of the group (vol. xxii.), and is one of the best yet issued of the valuable series to which it belongs. So far as published, the volumes of Allen's Naturalist's Library are each of them concise monographs of the groups they relate to, well illustrated and published at a very low price. The aim of the author has been to treat the subject in such a way that it may not only be useful as a scientific work of reference, but also as a handy book for sportsmen and field naturalists. With its aid they should be able not only to identify the birds they shoot with as little trouble as possible, but also to find out what is known concerning the life-history of each species. The work will be specially valuable to the museum curator; indeed, it is the only handy and up-to-date monograph of the families it describes. This volume contains twenty-one full-page coloured illustrations, some of which are republished from Jardine's Naturalist's Library; the majority, however, have been specially drawn for it by Mr. Keulemans. It is to be regretted that Messrs. Allen do not see it to their advantage to dispense with the

antiquated figures of the former edition, for when they are placed beside Mr. Keulemans' beautiful plates, the contrast is too striking not to call forth unfavourable remark. The birds from the hand of that artist seem transported fresh from the heaths and the hills; the others look like worn museum specimens. A special feature in Mr. Ogilvie-Grant's hand-book, is the full account given of the various phases of the moult in the grouse, partridge and blackcock, and of the curious change of plumage that takes place in these birds without moulting. We are indeed indebted, as observed above, to him more, we believe, than to any other, for the elucidation of these interesting, and to a great extent inexplicable, variations. The account he gives of the plumage-changes in the blackcock (*Lyrurus tetrix*) have never till now been so fully described. We understand that the description of both male and female of every species has been carefully made from the actual skins, and checked with the specimens, in proof. This is sufficient to establish the accuracy and value of Mr. Ogilvie-Grant's work. The only doubtful statement we have detected is on p. 189, where the author has stated, following the authority of Sir Walter Buller, that the New Zealand quail, now extinct in that colony, still exists on the Kermadec Islands. We are inclined to believe that its discovery on the latter island was a mistake, and that this interesting bird is now absolutely exterminated.

"The Land-birds and Game-birds of New England" is a new edition of this local fauna published some nineteen years ago. Its author is the late Mr. Henry D. Minot, who, as we learn from a biographical notice which prefaces the book, had from early childhood showed a great fondness for nature, and who, devoting himself to the study of birds, had completed the manuscript of this volume of over 400 closely-printed pages in his seventeenth year. This new edition issues from the press under the care of the distinguished ornithologist, Mr. W. Brewster, who says that the book was well received on its appearance, sold rapidly, and soon became out of print. Mr. Minot adopted the profession of a railroad engineer, and for fifteen years lived in the hope of adding to, and correcting his published observations. His duties, however, prevented him from accomplishing this task, and his career terminated in 1890 by his being killed in a railway collision. Written by a youth of seventeen, as the editor observes, "with, as I am assured, almost no outside help of either a literary or scientific kind, it is a remarkable and interesting book, for most of the [bird] biographies relate to his own experiences or impressions." The book is certainly worth republishing. The original text has been left almost untouched, and a few notes found in Mr. Minot's annotated copy are inserted at the foot of the pages. As could not but happen in one so young, there are not a few errors, both of fact and deduction; but the "editorial touches" of Mr. Brewster have safeguarded the reader against being misled, and given to the book much of the value it now possesses. Mr. Minot was a keen observer, and the worth of his work, apart from what it possesses as a local fauna, and from Mr. Brewster's annotations, lies in his field notes on the habits of the New England birds. Future monographers will find in it much accurate and interesting material, recorded in a pleasant and easy style. In speaking of the quail (*Colinus virginianus*), he racily describes the unsuccessful pursuit of a covey by a young "gunner," and concludes: "Now the lad returns home, and explains his ill-luck by an extraordinary theory, read of in books, and verified by his own experience, that our Quail have a wonderful power of retaining their scent. The only sound argument to prove this statement is that our game-birds, when very young, by a thoughtful provision of nature, emit little or no scent." In later years the author added this note. "... When game-birds drop suddenly to the ground and remain motionless, the dog does not perceive them. Quail most frequently alight in this way, but as soon as they begin to move, the effluvium escapes and is disseminated." Mr. Brewster adds his "editorial touch" to the following effect: "The question cannot be settled in this summary manner, for the writer overlooks the important fact that the habit of retaining scent is not common to all the quail of any one locality or region. On the contrary, it is peculiar to certain individual or bevies who invariably practise it when pursued by sportsmen. Yet these individuals do not drop more suddenly, nor remain more motionless, than the less fortunate birds which the dogs easily find and point." Thus author and editor.

The illustrations consist of woodcuts in outline, but though "drawn from nature," are of no practical use, and might have been omitted with advantage. The book is well printed, and has, as frontispiece, a portrait "prepared and engraved by Mr. A. F. Jaccaci as a personal tribute" to the talented but unfortunate author.

In "Wild England of To-Day," by Mr. Cornish, we have a collection of essays republished from different journals, but chiefly from the *Spectator*, describing the life in various "wild," secluded or thinly populated districts of the country "ranging from the southern cliffs to the Yorkshire fen." Although we find such subjects discussed as "salmon-netting at Christchurch," "trout-breeding," and "the deer in Richmond Park," the majority of the papers are devoted to bird-subjects, and thus come lawfully within the scope of this article. The whole of the sketches, while quite popularly written, are scientifically accurate, without being or pretending to be permanent contributions to science. Charmingly indited, they remind one of the style and flavour of the late Richard Jefferies' psalms in praise of nature. The book is adorned by a number of full-page illustrations of exceptional excellence, from photographs and from drawings specially made for it, of which the "Peewit's Nest," by J. W. Oakes, A.R.A., deserves special mention as an exquisite little picture.

The latest addition to the attractively bound "Fur and Feather" series, whose volumes form such pleasant journeying companions, is "The Pheasant." The Rev. H. A. Macpherson treats, as he does in several of its predecessors, of the natural history of the bird. He discusses concisely its acclimatisation from the earliest times, its geographical distribution and its nesting habits, while under the heading of "Freaks and Oddities" he describes its plumage-changes and its cross-breeding. His section concludes with two chatty chapters on "Old World Fowling" and "Poaching in the Nineteenth Century."

Mr. Stuart-Wortley discourses with authority on how to shoot—slaughter?—this tame "Byrd of singular beauty," when driven in bevies slowly and with not a little persuasion just sufficiently far away to "home," on being flushed, at a proper altitude over the guns, which are thickly stationed in hiding to rain a murderous hail on them. The shooting of the wild-bred bird is, however, nobler sport. "Nothing strikes one more in Norfolk," says Mr. Stuart-Wortley, "especially in the heath district, than the prevalence of pheasants everywhere . . . and it adds greatly to the charm of a partridge drive when it is varied by a few rocketing pheasants out of the belt you are standing by, or when they rise high off the heath and come over with the partridges, and quite as fast. . . . The late October days in Norfolk and Suffolk, especially where there is heath, are among the most fascinating to be got in England."

Mr. Innes-Shand plays on our salivary glands by extolling the excellence of the bird "when she is in the dish," roast and with bread-sauce, and in many a fascinating style besides that "sublimest form of art . . . the *faisan à la Sainte-Alliance*." Altogether "The Pheasant" is, as remarked above, a delightful *compagnon de voyage*, and will be found in many a portmanteau in the late October days. The ten well-produced full-page plates add much to the attractiveness of the volume.

OUR BOOK SHELF.

The Elements of Botany. By Francis Darwin, M.A., M.B., F.R.S., Fellow of Christ's College, Cambridge, and Reader of Botany in the University. (Cambridge: University Press, 1895.)

IN this little book the elements of botany are presented in a more refreshing form than is too often the case. The author has chosen to emphasise certain principles and phenomena of morphological or of physiological importance, rather than to crowd his pages with vast numbers of facts. Various plants are requisitioned to serve as illustrations of the different subjects under treatment; and thus the student will certainly acquire a clearer and more general conception of what, for instance, a flowering plant is, and how it lives, than would have been possible had only one example been selected as a type, even though this had been far more exhaustively dealt with.

There are some matters, however, in which it may be doubted whether the method of treatment adopted will commend itself equally to most botanists. Thus, although Mr. Darwin says that he advisedly puts the doctrine of alternation of generations into the background, many will doubtless regret his decision. It is true that without the introduction of a few more intermediate types, the question would possess, as the author says, but little interest for the elementary student. But in view of the great importance, both of the facts and of the comparisons based upon them, one cannot help wishing that the general bearings of the question could have been indicated somewhat more fully.

A second matter is the employment of the term *bark* in the popular, as opposed to its more technical, sense. Botanists have come to attach a special and restricted meaning to the term; and though it is no doubt highly improper to pirate English words, still this is done in every technical department, and thus, in spite of its admitted inconvenience to the beginner, we think the balance of advantage is in favour of the retention of the appropriated word in its restricted significance.

But these are cases in which there is room for difference of opinion; there will be none at all on the question as to the merits of Mr. Darwin's book considered as a whole. It is an admirable work which both teacher and student will cordially and deservedly welcome.

The Book of British Hawk-Moths, a Popular and Practical Handbook for Lepidopterists. By W. J. Lucas. With illustrations from Nature by the Author. (London: L. Upcott Gill, 1895.)

THERE is a great flood of books on the larger and more showy British *Lepidoptera* issuing from the press at the present time; but so long as the information which they contain is fairly accurate, and they place on record a portion of the floating information derived from periodicals or personal observation, we do not see that the fact is to be regretted. At least it is a sign that an intelligent interest in entomology is now taken by a large number of persons who are not entomologists or collectors themselves; for we do not believe that there is a sufficiently large number of entomologists to buy up the large editions of popular books which are now offered to them; they must appeal to a considerable number of outsiders as well.

The book before us is restricted to a very small group of British moths, the *Sphingidæ* proper, numbering only seventeen species, several of which are possibly only casual visitors rather than permanent residents. Consequently, the author has been able to treat of the subject in considerable detail, though a good deal of the introductory part of the book deals with the collecting and preserving of *Lepidoptera*, rather from a general point of view, than as specially applicable to *Sphingidæ*. The illustrations consist of folding plain plates, representing the larva, pupa, and imago of each species, the earlier stages, when not observed by the author himself, being usually copied from Buckler's work on larvæ. There are also occasional woodcuts in the text. The letterpress is pleasantly, though sometimes hastily, written, and is fairly complete and up to date; and most of the illustrations are good. On the last plate, the names of the two bee hawk-moths appear to have been reversed, probably by a printer's error. The information given is, we believe, accurate; but every entomologist will be able to supplement it according to his own experience. Thus, it might have been stated that *Smerinthus tiliæ* (the lime hawk-moth) is one of the commonest of the *Sphingidæ* in the suburbs of London. *Sphinx pinastri* (the pine hawk-moth) is mentioned as sometimes found at rest on the trunks of pine trees. So it is; but it will also rest on other trees, and on the continent it is often found resting on the trunks of the poplars which often fringe the roads in the neighbourhood of pine forests.

W. F. K.

Biology Notes. Vol. i. Edited by David Houston, F.L.S. Pp. 290. (Chelmsford: Technical Laboratories, 1895.)

THIS volume is a collection of bulletins published monthly by the Technical Instruction Committee of the Essex County Council, as an aid to the teaching of biology. It contains information bearing upon the applications of biology to the industrial pursuits of the county, and notes of interest to biological students. Among the subjects of short articles are ergot and its physiological effects, bracken poisoning of cattle, biological aspects of dairying, injurious insects, diseases of cultivated plants, zoology on the Essex coast, and spraying experiments; and there are also included in the volume several detailed syllabuses of courses of practical instruction in vegetable and animal biology. The "Notes" are well illustrated, and must be of great assistance to the students in the classes controlled by the Essex County Council. Other County Councils would do well to issue monthly bulletins of the kind collected in this volume.

LETTERS TO THE EDITOR.

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

The University of London.

I HAVE been away from home, and have only now seen Mr. Thiselton-Dyer's letter of August 23.

My previous letters were, I thought, quite clear; but as he asks me to do so, I write to explain that my two statements which he quotes, viz.: (1) "I am not asking that any privilege which they do not at present possess should be conferred upon my constituents, but only supporting what is now their legal right. . . . This right I know they highly value"; and (2) "It is the law at present," had reference to the present right of veto possessed by Convocation.

As regards the vote being taken as at a senatorial election, so far from stating that this was at present the law, the very terms of my letter implied that it was a change.

Whether it would be "radical" or "revolutionary" is, of course, a matter of opinion, but I certainly did not make the suggestion with the object attributed to me; nor do I share my friend's opinion that the graduates would take a course which, to quote his words, "would destroy the prospects of Academic study in London." JOHN LUBBOCK.

High Elms, October 8.

Sir Robert Ball, and "The Cause of an Ice Age."

MR. JAMES GEIKIE has recently brought out another edition of his "Ice Age," a well-known and influential work. In this book he quotes freely from Sir Robert Ball's "The Cause of an Ice Age," which appeared in 1891, and which was remarkable as the first work written by a professed astronomer in which an astronomical explanation of an Ice age was put forward and defended. As the influence of these books upon popular opinion, and even perhaps upon some scientific men, may prove very misleading and mischievous, perhaps you will allow me a little space in which to discuss Sir Robert Ball's work.

The book was preceded by much advertisement, in which we were told not only that it contained an entirely new view of the subject, but that an astronomical basis of the Ice theory was at last securely established.

When the book itself was published, it appeared also that the new matter in it consisted of "a law, hitherto unsuspected, regulating the distribution of heat between summer and winter in either hemisphere." Thus on page 113 the author says: "*I discovered* the law of distribution of sun heat on a hemisphere between the two seasons into which the year is divided by the equinoxes." Again he says: "*I enumerated and proved* that law of the distribution of sun heat between the two seasons, which I have already referred to as the cardinal features of this little book" (*op. cit.* 113.) Again, in the appendix he says: "The following is the calculation often referred to in this book, and in which *for the first time*, so far as I know, the astronomical facts relating to Ice ages have been correctly given." Lastly, he says: "If it should prove that the facts which these numbers imply have not been given by any previous writer, *then their announcement is the novelty in this book, the one central feature by which it is to be judged.*" Sir Robert Ball afterwards speaks slightingly of Herschel and Croll for having ignored this law.

It was very soon pointed out in a review of his book that this particular law which Sir R. Ball claimed to have discovered had been already enunciated and published by Wiener.

This fact might easily have escaped any one else but a writer who was himself a mathematician writing expressly on this very point, which was the justification of his book. Let that pass, however.

It seems to some of us that when the Astronomer Royal for Ireland had had this pointed out to him, he ought at once to have written to the scientific papers correcting his mistake, and doing justice to the real discoverer of the law, and that the book itself should not have been issued again without this correction appearing in it, for the publication of the supposed discovery was the *raison d'être* of the book.

Nothing of the kind has happened, however, and the only correction that I know of the mistake by its author is in an *astronomical* book published in 1893, entitled "The Story of the Sun," in which no reference whatever is made to the claims set up in 1891, but the law in question is simply referred to as "Wiener's law," as if everybody in the world must know that Wiener and not Ball had discovered it. Meanwhile, "The Cause of an Ice Age" is not cancelled or withdrawn or corrected, but is being continually issued with all its exploded claims.

What I have just written refers merely to a claim to have discovered a law which was discovered by some one else, and to the amenities which generally regulate our conduct when we are shown in such a case to have done another man an injustice. But this is a very small matter. A much more important matter remains.

The law which Sir R. Ball claimed to have discovered is an indisputable one. No one doubts it, or could doubt it. What most people who have examined the problem say, however, is not that the law is not a perfectly good one, but that it has nothing whatever to do with the question of an Ice age. The law in question is briefly, that the quantity of heat received by either hemisphere of the earth in summer is to that it receives in winter in the ratio of 63 to 37. This is an invariable ratio, true at all times, and true under all conditions of eccentricity of the orbit. It never varies. It was the same millions of years ago, so far as we know, as it is now, and so it will remain. It is therefore a *constant* factor in the problem, and being a *constant* factor it cannot be the cause of *variability* of climate. If, as we are told in the book over and over again, this particular proportion is the cause of an Ice age, we must be living in an Ice age now, and we must always have been in an Ice age. Therefore the law in question was not only not new, but it is an absolutely irrelevant law so far as the problem at issue is concerned. Whether the particular numerical ratio was present to the minds of Herschel and of Croll when they wrote on the problem, is quite immaterial; and being so, the whole *raison d'être* of Sir R. Ball's book is gone, and so far as we know there is not a single material factor of the problem discussed by Sir Robert Ball which was not present to Croll when he wrote "Climate and Time" and his other works.

Lastly. Sir Robert Ball, following in the wake of Croll, has subjected the various facts and conditions, both astronomical and meteorological, which in his view induced an Ice age to analysis, and has reached certain conclusions which he has emphasised in his later work, "The Story of the Sun." This analysis has been criticised and examined by more than one person, but with especial closeness of reasoning and conclusiveness by one of Sir R. Ball's own pupils, a distinguished Fellow of Trinity College, Dublin, Mr. Culverwell. His criticisms have appeared in NATURE and in the *Geological Magazine*.

In the view of those who have read these criticisms, they are simply crushing. No more complete and acute dissection and destruction of a scientific argument has appeared for many years.

This criticism was originally read at the British Association, in the presence of Sir R. Ball himself, who made no attempt whatever to answer it, but (mistaking his audience) merely gave vent to some jocular remarks. The Lowndean Professor at Cambridge cannot turn the flank of serious criticism by ill-timed jokes. Since then he has not, so far as I know, answered his critics in any way, or tried to justify his riddled arguments, and the books in which they are contained are being sold, and their conclusions are being quoted as if they were sound instead of being absolutely untenable.

If Sir R. Ball were an ordinary person, a free lance in literature and science, he might say anything and publish anything with impunity, and might refuse to answer criticism from any quarter; but he was once Astronomer Royal for Ireland. He now fills the chair at Cambridge once occupied by Adams. He cannot write without in some way committing that chair and that University by his opinions; and his principal critic is not an obscure scribbler, but a mathematician as accomplished as himself. Is it right or decent that, under these circumstances, he should continue to publish, with his name on the title-pages, works such as those I have described? Ought he not either to at once confess his mistakes, to answer his critics; or if he cannot do this, to withdraw books which have done some harm to thoughtless people, which have brought no credit to the chair he fills, nor to the University of which he is a Professor; and which have given rise to a good deal of angry comment among those who do not understand a man of science, of real distinction, remaining, for a day longer than he can help, the foster-father of what has been shown to be wrong either in fact or in argument?

I do not think Sir John Lubbock can know the facts of the case, or he would not permit his name to appear as the godparent of a book thus flyblown; nor should its publishers continue to issue it, and this not because the book contains mistakes—all books do that—but because its mistakes have been pointed out, and because its author is a great deal more than Sir Robert Ball, and cannot therefore escape the penalty of such a position.

The Athenæum Club, October 4. HENRY H. HOWORTH.

MacCullagh's Theory of Double Refraction.

AN attempt has recently been made by Mr. Larmor to resuscitate MacCullagh's dynamical theory of double refraction (Brit. Assoc. Rep., 1893; *Phil. Trans.*, 1894, A, part ii.), but on examination this theory appears to me to infringe one of the fundamental principles of dynamics, viz. the principle of angular momentum.

Whatever the constitution of the medium may be, the forces which act upon any element consist of two distinct classes: (1) forces due to the action of contiguous parts of the medium; (2) forces arising from causes external to the element. The forces comprised in the first class are usually termed stresses; they act upon the surface of the element, and are completely specified by the nine quantities X_x, X_y, &c. The forces comprised in the second class act upon each element of mass, and arise from attraction or repulsion due to external causes or to the action of the medium upon itself. These forces, from whatever cause they may arise, are capable of being compounded into a single force along a line through the centre of inertia of the element, and a couple about some axis through this point. In ordinary gravitating matter the couple vanishes.

The equations of motion of the element in terms of the stresses and the *force constituent* of external action are the analytical expressions for the principle of linear momentum; but this principle is not sufficient to determine the motion of the medium—it is further necessary to satisfy the principle of angular momentum, and any theory which violates the latter principle is dynamically unsound. Now the principle of angular momentum requires that three relations of the form $X_y = Y_x$ should exist between the six shearing stresses, thereby reducing their number from six to three, except in the following two special cases. The first case occurs when the medium, previously to being disturbed by the passage of a wave of light, is *not at rest*, but possesses an independent angular momentum; that is to say, the medium is what has been termed a *gyrostatic* one. The second case occurs when the resultant of the external forces which act upon the element consists of a *couple* as well as a force. In the first case the kinetic energy of the disturbed motion of an element will not be proportional to the square of its velocity of translation, but will contain a term depending on the gyrostatic momentum; whilst in the second case the potential energy must necessarily contain a term due to external action.

Mr. Larmor assumes that the kinetic energy of an element is proportional to the square of its velocity of translation, so that the medium he considers is not a gyrostatic one; whilst the potential energy is supposed to be a quadratic function of the rotations, and he obtains his equations of motion by means of the principle of least action. Now, as we have pointed out, the potential energy of an element *may* consist of two distinct parts, viz. one due to deformation, and the other due to the action of external causes; and it is quite legitimate to assume *by way of trial* that the former part contains rotational terms. But it is well known that a quadratic expression which contains rotational terms will not satisfy the conjugate relation between the six shearing stresses, and consequently the principle of angular momentum will be violated, unless every element of the medium is under the influence of some system of forces, of the kind belonging to the second class, the couple constituent of whose resultant *does not vanish*. The potential energy ought therefore to be of the form W + V, where W is the portion due to deformation, whilst V is the portion due to external causes which supplies the couple which is necessary in order to prevent the principle of angular momentum being violated; and unless Mr. Larmor is able to surmount this difficulty, I am at a loss to understand how his paper is an improvement upon theories which are at any rate *dynamically sound*, whatever other imperfections they may possess. The question is one which cannot be disposed of by pages of vague and obscure generalities, but requires a detailed and careful mathematical investigation for its elucidation.

Holyport, Berks, October 3. A. B. BASSET.

The Southern Carboniferous Flora.

SO far as I am aware, Dr. Kurtz's paper on the newly discovered Carboniferous Flora in Argentina had not been noticed in print in this country until the appearance of the number of NATURE for September 26, which contained a note (p. 523) giving a brief abstract from the translation published in the Records of the Geological Survey of India. The circumstance that the original paper, which appeared nearly a year ago, was in Spanish, may have caused its being overlooked.

The subject of the ancient Southern floras is naturally unfamiliar to most European geologists, and I hope I may be allowed to point out why the present discovery is important. It completes a mass of evidence gradually accumulated. It is, of course, well known that several successive floras of Upper Palæozoic and Lower and Middle Mesozoic Age have been found associated with beds mainly of freshwater origin, some of which combine valuable coal seams, in India, Australia, and South Africa. The most ancient of these beds in Australia and South Africa contain certain plants, amongst them a *Lepidodendron*, allied to the ordinary Carboniferous flora of Europe and North America. From the upper beds in all the three regions named, Ferns, Cycads, and a few other plants have been obtained that are related to the Rhætic and Jurassic types found in European rocks. Between the upper and lower plant-bearing strata in South Africa and Australia, and beneath the upper series in India, are found beds, with coal seams in places, containing by far the most remarkable flora of the whole, the Glossopteris-flora, as it has been called. The particular interest attaching to this flora is mainly due to two circumstances. (1) It is clearly Upper Palæozoic, for in Australia the coal measures containing it are interstratified with marine beds abounding in carboniferous fossils, and yet it differs radically from any known European or North American flora of that age. (2) The basal beds, in India, Australia, and South Africa, are boulder beds, resembling the Pleistocene glacial boulder clay more than they do any other formation.

Now in Argentina the occurrence of the Southern Jurassic or Rhætic flora has been known for some years, and Prof. Derby has called attention to the presence in Southern Brazil of a great boulder bed, that very probably corresponds in character and geological position to the Talchir beds of India and the Dwyka beds of South Africa. More recently traces of the ancient Lepidodendron flora have been discovered in Argentina, and some additions to that flora are described in Dr. Kurtz's paper. But the important announcement in this paper is the discovery in Argentina of three Indian lower Gondwána plants, *Neuropteridium validum*, *Gangamopteris cyclopteroides*, and *Naggerathiopsis hislopi*, all three associated in India with the Karharbári coal-seams near the base of the Lower Gondwána. Two of the species are also found or represented by closely allied forms in Australia and South Africa. In Argentina, as in India, Australia, and South Africa, there is a remarkable absence in this particular flora of forms characteristic of the Upper Palæozoic of Europe, no representative of Lepidodendron or Sigillaria occurs, and the Ferns, Cycads, and Equisetaceæ that constitute the flora are related to European Mesozoic types.

It is difficult to understand how two floras differing from each other far more widely than do any two continental floras living on the earth's surface at the present day, can have coexisted unless there was, for a long period of geological time, a great southern continent—the Gondwána-land of Suess—isolated by a wide sea, probably an ocean, from the land that occupied in Carboniferous and Permian days so wide an area in the northern hemisphere. The importance of the new discovery is the immense extension that it gives to Gondwána-land, and the proof it affords that the region with its flora extended to the western hemisphere, and included a part, at all events, of South America. This appears to indicate that a considerable area now occupied by ocean in the southern hemisphere was land in the Carboniferous period. Further research is needed to show whether the various tracts of Gondwána-land were connected by a South Polar land area.

October 4. W. T. BLANFORD.

About a certain Class of Curved Lines in Space of n Manifoldness.

THE class of curves to be considered is defined by the following property: A curve of that class situated in plane space of n manifoldness is cut by a S_{n-1} in n (different or coinciding) points. In the plane it is therefore a conic, and in space a twisted cubic.

If through $n-1$ of its points a pencil of S_{n-2} is drawn, then each element of that pencil cuts out of the curve *one* additional point, and has with a straight line *one* point in common. The coordinates of the curve must therefore be expressible as rational functions of one parameter. If any fixed pyramid A_1, A_2, . . . A_{n+1} is accepted as pyramid of reference, then any point P of the curve

$$(\Sigma\chi_i) \cdot P = \chi_1 A_1 + \ldots + \chi_{n+1} A_{n+1},$$

where the χ_i are the homogeneous coordinates of P; and it follows

$$\chi_i = R_1(\lambda, \mu) \ldots \chi_i = R_i(\lambda, \mu),$$

where the R_i are homogeneous and integer functions of the λ, μ. To ensure that a S_{n-1} has n points exactly with the curve in common, necessitates that the degree of the R_i is $= n$.

It follows from the definition that no S_k can have more than $k+1$ points in common with the curve (unless the curve is wholly contained in the S_k), as otherwise through this S_k and $n-k$ additional points belonging to the curve a S_{n-1} might be constructed, having more than n points in common with the curve.

The curve is uniquely determined by any $n+3$ of its points; and between any $n+4$ of its points a certain condition is fulfilled (from which for $n=2$ the well-known Chasles and Pascal theorems for conics are easily deducible). To construct this condition and verify this proposition, let us return to the article entitled "Metrical Relations," &c., of NATURE, August 8. There it was pointed out that a point and a S_{n-1} may have a peculiar situation in regard to a pyramid of n manifoldness, by virtue of which to each point of the S_n corresponds one S_{n-1}, and *vice versâ*. It is not difficult to verify that when the coordinates of the point in regard to the pyramid are

$$a_1 \ldots a_{n+1},$$

then the coordinates x_i of the points of the S_{n-1} satisfy the condition

$$\frac{x_1}{a_1} + \frac{x_2}{a_2} \ldots + \frac{x_{n+1}}{a_{n+1}} = 0.$$

If point and S_{n-1} have that relation to a pyramid, then they may be called pole and polar to it. It will be remembered that the construction of pole to polar, and *vice versâ*, is a purely projective one, by means of cuts of plane spaces, &c. The relation of $n+4$ points of the curve to each other is now, that the polars of any three with regard to the pyramid of the other $n+1$ have a S_{n-2} in common.

Indeed, let $A_1 \ldots A_{n+1}$ be $n+1$ points of the curve, and P any of its other points, also

$$(\Sigma\chi_i) \cdot P = \chi_1 A_1 + \ldots + \chi_{n+1} A_{n+1} \text{ and } \chi_i = R_i(\lambda, \mu).$$

Then, A_1 being a point of the curve, $R_2 \ldots R_{n+1}$ must have a common zero point; and the same is true for $R_1 R_3 \ldots R_{n+1}$; $R_1 R_2, R_4 \ldots R_{n+1}$, &c. It is therefore easily seen that the coordinates of P may be put into the form

$$\chi_i = \frac{1}{a_i\lambda + b_i\mu}, \text{ where } a_i \text{ and } b_i \text{ are constants.}$$

The polars to P form, therefore, a pencil; that is, they have a S_{n-2} in common.

If the points of the curve are projected from any one of its points into a S_{n-1}, they form a curve of the class considered in that space (as can be verified from the representation of the coordinates by parameters). For $n=1$ the curve becomes a straight line, whose points form a homographic range with that (auxiliary) line, whose points are the representatives of the parameters (λ, μ). It follows, therefore: four points of the curve form with any group of $n-1$ curve-points $4S_{n-1}$ of constant cross-ratio.

If the curve degenerates, it degenerates always into straight lines or curves of the same class. This follows almost immediately from the definition. It is also obvious, that each degeneration implies the occurrence of at least one double-point. A twisted cubic may, for instance, degenerate into a conic and a straight line, that has with it a point in common (but is not situated in the same plane), or into three straight lines, of which one has one point in common with each of the other two.

In each point of the curve there is one straight line, that has two coinciding points in common with the curve, and one plane, that has three points of intersection which all coincide, &c. They may be called tangent lines, planes, &c., of the curve. Cut the curve by a S_{n-1}. If the n points of intersection are distinct, draw the n tangent S_{n-1} through them; and if only $n-2$ are distinct, and 2 coincide, draw the $n-2$ tangent S_{n-1}, and the one tangent S_{n-2}; and so on.

The point of intersection of these plane spaces may be called the *pole* of the original S_{n-1} to the curve; and this one, the *polar* of that point. The polar of any point of the polar passes the pole. Let the pyramid of reference be chosen so that the equation of the curve is

$$\chi_1 = \lambda^n \quad \chi_2 = \lambda^{n-1}\mu \ldots \quad \chi_{n+1} = \mu^n.$$

The S_{n-1} may satisfy the equation

$$p_1\chi_1 + \ldots + p_{n+1}\chi_{n+1} = 0.$$

The n points of intersection are then given by

$$p_1\lambda^n + \ldots + p_{n+1}\mu^n = 0.$$

Their roots may be

$$\lambda/\mu = \alpha_1, \ \alpha_2 \ldots \ \alpha_n.$$

Through $\chi_1 = \alpha^n \ \chi_2 = \alpha^{n-1} \ldots$ the tangent S_{n-1} (whose coordinates may be ξ_i) $a_1\xi_1 + \ldots + a_{n+1}\xi_{n-1} = 0$ will be such that

$$a_1 = 1 \quad a_2 = n \cdot \beta \quad a_3 = (n)_2\beta^2 \ldots \ a_{n+1} = \beta^n,$$

where β is a parameter, whose value is found $= -\alpha$. The point of intersection of the n S_{n-1}, whose equations are

$$\xi_1 - n \cdot \alpha_i \quad \xi_2 + (n)_2 \cdot \alpha_i^2 \quad \xi_3 - \ldots \pm \alpha_i^n \xi_{n+1} = 0$$

is obviously

$$\xi_{+n_1} = p_1 \quad \xi_n = -\frac{p_2}{n}$$

$$\xi_{n-1} = \frac{p_3}{(n)_2}, \text{ &c.}$$

(on account of the equation satisfied by the α).

If ξ_i is any point, and χ_i any point on its polar, the equation exists

$$\xi_{n+1}\chi_1 - n\xi_n\chi_2 + (n)_2\xi_{n-1}\chi_3 - \ldots = 0,$$

which is symmetrical, and therefore proves the proposition.

The polar to a line joining two points is the cut of their polars; and so generally. It is therefore possible to speak of the polar, or pole, of any plane space, in regard to the curve. The two are united only when the two sets of coordinates are equal, that is, when they satisfy a condition of the second degree. Pole and polar cut a straight line in involution, as immediately follows from the symmetry of the equation connecting them. The double points of the involution are the points in which the straight line cuts that surface of the second order.

Much more could be said concerning this class of curves, the properties of which are so much like those of the conics; but I hope that what has already been mentioned will be found sufficient to interest mathematicians in their existence.

London, September 6. EMANUEL LASKER.

The Freezing Point of Silver.

THE subject of high temperature thermometry has recently attracted considerable attention, and on account of the ease with which silver can be obtained in a pure state, coupled with its great thermal conductivity, the freezing point of this metal has been suggested as a standard temperature. We therefore wish to call attention to an error into which we believe M. le Chatelier has fallen with regard to this constant. In the *Zeitschrift für Physikalische Chemie*, Band viii. p. 186, he says that the melting point of silver can be lowered by as much as 30° through the absorption of hydrogen; again, in the *Comptes rendus* for August 12, 1895, he states that the melting point of this metal is lowered by a reducing atmosphere. He therefore recommends that when the melting point of silver is used as a fixed point in calibrating pyrometers, the experiment should be performed in an *oxidising* atmosphere. This conclusion is contradicted by Prof. Callendar's experiments and by our own, for in the *Phil. Mag.*, vol. xxxiii. p. 220, Callendar shows that the freezing point of silver is lowered and rendered irregular by an oxidising atmosphere; and our own results confirm this

conclusion. But serious doubt having been raised on this point by so high an authority as M. le Chatelier, we have thought it right to make further experiments.

These experiments convince us that the freezing point of molten silver is lowered and rendered variable when the surface is exposed to the air. We also find that by blowing oxygen through the molten metal, the absorption of this gas is sufficiently great to lower the freezing point 20°. Moreover, when the oxygen is removed by the action of either carbon, coal gas, or hydrogen, a constant maximum freezing point is reached. Further, if the atmosphere of hydrogen, or coal gas, be replaced by carbon dioxide, there is no change in the freezing point, whilst if nitrogen be used to sweep out the hydrogen, there is a slight fall. In neither case does the removal of the hydrogen bring about a rise, as should be the case on M. le Chatelier's hypothesis.

Another strong reason for believing that the true freezing point of silver can only be obtained in a reducing atmosphere, is to be found in the remarkable constancy with which a considerable mass of pure silver maintains its temperature from the moment that freezing commences until the whole is solid, provided it has not been exposed to the action of free oxygen. It is also noteworthy that in a reducing atmosphere the melting and freezing points are identical.

Impure substances do not as a rule behave in this way, and hence it is improbable that the silver can contain dissolved hydrogen. In an oxidising atmosphere the freezing point is less sharply marked, and the silver behaves as if it were impure.

These are our reasons for venturing to differ from M. le Chatelier, and we hope that he will further examine the question.

Cambridge, October 12. C. T. HEYCOCK.
F. H. NEVILLE.

Plant-Animal Symbiosis.

IN your issue of August 22, 1895, Mr. Schwarz describes his finding in South Africa some ants inhabiting the thorns of a mimosa tree, by which he evidently means a species of *Acacia*. This symbiosis is well known out here, and probably also in Europe, as will be seen by a reference to Schimper's "Wechselbeziehungen zwischen Pflanzen und Ameisen im tropischen Amerika," p. 48. I first observed ants inhabiting the thorns of *Acacia horrida* in the neighbourhood of Grahamstown about six years ago. I also found them near Port Alfred. As far as my repeated observations go, the partnership between the ants and the trees is a very one-sided one.

The former receive shelter and food from the trees, whereas I have failed to find that the latter derive any advantage from it. This last conclusion is not surprising, as, firstly, amongst the "mimosa"-scrub near Grahamstown, one only finds here and there a tree the thorns of which are inhabited by ants, and as, secondly, in some years *all* individuals of *Acacia horrida* are completely denuded of their foliage over wide areas by caterpillars. Moreover the ants (of which I found two different kinds) are, as Mr. Schwarz rightly observes, not at all aggressive, whereas Belt showed that the little ants living in the hollow thorns of *Acacia sphærocephala* in Central America are very pugnacious, and protect the plant against browsing mammalia and insect enemies.

The two cases are, therefore, very different from one another.

S. SCHÖNLAND.

Albany Museum, Grahamstown, South Africa,
September 16.

The Recent Dry Weather.

WITH reference to the recent remarkable weather, both at the commencement of the year and during September, it is worth while calling attention to the climatological period of about thirty-five years, which Prof. Brückner, of Berne, pointed out as existing relatively to the years or groups of years characterised by marked cold or heat, as mentioned in vol. xliii. p. 163 of NATURE. He therein indicated the years 1700, 1740, 1780, 1815, 1850, and 1880 as centres of cold periods, while the years 1720, 1760, 1795, 1830, 1860 (and now 1895) appear as centres of warm, dry periods. The coincidence for the present year is certainly remarkable, and merits attention as to the causes which underlie these periodic fluctuations of weather.

Dublin, October 11. J. P. O'REILLY.

The Genus "Testacella."

IN NATURE for last year the writer gave a list of the localities for *Testacella scutulum* which had come under his notice. With a view to making this list more complete, and to obtaining a more definite idea of the distribution of the various species of the genus in the British Isles, the writer would be greatly indebted to any reader of NATURE who could forward to him, localised specimens of *Testacella*, alive, or preserved in alcohol, the present month being a likely one for the coming above ground of these slugs, which should now be found under logs and stones in the neighbourhood of rich garden soil.

WILFRED MARK WEBB.

"Holmesdale," Brentwood, Essex.

The B.A. Committee on Coast Erosion.

IN the reference, in your number of Oct. 3, to "Geology at the British Association," the statement as to the Coast Erosion Committee, in their final report, recommending a "Departmental Committee of the House of Commons," to inquire into the subject, is taken from the "first proof" of the report, which was drafted by myself as surviving Secretary. The suggestion has *not* been adopted by the majority of the Committee, who considered their duty did not extend to drawing up and formulating recommendations. This termination I regret, as when the Association adopted my suggestion in 1881, to appoint this Committee, I hoped it would have had a practical outcome, leading to the conservation of our coasts.

CHARLES E. DE RANCE.

A Substitute for Sulphuretted Hydrogen.

IN your Notes of February 14 last, you state that ammonium thio-acetate has been found to be a satisfactory substitute for sulphuretted hydrogen in chemical analysis. Can any of your readers tell me where I can obtain it? I cannot find it in catalogues of chemical manufacturers. RUSTICUS.

THE GRAPHICS OF PIANO TOUCH.

MUCH trouble has been taken in order to construct an apparatus that will reproduce graphically the effects of touch in keyed musical instruments. The experiments are most easily made with the piano, and have therefore been tried on that instrument.

Recently a most interesting article appeared in the *Revue Scientifique*, written by M.M. Binet and Courtier, who have studied this subject closely, and have made many experiments with their apparatus. They have treated the matter very fully in their article, of which the following is a *résumé*:—

When a certain point of perfection has been attained in piano playing, it becomes very hard to distinguish inequality of touch; yet, owing to the varying strength of the fingers, it is only with much practice that perfect equality is possible. As will be seen further on, involuntary movements and irregularities, scarcely perceptible to the ear, are shown by the graphical method.

The apparatus (Fig. 1) is quite simple in construction, and consists chiefly of an india-rubber tube, placed under the key-board, united at its two extremities by a registering drum, also of india-rubber. When the notes of the piano are played, the pressure on the tube causes a wave of air to be sent through it into the drum, upon which is attached a pen that in the ordinary way is made to record its movement on a moving roll of paper. The wave makes the drum vibrate, which in its turn jerks the pen, thus causing irregular marks to be left on the paper. The board on which the tube rests is regulated by means of wedges adjusted by a screw, the board being either lowered or raised. When raised it almost reaches the notes of the piano, and in this case the registering action takes place; but if it is lowered, the whole apparatus is disconnected from the key-board.

When no notes are being played, and the registering drum is connected, *i.e.* the board is raised, merely a straight line is drawn. In Fig. 2, first *a* is struck, then two notes with *b*, then three notes with *c*, and so on. It

is difficult to tell whether the mark made for each additional note is the same length, for when three notes are struck they may not each be struck with the same force. In the second case (Fig. 2) one note is struck, held down and another struck, and so on, the previous notes always being kept down. The effect produced is

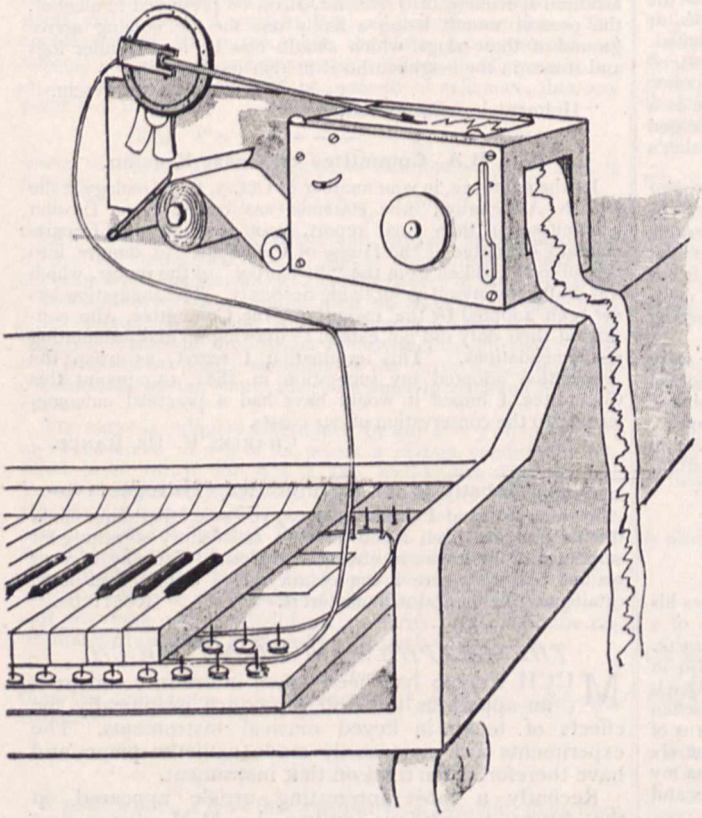

FIG. 1.—Illustration of the apparatus.

curiously like a flight of stairs, but the height of each stair is not absolutely equal. This proves that the apparatus is sufficiently sensitive to show, by the height of the lines, the intensity with which a note is struck.

With regard to *time*, it is reproduced with the utmost precision, and it is in order to guarantee accuracy that the tube is connected to the drum at both ends, otherwise the notes situated near the end which was not connected, would be further removed from the drum than the others, and this would cause a delay in their being registered.

The graphical *form* ought theoretically to be an imitation of the movement played, but this result is not often achieved. When very quick passages are being played, the strong wave of air shakes the drum so forcibly, that the pen ceases to act properly. Much trouble has been taken to devise a way of lessening the force of the wave; amongst other materials, cotton has been inserted into the tube, but these experiments were not entirely successful. It has been found that placing a diaphragm with a small hole in the tube, lessens the force of the wave of air very considerably, and to a certain extent prevents the drum vibrating too strongly.

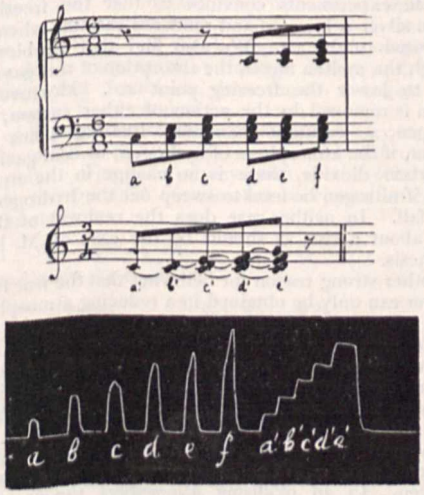

FIG. 2.—Effects produced: *a*, in striking one note, and *b*, *c*, *d*, *e*, *f*, in striking chords of two up to six notes; in the second case, *a'*, *b'*, *c'*, *d'*, *e'*, in playing five successive notes, and keeping them down.

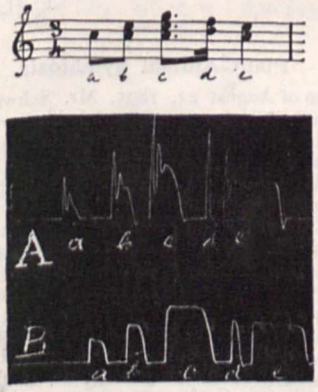

FIG. 3.—A represents effect without the insertion the diaphragm, B the effect with the diaphragm.

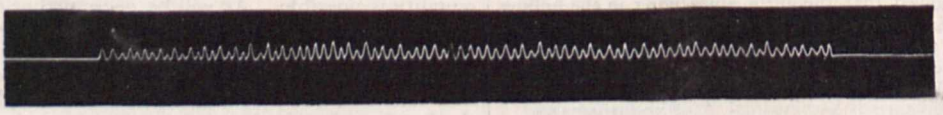

FIG. 4.—Shake executed with first and second finger.

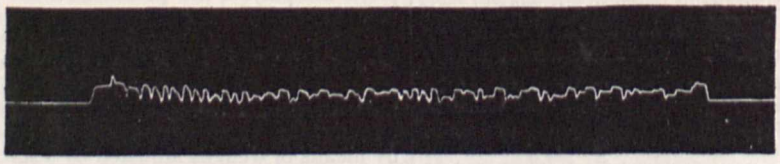

FIG. 5.—Effects produced by an irregular shake.

The effect produced without and with the diaphragm will be seen in Fig. 3.

Figs. 4 and 5 illustrate shakes, and show clearly the importance of equality of touch; they show, too, how precisely the apparatus reproduces any irregularity.

Many questions have to be considered with regard to quick playing, but one of the most striking features is that the more quickly the notes are played, the more the force of the movement diminishes, until finally a certain stage is reached, when the amplitude ceases to vary.

Let us now consider the advantages of the instrument; they are threefold.

(1) Dealing with its advantage from the psychological point of view, it is found that the voluntary movements of the pianist can be observed without putting him to any restraint or embarrassment, for the small tube does not affect the resistance of the notes, nor is the exterior of the piano altered.

(2) For teaching purposes the device has been of great use. The record on the roll of paper shows the faults so precisely, that although they are scarcely perceptible to the ear, there is no denying their existence.

(3) We are well aware that written music cannot show every slight change in the time the composer might desire. By applying the graphical method, this difficulty is eliminated, and the time will be reproduced with the smallest details.

THE NEW METEOROLOGICAL STATION ON MOUNT WELLINGTON.

A VIEW of the new meteorological observatory on Mount Wellington, Tasmania, is shown in the accompanying illustration. As we announced in a previous issue (July 25), the observatory was begun in May last, and it will be to the southern hemisphere what the Ben Nevis and other high-level observatories are to the northern. Mount Wellington is about four miles distant from Hobart, and rises almost directly from the level of the sea. The station is supplied with a "Fortin" mountain barometer, "Richard" barograph and thermograph, dry-wet, and maximum and minimum, thermometers, as well as a "5-inch" gauge with extra deep rim for retaining snow. Similar instruments are in use at the Springs (2495 ft.) and at Hobart, 160 feet above sea-level. Mr. Clement L. Wragge, Superintendent of the Chief Weather Bureau, Brisbane, has organised the stations. Very valuable results, bearing upon the distribution of pressure, temperature and humidity attaching to anticyclonic and cyclonic systems through vertical sections of the atmosphere in the northern and southern hemispheres respectively, will probably be forthcoming when the Mount Wellington and Hobart results appear and are discussed side by side with those obtained at Ben Nevis and Fort William. Except for a few degrees of latitude, Mount Wellington and Hobart are geographically and physiographically almost the very counterparts in the southern hemisphere of Ben Nevis and Fort William in the northern. Mr. Wragge has entirely reorganised the Tasmanian Government Meteorological Service on federal principles in direct connection with the Queensland Weather Service, and he was enabled to perform this work through the courtesy of the Queensland Government, who allowed him as their officer to render federal aid in the cause of science to the sister colony. Mr. H. C. Kingsmill has charge of the Tasmanian section.

The barometer cairn, now a larder, and barometer transferred to house (4166 feet).

The Observatory, Mount Wellington (4166 feet above sea-level).

DR. E. VON REBEUR-PASCHWITZ.

E. VON REBEUR-PASCHWITZ was born in 1861, and died, after an illness of ten years, on the first of the present month. In many ways he always seemed to me to resemble our incarnation of the ideal man of science. He had Darwin's lovable nature, as well as his modesty and utter carelessness of his own fame. But the likeness was closest in the unceasing energy with which he laboured, in spite of the constant suffering that would have made many stronger men feel their life's work was done.

For some time von Rebeur-Paschwitz was a Privat-docent in Astronomy at the University of Halle. His first notable achievement was, I believe, the modification of Zöllner's horizontal pendulum, the two springs by which it was supported being replaced by agate cups resting on fine steel points. The earlier investigations with this instrument were intended to be of an astronomical character, but its wonderful sensitiveness to the pulsations of distant earthquakes soon became apparent, and he was gradually led to give more time to their study, until he became the chief authority on this fascinating branch of seismology. On two occasions he contributed articles to NATURE on this subject (vol. xl. pp. 294–295; vol. li. pp

208-211), and, at the request of the Earth Tremors Committee of the British Association, he wrote an admirable summary of his results up to the middle of 1893. As this is readily accessible, it is unnecessary to enlarge upon his achievements here. I will merely add that since that date he has written several papers on earthquake-pulsations in Petermann's *Mittheilungen* and the *Astronomische Nachrichten*. His last memoir, and one of the most valuable, has just been published in Gerland's *Beiträge zur Geophysik*.

For several months before his death, von Rebeur-Paschwitz was occupied with a scheme for the organised study of earthquake-pulsations all over the globe. The suitability of his horizontal pendulum for this purpose had received ample proof, and nothing but the want of health seemed likely to prevent the fulfilment of his plans. These, no doubt, will be carried out by other, if less skilful, hands; but to him will belong a great part of the credit for any results that may be attained. Dying at thirty-four, he had done work which most men of twice the age might regard with satisfaction as the fruits of a well-spent life. CHARLES DAVISON.

CHARLES V. RILEY.

CHARLES V. RILEY, M.A., Ph.D., whose death on the 14th ult., in consequence of injuries received in a fall from a bicycle in the streets of Washington, was announced in these columns on October 3, was an Englishman, born at Walton-on-Thames in 1843. He emigrated to the United States at the age of seventeen, and settled, as we learn from the *Garden and Forest*, on a farm in Illinois. Like so many other Americans, who have since made a reputation in science, he served as a soldier in the civil war. Subsequently, after some experience as a journalist, he was appointed State Entomologist of Missouri, a position he occupied nearly ten years. During this period he did excellent work in the investigation of the life-histories of insects injurious to plants, and experiments to discover the most effectual means of destroying them. But one of his earliest papers was on a new genus (*Pronubia*) of the Tineidæ, and the part it plays in the fertilisation of *Yucca*.[1] This was an important and interesting contribution to biological science. In 1878 he accepted the post of Entomologist to the United States Department of Agriculture at Washington, where, in the words of the authority cited above, he practically supervised all the entomological work of the Government until his resignation last year. The valuable results of the investigations and experiments conducted by him and his staff, were in part published in occasional bulletins, of which thirty-two appeared between 1883 and 1894, and partly in the now familiar periodical entitled *Insect Life*, which was established in 1888. Six volumes appeared under his editorship. Dr. Riley was an indefatigable worker, and his organising and administrative abilities were well exemplified in the department which he so successfully developed. W. B. H.

NOTES.

IT is stated that in order to enable the Berlin Academy of Sciences to issue a complete edition of Kant's works, the Government of Russia has consented to place at its disposal for a time the philosopher's manuscripts belonging to the University of Dorpat.

ACCORDING to the *British Medical Journal*, the New York Pasteur Institute has purchased thirty-five acres of land near Tuxedo Park, on which an experiment station is to be established. The station will be stocked with cows, horses, sheep, and goats, which will be used for the production of diphtheria and cancer antitoxins. The situation is healthy, and in the grounds there will be a house in which some of the patients of the Institute will be treated. A new station, to be known as the Pasteur Station, will be established on the Erie Railroad, close at hand.

WE regret to notice the following announcement in *Science*:—"Prof. Ernst Ritter, whose appointment as assistant professor of mathematics in Cornell University was recently announced, died on September 23, of typhoid fever, on his arrival in America from Germany. Ernst Ritter was born at Waltershausen, Germany, on January 9, 1867. He spent twelve years at the Gymnasium at Gotha, and afterwards studied mathematics and natural science under Thomas, at Jena, and under Klein and Schwartz, at Göttingen. In 1890 he passed the Government teacher's examination with the highest distinction, after two years of pedagogical work at Cassel, and at the Wöhlerschule in Frankfurt. He took the degree of Ph.D., *summa cum laude*, at Göttingen in 1892. In 1893 he was appointed assistant to Prof. Klein, and began to devote his entire time to mathematics, contributing regularly to mathematical periodicals. Last year he lectured on geometry and the theory of automorphic functions, in which he was an authority. He was appointed to his Cornell professorship last June."

WE learn from the *Journal* of the Franklin Institute that the German Hygienic Association offers a prize of 1200 dols. for a research essay on the efficiency of electric heaters. The programme is as follows: "The heat given out in heating installations by heaters in their various forms and modes of use is to be ascertained. The investigations are to be described in detail in respect to the arrangement of the heaters, the nature of the heating agents, and the observations made; and they are to be illustrated by drawings. The heating values obtained are to be stated in units of heat given off per hour per unit of surface. In the case of heat given out to air, the investigations must be conducted with currents of air at speeds as different as possible. The heaters are to be described in detail as regards form and measurement, and the relation of their heating efficiency to their weight is also to be ascertained." Essays are to be written in German, and sent, with a motto and sealed envelope, to Prof. Konrad Hartmann, Charlottenburg, Fasannstrasse 18, before July 1, 1896. The essay will remain the property of the successful competitor, but he is required to publish it within six months, and to give the prize offerers gratuitously 300 copies. The offerers reserve the right to divide or withhold the prize.

THE display of horseless carriages, held at Tunbridge Wells on Tuesday, under the superintendence of Sir David Salomons, will do something towards the introduction of self-propelling light vehicles in England. Two carriages, fitted with Daimler motors, were shown in operation. One of these, that belonging to Sir David Salomons, weighs 13 cwt., and will run nearly two hundred miles without recharging. The motor has a horse-power of $3\frac{3}{4}$, and a speed of fifteen miles an hour can be attained on a level road, while on a gradient of one in ten a speed of four miles an hour is reached. A mechanical tricycle, worked by a petroleum motor with electric spark ignition, was shown by MM. de Dion and Bouton, of Paris. The tricycle can run at a rate of fourteen miles an hour, and only needs a fresh supply of benzine after about six hours' work. The exhibition proved the capabilities of auto-mobile carriages to a large number of spectators, and it will probably do something to bring about a change in the present vexatious Highways and Locomotives Act, which at present limits the rate of speed of self-propelled carriages to two miles an hour, and makes it necessary for a man carrying a red flag to precede the carriage as a warning of approaching danger!

[1] *Transactions* of the Academy of Science of St. Louis iii. (1873) p. 55.

THE first series of lectures given in connection with the Sunday Lecture Society begins on Sunday afternoon, October 20, in St. George's Hall, Langham Place, at 4 p.m., when Prof. Sir Frederick Pollock, Bart., will lecture on "Tyndall as Worker and Teacher." Lectures will be subsequently given by Dr. C. W. Kimmins, Rev. Stewart Headlam, Prince Kropotkin, Mr. Graham Wallas, Mr. Wyke Bayliss, and Dr. R. D. Roberts.

FACTS are always worth recording, and we publish the following note because it contains an interesting fact, which is, moreover, in accordance with other observations. The note came to us from Mr. Mata Prasad, Benares: "It was quite accidentally observed, by a stammering friend of mine, during the months of May and June last, that on moonlight nights he stammered more than on dark nights, and when he slept exposed to the rays of the moon during the month of June, he found that he stammered the most on days succeeding full moons, while a day just after the new moon, and a day before, he had not a single attack of the fit."

THE organisms responsible for the production of the Japanese beverage saké are still the subject of comment and investigation. Only a few weeks ago we received a communication from Dr. Jörgensen, in which he claimed to have discovered that the mould known as Aspergillus oryzæ, employed in the preparation of saké, was capable of producing the yeast cells invariably present, and that, therefore, only one organism was responsible for the elaboration of this well-known beverage. Mr. Atkinson, who investigated this subject some years ago in Japan, could find no evidence of the transformation of the mould into yeast cells, and maintained that the mycelium and the ferment were entirely distinct. This view has been quite recently upheld by some experiments published by Messrs. Kosai and Yabe, of Tokio. They have found that in the preparation of saké two distinct organisms are required, the well-known Aspergillus and a species of yeast. These have been carefully isolated and their growth watched in various solutions, with the result that the mould only gave rise to typical mycelium growths, whilst the yeast elaborated only yeast cells, without exhibiting a trace of mould. The authors are now engaged upon carefully identifying this saké-yeast, and state that, as far as their investigations at present go, it resembles the *Saccharomyces cerevisiæ*, with which they are carrying out numerous comparative experiments.

ONLY those who have much to do with scientific literature know how important, and yet how much neglected, is the art of making references. No apology is needed, therefore, for reprinting in full the following rules abstracted from a paper that appeared in the *British Medical Journal*, 1895, vol. i. p. 875, by Mr. J. B. Bailey, Librarian of the Royal College of Surgeons of England. The rules can be obtained printed on a card, so that an abstractor can always have them before him. (1) The titles of all books and periodical publications should be given in the language in which they are written. (2) References should be taken from the title-pages, and not from the lettering on the backs of books. (3) Where two, or more, vols. are bound together, care should be taken that the reference is made from the right title-page. (4) Where a journal is in more than one series, the number of the series as well as the vol. and date should be given. (5) When an abstract only of a paper is referred to, this fact should be stated, and reference to the original paper given if possible. (6) Journals and Transactions should not be quoted by the date of issue, but by vol., date and page. (7) In books which have two sets of paging, care should be taken to specify exactly the pagination to which reference is made. (8) The name of the editor of a journal should not be used as part of a title unless it be necessary to distinguish between two journals with similar titles. (9) References to papers read before Societies which do not publish any separate reports of their meetings should quote the journal where the paper in question can be found. (10) In abbreviating titles care should be taken that the abbreviation shows exactly what journal is referred to, *e.g.*, *Jnl. Anat. Physiol.* does not make it clear whether an English, French or German book is quoted.

THE Smithsonian Institution has recently published a series of directions for collectors, as separate portions of *Bulletin* No. 3 of the U.S. National Museum. The directions for collecting minerals, rocks, and fossils (parts H, I, and K) are written by the curators of the respective departments, and include advice not only on actual collecting, but on preparing, labelling, making sections, &c. Many of the recommendations are novel, and all cannot fail to be helpful to amateur collectors.

THE *Bulletin of Miscellaneous Information* of the Royal Gardens, Kew, for September, continues the *Diagnoses Africanæ*, in which, in addition to a large number of new species, two new genera are described: *Cyclocheilon*, Oliv., belonging to the Scrophulariaceæ, and *Phillipsia*, Rolfe, belonging to the Acanthaceæ. An interesting account is given of the history of the rock-garden, based on a list of herbaceous plants cultivated in the Royal Gardens, Kew, issued by the Department.

UNDER the modest title of "Guide to the Collections of Rocks and Fossils," the Geological Survey of Ireland has published what is really an excellent guide to the geology of Ireland. The authors are Messrs. W. W. Watts and A. McHenry, and the price of the book is ninepence. It opens with a short introduction, explaining the principles on which is based the classification adopted in the Science and Art Museum, Dublin. Two-thirds of the book are taken up with an account of the rocks of Ireland, each of the four provinces being taken in turn. Part iii. begins with a popular account of general Palæontology, which is followed by a description of the fossils exhibited, and this by a catalogue of figured and type specimens in the museum. Finally we have an index of localities for the rocks described, that should be most useful to amateur geologists.

THE Observatory of Manila has published an extensive discussion of the typhoons of the year 1894, prepared by the Rev. J. Algué, S.J. The work occupies 176 small folio pages, and is accompanied by a large number of plates showing the tracks of the different storms and concomitant data, and also contains some general considerations respecting the character of these disturbances in the extreme East. A section is devoted to the distribution of the various meteorological elements around the centres of areas of low barometic pressures at Manila during the years 1879-94. The result of this discussion shows that the distance of the cyclonic centre cannot be determined from the reading of the barometer alone; but the author describes an apparatus, which he calls a "cyclonoscope," whereby an aproximate idea of the distance of the vortex may be determined.

W. ENGELMANN, Leipzig, will shortly publish the collected papers of Prof. W. Roux upon the "Entwickelungsmechanik der Organismen." The work will consist of two volumes, illustrated with lithographic plates, and numerous illustrations in the text.

THE sixth part of *Bulletin* No. 9 of the *Minnesota Botanical Studies* (August 1895), is entirely occupied by a very useful "Contribution to the Bibliography of American Algæ," by Miss Josephine E. Tilden. No less than 1544 separate works or papers are enumerated.

THE discourse entitled "The Splash of a Drop," delivered by Prof. A. M. Worthington, F.R.S., at the Royal Institution in May 1894, has been published in book form by the Society for Promoting Christian Knowledge, with illustrations of the

beautiful phenomena described. The arrangement employed to obtain photographs of drop-splashes, and some of the results, were shown in NATURE of July 5, 1894.

DR. E. RUDOLPH, who has given much attention to submarine earthquakes and eruptions, has recently contributed a second valuable memoir on "Seebeben" to the *Beiträge zur Geophysik*. It contains accounts of more than two hundred additional shocks, and also a small map of the seismic zone of the Equatorial Atlantic. The memoir concludes with a useful list of questions for the observation of submarine earthquakes.

M. DE FONVIELLE has translated into French Lord Salisbury's Oxford Address to the British Association, and MM. Gauthier-Villars et Fils have just published the translation in their series of Actualités Scientifiques, under the title "Les Limites Actuelles de notre Science." The address is prefaced by a long introduction, in which the translator describes the circumstances under which it was given; and throughout the pages there are numerous notes explanatory of points, the importance of which might be overlooked by French readers.

A NEW volume in the Aide mémoire Series, published jointly by Gauthier-Villars and Masson, is "Polarisation et Saccharimétrie," by D. Sidersky. The volume is a handy aid to the study of polarisation and its numerous applications in analytical chemistry. The first part contains a description of the properties of polarised light, a table of the specific rotatory powers of various optically active substances, and explanations of polarising apparatus. The second part of the book is devoted to the applications of the constant of rotation to the quantitative analysis of sugars, alkaloids, &c., together with a number of tables which will facilitate the practical application of the processes described.

BY the recent publication of two numbers of the *Essex Naturalist*, the Essex Field Club has brought their journal up to date. The first number (November–December 1894) includes papers on "Izaak Walton's Association with the Lea," by J. E. Harting, the "Geology of the Lea Valley," by T. V. Holmes, and on "Navestock in Olden Days," by Rev. S. Coode Hore. The second number (January–June 1895), contains a paper, by Prof. Meldola, on the "Eastern Boundary Stones of Waltham Forest," the Presidential address (in which the part played by the Club in the development of technical education in the county is explained), and a series of three papers, by Messrs. T. V. Holmes, E. T. Newton, and W. M. Webb, on the section in brick-earth at Chelmsford in which mammoth remains were recently found.

SEVERAL interesting papers are contained in the part of the *Proceedings* of the Royal Society of Edinburgh, just published (vol. xx. pp. 385–480). In "A Sketch of Lake-Dwelling Research," Dr. Robert Munro shows that over a wide geographical area, extending from Ireland to Bosnia, and from North Germany to Italy, the habit of constructing lake- and marsh-dwellings was prevalent in former times. Prof. Sir William Turner, F.R.S., has a paper "On M. Dubois' description of remains found in Java, named by him *Pithecanthropus erectus*; with remarks on so-called transitional forms between Apes and Man." A paper on drops, by Mr. J. B. Hannay, summarises the work of various observers on the formation of drops, and the variation with density and chemical composition of the liquid forming them, and gives the author's own investigations upon the subject. There are also in the *Proceedings* Prof. T. R. Fraser's two papers on "Antivenine," and a paper by Prof. J. C. Ewart "On the Dorsal Branches of the Cranial and Spinal Nerves of Elasmobranchs."

THE fourth edition, revised and enlarged, of Dr. Carl Günther's "Bakteriologie" has been published by Georg Thieme, Leipzig. We noticed the third edition in March of last year (vol. xlix. p. 455), and the present issue sustains the commendation then given, viz. that "the volume is undoubtedly one of the best introductions to the study of bacteriology which has yet been produced." Another new edition which we welcome is the "Cours Elementaire de Manipulations de Physique," by Prof. A. Witz, published by Gauthier-Villars. The book contains a descriptive course of work covering the fundamental principles and laws of physical science. Each experiment is divided up into four sections, as follows: first, the theory of the experiment is stated; then the apparatus is described; the experimental operations form the subject of another section, and the results of observations are given in the fourth. Though the book is here and there deficient in the details required by students of practical physics, it is altogether a useful companion to the physical laboratory.

THE Catalogue of the Library of the Royal Geographical Society, compiled by Dr. H. R. Mill, and lately published, is a very full and valuable index to the literature of geography. The Catalogue contains the titles of all works in the possession of the Royal Geographical Society published up to the close of 1893. The entries (amounting to as many as 18,000) are arranged in four divisions. The first division, which runs into 521 of the 833 pages, is a general alphabetical author's catalogue; the second comprises collections of voyages and travels, arranged in alphabetical order under authors' names, and containing a brief analysis of the contents of each volume; in the third division, Government, anonymous, and other miscellaneous publications are arranged geographically; while the fourth consists of a list of transactions and periodical publications, arranged in a similar manner according to the place of publication. With such a comprehensive classification, it is easy to find the works of each author, and to refer to the literature concerning different divisions of the earth. A valuable supplement to the Catalogue will be the subject index now being prepared, and in which the principal contents of all the geographical books and periodicals belonging to the Society will be classified.

THE additions to the Zoological Society's Gardens during the past week include a Macaque Monkey (*Macacus cynomolgus*, ♀) from India, presented by the Rev. Sidney Vatcher; a Crested Porcupine (*Hystrix cristata*) from East Africa, presented by Captain B. L. Sclater; three Common Rheas (*Rhea americana*) from South America, presented by Mr. Robert Günther; four Rhomb-marked Snakes (*Psammophylax rhombeatus*), three Crossed Snakes (*Psammophis crucifer*), two Rough-keeled Snakes (*Dasypeltis scabra*), a Smooth-bellied Snake (*Homalosoma lutrix*), a Robben Island Snake (*Coronella phocarum*) from South Africa, presented by Mr. J. E. Matcham; a Bonnet Monkey (*Macacus sinicus*) from India, a Yellow Baboon (*Cynocephalus babouin*) from West Africa, a Rose Hill Parrakeet, (*Platycercus eximius*) from Australia, deposited; three Prevost's Squirrels (*Sciurus prevosti*) from Malacca, purchased.

OUR ASTRONOMICAL COLUMN.

THE OBSERVATORY ON MONT BLANC.—Two causes combined to induce Dr. Janssen to undertake his recent ascent of Mont Blanc. First, he was anxious to be convinced of the perfect safety of the new telescope which has been conveyed to the observatory; and second, the meteorograph had ceased to perform its various important duties (*Comptes rendus*, October 7). It is intended to mount the telescope, which has an aperture of thirteen inches, with its axis parallel to that of the earth, and a mirror nearly twenty-four inches in diameter will be employed to reflect the light of the heavenly bodies into the telescope; the mirror and telescope will have a common movement, so that the relative positions of the stars will not change on account of the diurnal motion. The meteorograph was found to be some-

what unstable, but arrangements have been made by which it is hoped that the records may be continued. A slight movement of the observatory towards Chamounix was noted, but it is expected that future displacements will be insignificant; and, in any case, the means are at hand to restore it to its original position. The practicability of the establishment of observatories on snow-clad mountains is therefore no longer to be questioned, and the multiplication of such institutions as that on Mont Blanc will no doubt contribute largely to our knowledge both in meteorology and astronomy.

It is characteristic of Dr. Janssen that he should take advantage of the opportunity of observing the aqueous bands in the solar spectrum. The air above him being very rare and also extremely dry, he found that when observing sunlight in its totality the bands at C and D were absolutely invisible, while the group at α was so pale that its presence could scarcely be determined. Dr. Janssen already regards it as certain that there is neither oxygen nor aqueous vapour in the solar envelopes, but the question is so important that too many observations cannot be made. To carry the observations a step further, it will be necessary, under analogous atmospheric conditions, to compare very carefully the centre of the sun's disc with the edge, to see if there is any augmentation of the α group as the limb is approached, this group being especially sensitive to variations in the amount of absorbing vapour.

EPHEMERIS FOR FAYE'S COMET.—The following ephemeris, for Berlin midnight, is given by F. Engström in *Astr. Nach.* No. 3313:—

	R. A.	Decl.
	h. m. s.	° ′
Oct. 17 ...	21 11 9 ...	−4 20·6
19 ...	12 10 ...	31·7
21 ...	13 18 ...	42·1
23 ...	14 32 ...	51·9
25 ...	15 54 ...	5 1·0
27 ...	17 23 ...	9·5
29 ...	18 59 ...	17·3
31 ...	20 42 ...	24·5
Nov. 2 ...	22 32 ...	31·0
4 ...	24 28 ...	36·7
6 ...	26 30 ...	41·6
8 ...	28 38 ...	45·8
10 ...	30 52 ...	49·3
12 ...	33 13 ...	52·2
14 ...	21 35 39 ...	−5 54·4

The calculated brightness is practically constant throughout the above period. Perihelion passage will not occur until March 19, 1896.

VISIBILITY OF THE DARK SIDE OF VENUS.—Various theories have been advanced at different times to account for the visibility of the hemisphere of Venus which is not illuminated by the sun, but there is no general agreement as to which is the most probable. Still another explanation is offered by M. Camille Flammarion, and it has the merit of being based on careful observations made at Juvisy during August and September of the present year (*Bull. Soc. Ast. de France*, October). The planet was frequently observed in full sunshine by M. Flammarion and his assistants, and the observations appear to put the matter in quite a new light. To these observers it has several times seemed that the interior of the crescent of Venus was darker than the sky, even on the day of inferior conjunction. That this appearance was not simply an effect of contrast produced by the luminous crescent is shown by the fact that no such darkening was apparent at the exterior edge of the crescent, and again by the visibility of the obscure hemisphere when the luminous part was artificially eclipsed. The colour of the unilluminated area was slightly violet in all the varied conditions of observation. M. Flammarion considers that the observations can be best accounted for by supposing that Venus is projected on a somewhat lighter background, such as might be furnished by the zodiacal light, or an extended solar atmosphere. The violet tint which was noted may have been due to the considerable refraction of the sun's rays by the atmosphere of the planet, the reddish tinge thus produced on the planet appearing purple when seen through our own blue sky.

In the same article, M. Flammarion gives some interesting facts relating to the history of the phenomenon, and some calculations which indicate that "earth-shine" is insufficient to account for it. Under the most favourable conditions, the terrestrial light received by Venus is 12,000 times feebler than that received by the moon, and 822 times less intense than the light we receive from the full moon.

THE MELBOURNE OBSERVATORY.—The twenty-ninth report of the Government Astronomer, Mr. R. L. J. Ellery, on the work of the Melbourne Observatory during the year ending at the beginning of last June, has just come to hand. Meridian observations, the daily photography of the sun, magnetic and meteorological observations, have been carried on as heretofore. The number of plates secured, in connection with the photographic chart and catalogue, up to June 1, was 1080. Preliminary measures have been made of 238 plates to obtain the positions where possible, of five stars on each plate, to be used for the determination of the constants of the plates. Mr. Ellery refers to the important change in time-reckoning made in February last by the introduction of zone or standard time in all the Australian colonies. By the zone system, Eastern Australian time, which covers Queensland, New South Wales, Victoria, and Tasmania, conforms to that of the 150th meridian; and this makes Melbourne exactly ten hours in advance of Greenwich time, instead of 9h. 30m. 54s., which is the true difference of longitude. The retirement of Mr. Ellery from his post as Government Astronomer has already been noted in these columns. Mr. Ellery has built up the Melbourne Observatory from its very small beginning in 1853 to its present recognised position among the national observatories of the world; and we are glad to see that the Government has appointed him a member of the Board of Visitors, so that he has not entirely severed his connection with the observatory. He has been succeeded in the directorship by the chief assistant, Mr. P. Baracchi, whose pendulum observations are well known to students of terrestrial physics.

A NEW OBSERVATORY.—The New York *Nation* notes a new departure at the University of Pennsylvania, by the addition of an astronomical observatory. The observatory has already been commenced, and, when completed, it is designed to furnish better facilities, not only for instruction, but for original research as well. The new edifice is two miles from the limits of Philadelphia, and about five miles from the university buildings. The instruments are an eighteen-inch equatorial, with spectroscope attachment, by Brashear, and a meridian circle and zenith telescope, each of four inches aperture, also by Brashear. The mountings are by Warner and Swasey. This institution will be known as the Flower Observatory, and its director is Prof. C. L. Doolittle, formerly of the Lehigh University.

THE INTERNATIONAL CONGRESS OF PHYSIOLOGISTS AT BERN.[1]

II.

THURSDAY morning, September 12.—Presidents: Profs. Dastre and Wedensky. Prof. Arloing (Lyons) gave the result of his researches on the persistence of electric irritability in the peripheral ends of divided nerves. The author found that the length of time for which electric irritability was retained varied with the species of animal, and also with the individual, and further that it was different both for different nerves and for the different kinds of fibres in compound nerves, such as the vagus. For spinal nerves the irritability lasted from four to five days in dogs, and from eight to ten days in horses. In one ass the author obtained cardiac inhibition with a rise of blood pressure, upon stimulating the peripheral end of the vagus fifty-seven days after section; this result he attributed to a tetanus of the myocardium.

Dr. Arthus (Paris) defended the view that the salts of calcium are necessary to the coagulation of the blood, against that of Alex. Schmidt, who does not believe their *rôle* to be an essential one. He further discussed the action of neutral solutions of the oxalates, fluorides, &c., in rendering the blood incoagulable. He disagreed with Schmidt, who holds that they act specifically, and maintained that their effect is due solely to the fact that they precipitate the calcium salts. Arthus repeated Schmidt's experiments, and was unable to confirm his results.

Prof. v. Kries (Freiburg) discussed the phenomena of colour vision in eyes adapted for darkness.

Prof. Gamgee (Lausanne) gave the result of his researches on the violet and ultra-violet spectrum of hæmoglobin and its derivatives. He exhibited photographs which showed the

[1] Continued from p. 556.

absorption band between G and H presented by hæmoglobin. In the spectra of reduced hæmoglobin, of CO and NO hæmoglobin, the band was shown to be displaced towards the less refrangible end of the spectrum. This very remarkable and unusual band he showed to be due to the hæmatin moiety of the hæmoglobin molecule, and to be independent of the Fe. Prof. Gamgee described and showed photographs of the spectrum of turacine, a pigment obtained from the feathers of certain birds. This substance, containing 6·9 per cent. of copper, gives a spectrum identical with that of hæmoglobin. A demonstration followed at which the spectra were shown.

Prof. Burdon Sanderson (Oxford) gave a demonstration, illustrated by slides, of electrometric photographic curves, and maintained the following propositions.

Proposition A.—There are two kinds of electrical response (Reizschwankung) to excitation of a muscle by its nerve. I. Diminution of the E.M.F. of the previously existing muscle current. II. The excitation wave. The first (I.) is evoked (*a*) when the nerve is stimulated by equal alternating currents of great frequency, (*b*) by the constant current, (*c*) by salt crystals, &c. The second (II.) is evoked in uninjured muscle (*a*) by single electrical and mechanical momentary excitations, (*b*) by rhythmically repeated momentary excitations (true tetanus). I. and II. exist together in rhythmical excitation of injured muscle.

Proposition B.—In the reflex spasm of strychnine each phase of excitation resembles I. The strychnine spasm is not true tetanus.

Dr. Waller (London), gave the results of his researches on the influence of chemical reagents on the electrical excitability of isolated nerve. Excised frogs' nerves were rhythmically excited once a minute during one-eighth of a minute. The current of action was recorded by a galvanograph. The nerve was enclosed in a gas chamber to study the effects of gases, and dipped for one minute in decimolecular solutions for salts, and 1 per cent. solutions for alkaloids. By means of this method Dr. Waller was enabled to study the action of a large number of bodies, the results of which he gave; his researches also extended to the study of physiological antagonism.

Dr. Epstein (Bern) showed that the increase in the acuteness of vision, which occurs under the influence of auditory impressions, can be experimentally demonstrated. The author described his apparatus. He further expressed the opinion that the centre for this process lay not in the cortex, but in the superior corpora quadrigemina. He regarded it as essentially dependent upon a reflex sensibility of the retina, the optic nerve containing the efferent fibres; in favour of this view, he quoted an experiment in which by faradic excitation of the nerve from the cochlea he obtained eye movements, and increased conjunctival reflex.

Thursday Afternoon.—Presidents, Profs. Vitzou and Fredericque. Prof. Rutherford (Edinburgh) gave an account of his researches on the structure and contraction of striped muscular fibre. His observations were mostly made upon crabs' muscles fixed in a 4 per cent. solution of formaldehyde, and then stained with eosin or heliocine. He regards the fibrils as the essential elements of the sarcous substance, each fibril has in its whole length a thin envelope. He regards the fibril as composed of a series of segments—(1) Bowman's element, (2) the intermediate segment placed midway between successive Bowman's elements, and (3) the clear segment placed between (1) and (2). The intermediate segment is tripartite, and consists of Dobie's element, forming a node in its equator, and Flögel's, element (Nebenscheibe) on each side of it. During contraction, the first change consists in the shortening of the interval between the adjacent ends of Bowman's elements. This stage of the contraction probably results from the absorption of fluid by Bowman's elements. In the next stage Bowman's elements shorten owing to a real contraction of their tissue, their chromatin moving to their ends, which become swollen.

Drs. Sherrington and Mott gave the results of their researches on the functions of the posterior roots of the spinal nerves from the fourth cervical to the second dorsal. (*Roy. Soc. Proc.*, vol. liii., 1895.)

Prof. de Burgh Birch (Leeds), read a paper on the equipment of an experimental laboratory. The author has succeeded in obtaining apparatus of sufficient exactitude for physiological research at a very moderate cost. (His mechanician is Abm. Kershaw, Cankerwell Lane, Leeds).

Prof. Rosenthal (Erlangen) showed an apparatus for the quantitative determination of CO_2 in air. The apparatus was constructed for the purpose of practical hygiene.

Dr. Jacquet (Bâsle) gave the results of his researches on the blood in fever. In fever the red blood-cells are diminished; tepid baths but not antipyretics bring the number again to the normal. In artificial fever (rabbits raised to a temperature of 50° C.) the red blood-cells are also greatly diminished in the systemic veins, but are increased in the liver.

Dr. Gley (Paris) discussed the action of the intra-vascular injection of solutions of peptones in rendering the blood incoagulable. He showed that these bodies did not possess this action after the ligature of the lymphatics coming from the liver. From this experiment the author inferred that the substance which renders the blood incoagulable, and is produced in the organism under the influence of the peptones, is secreted by the hepatic cells.

Dr. I. V. Üxhüll (Heidelberg) showed an apparatus for the rapid mechanical stimulation of the nerve of a muscle-nerve preparation.

Dr. Schenk (Wurzburg) read a paper on the innervation of the iris. The author's communication chiefly concerned the observation of Dogel, that upon stimulation of the cervical sympathetic in cats, dogs and rabbits, in addition to the dilatation of the pupil on the same side, a contraction of the pupil on the other side occurred. Schenk regarded this phenomenon as a consensual pupil reflex (consensuelle Pupilla-Reflex). In Dogel's experiments the eye on the same side as the stimulated sympathetic was exposed to the light; hence during stimulation more light entered the pupil, and this caused contraction of the pupil of the opposite side. When the eye on the stimulated side was shaded from the light, the contraction of the other pupil did not take place. This explanation would not hold for rabbits, as in them the consensual pupil reflex is absent; the author was, however, in the case of rabbits, unable to repeat Dogel's results.

Dr. Leathes (London) read a paper on the osmotic changes between the blood and the tissues. The author gave the result of his experiments on the influence of strong solutions of cane-sugar and dextrose, and of iso-, hypo-, and hyper-tonic solutions of NaCl in causing the passage of fluid from the blood into the tissues, or *vice versâ*. The author further discussed the osmotic pressure of the lymph in the thoracic duct, which he found $\frac{1}{100}$ to $\frac{1}{200}$ higher than that of the blood.

Friday Morning, September 13.—Presidents, Profs. Rosenthal and Langley. Prof. Wedensky (St. Petersburg) read a paper on the exciting and inhibitory action of electric tetanisation on the nerve-muscle apparatus. The author showed that, if induced currents of great frequency and intensity be applied to the sciatic nerve, the gastrocnemius contracts strongly but soon relaxes; if at this time the intensity of the exciting currents be diminished until they become moderate, a very strong (optimum) contraction of the muscle takes place. Further, if when the muscle is in a condition of relaxation produced by the application of strong and frequent induced currents to the nerve, one diminishes the frequency, a strong tetanic contraction can be reproduced, which at once disappears upon again increasing the frequency. There is for each stage of tetanisation an optimum of frequency. The relaxation of a muscle, under the application of strong and frequent induced currents to its nerve, is caused by the nerve-endings entering into a condition of inhibition. This can be demonstrated by applying to the muscle moderately strong induced currents; no effect is produced until the strong and frequent tetanisation of the nerve is discontinued.

Dr. Lüscher (Bern) read a paper on the nervous mechanism of swallowing. The author's experiments were made upon rabbits. He showed that the three branches of the recurrent laryngeal overlapped in their distribution to the œsophagus, *i.e.* each branch supplied some of the region supplied by the other. After division of the recurrent laryngeal stimulation of the central end of the superior laryngeal did not produce swallowing. Upon stimulation of the central end of the divided recurrent laryngeal (the nerve of the other side being intact) a faint act of swallowing was produced. Stimulation of the central end of the vagus only gave rise to swallowing when the recurrent laryngeal was intact.

Prof. Bowditch (Boston) showed an apparatus to demonstrate the mechanism of the ankle-joint. By the introduction of a spring balance into the cord representing the gastrocnemius muscle, and the application of a weight, he could determine the relation between power and weight for the action of this muscle.

Dr. Waller (London) read a paper on the photo-electric currents of the retina.

Prof. Hensen (Kiel) gave a demonstration on an acoustic apparatus, the result of which was to show that the view of Helmholtz, that the vowels owe their special quality to overtones produced in the mouth and adjoining cavities, requires modification; this, in the author's opinion, is impossible.

Friday Afternoon.—Presidents, Profs. Richet and Cybulsky. Dr. Sherrington (London) gave a demonstration on eye movements.

Dr. Lanz (Bern) read a paper on the effect of removal of the thyroid, and of thyroid-feeding in normal animals. Among many interesting results, the author found that thyroidectomised hens either lost their power of laying eggs, or laid very small and ill-formed ones. On the other hand, hens fed with thyroids (30 grms. per diem) had their egg-laying power greatly increased. In some animals the author found that the administration of large quantities of thyroid gland caused an arrest of growth.

Dr. Phisalix (Paris) showed that the blood of the salamander rendered animals immune to curare. This immunity in the case of the frog and pigeon lasts several days.

Prof. Mosso (Turin) read a paper on the effect of rarefied air upon man and apes. The author's researches on man were made on Mount Rosa, at a height of 5600 metres. The author showed that at this altitude the respiratory exchange is diminished; his observations were made under conditions of absolute rest, mostly during sleep. In the explanation of these phenomena the author thinks more attention should be paid to the diminution of CO_2. He describes them under the name of Akapnia (*καπνος* = smoke). Mosso further described an experiment which he made upon a monkey. He subjected this animal to an atmosphere of pure O at a low pressure; he observed under these conditions the phenomena of mountain-sickness (*Bergkrankheit*) even when the pressure of the O exceeded the partial pressure of this gas in the atmosphere under ordinary circumstances. The author concluded that the two main factors which come into play at high altitudes are (1) the diminution of CO_2 in arterial blood; (2) the physical effect of low pressure on the nervous system.

F. W. TUNNICLIFFE.

CORRESPONDING SOCIETIES OF THE BRITISH ASSOCIATION.

THE first meeting of the Conference took place on Thursday, September 12, the second on Tuesday, September 17, at the Co-operative Hall, at 3.30 p.m.

At the first meeting, the Corresponding Societies Committee was represented by Mr. G. J. Symons (Chairman), Prof. R. Meldola, Mr. J. Hopkinson and Mr. T. V. Holmes (Secretary). The Chairman opened the proceedings with an address.

On the conclusion of the address, Mr. T. V. Holmes made a few remarks with regard to the list of papers read before the various Corresponding Societies, and appended to the Report of the Corresponding Societies Committee. He hoped that the Secretaries of the Corresponding Societies, in preparing their lists, would be careful to group papers, which from their titles might belong to either of two Sections, with that to which they had most affinity. It was also most desirable that the names of papers sent in should not turn out to be mere popular lectures, but should contain something original. It had sometimes happened that on wishing to refer to some paper on the list sent in by some Society, in order to ascertain its true character, it could not be found on their shelves at Burlington House. In future no paper could be placed on the list published by the British Association unless it was on their book-shelves.

Captain Elwes (Dorset) laid upon the table a paper on the rainfall in the county of Dorset, which had been compiled by a member of the Dorset Natural History and Antiquarian Field Club, Mr. Eaton. It was a most careful piece of work, and was illustrated by maps and diagrams.

Mr. Hopkinson said that about twenty years ago he began to note the rainfall of Hertfordshire with about twenty observers. Last year the record he published contained the monthly returns from forty observers. He trusted that delegates would preserve any early meteorological records they might find.

Mr. De Rance remarked that the increasing usefulness of local societies was shown by the fact that two British Association Committees had ceased to exist, that on coast erosion, and that on the circulation of underground waters, on account of the admirable way in which their work had been taken up by the local societies.

His Honour Deemster Gill said that the subject of coast erosion had been taken up by a Committee of the Legislature of the Isle of Man, but their investigations were not yet complete. They had found that for some twenty miles on the west, the north-west and the north, there had been a destruction of land of about twenty acres to the mile within the last fifty or sixty years. The meteorology of the Isle of Man was also being well looked after.

Mr. Sowerbutts asked whether it was desirable that the Manchester Geographical Society should collect the results of observations at their local observatories, and forward them to the Meteorological Society; and the Chairman replied in the affirmative.

Capt. Elwes hoped that local societies might be induced to co-operate for the discovery of flint implements, and the formulation of the results attained.

Mr. Osmund W. Jeffs, Secretary to the British Association Committee for the collection and Preservation of geological Photographs, said that the photographs collected would be placed in the Museum of Practical Geology, Jermyn Street, London. The first part of the collection, 800 photographs, had already been placed there. It was proposed to go on collecting, as many parts of the British Isles were quite unrepresented.

Mr. De Rance thought that it would be a good thing if each society would issue a circular and send it to other local societies, so that it might be known what photographs had been taken in each locality.

Mr. J. B. Murdoch (Glasgow) thought that in too many of their investigations Scotland was excluded. He mentioned, as an instance, the British Association Committee for recording the position, &c., of erratic blocks of England, Wales and Ireland.

Some discussion arose on this point, in which Mr. De Rance, Mr. Sowerbutts and Mr. G. P. Hughes took part. Then the Chairman said that he believed Scotland had been omitted in that instance because the Royal Society of Edinburgh had been working at the subject before the formation of the British Association Committee.

Mr. Murdoch replied that it was true that a Boulder Committee had existed in Scotland, but its director, Mr. Milne Holme, was dead, and had been unable to get about the country for some time before his death. The eight yearly reports issued by his Committee were very valuable, but for some time the work had been practically at a standstill.

The Chairman remarked that in that case it was most desirable that Scotland should be included by the Erratic Blocks Committee.

Deemster Gill said that the boulders of the Isle of Man were being noted by the Isle of Man Natural History and Antiquarian Society.

Prof. Meldola moved, and Mr. Hopkinson seconded, a motion in favour of an application to the General Committee for a grant of £30 to enable the Corresponding Societies Committee to carry on its work. This was carried, and the meeting ended.

At the second meeting, on Tuesday, September 17, the Corresponding Societies Committee was represented by Dr. Garson (in the chair), Mr. Hopkinson, Mr. Symons, and Mr. T. V. Holmes (Secretary).

The Chairman said that it was usual at their second meeting to consider the recommendations from the various Sections respecting work in which it was thought the Corresponding Societies might usefully co-operate.

Section A.

Mr. White Wallis, representing Section A, said that the Committees for investigating earth tremors and seismological phenomena in Japan had been merged into one, with the title of "Committee for Seismological Observations." The Committee for the application of photography to meteorology had been reappointed, and so had the Underground Temperature Committee. The Meteorological Photographs Committee was simply desirous to obtain photographs of lightning, rainbows, halos, &c.

The Rev. J. O. Bevan inquired whether the meteorological work formerly carried on at Stonyhurst by Father Perry was still going on. Mr. Sowerbutts answered that it was, and Mr. White Wallis said that he would note the suggestion that they should communicate with Stonyhurst. He added, in answer to questions, that instruments for noting earth tremors were unaffected by vibrations from passing waggons, trains, &c.

Section C.

Mr. A. S. Reid, representing Section C, stated that Mr. Osmund Jeffs had consented to retain the post of secretary to the Geological Photographs Committee for another year, as Mr. W. W. Watts had agreed to act as co-secretary during that time, and afterwards to become sole secretary. The Erratic Blocks Committee had altered its title so as to include Scotland.

Mr. Murdoch hoped that the Earth Tremors Committee might include Scotland in its sphere of action. It was then a purely English Committee.

Mr. M. B. Slater thought that an exchange of local geological photographs among the various Corresponding Societies would be a good thing. Some discussion then took place on the practical difficulties likely to arise from an interchange, such as the burden likely to be laid upon the shoulders of the amateur photographer, &c. Mr. Hopkinson thought that copies should be obtainable at the Jermyn-street Museum at a small fixed charge, and Mr. Reid mentioned a plan suggested by Mr. Gray of Belfast. At that town a photographer had been appointed who received the negatives taken by various members of the local societies, and furnished as many copies as were required at a small fixed charge.

Section E.

Mr. Sowerbutts said that the Committee of Section E had asked the Council of the British Association to permit them to have a Committee for the purpose of making an inquiry into the condition of the teaching of geography in Great Britain in all schools, especially secondary schools, and to report next year. It was probable that the Corresponding Societies might be asked to furnish certain information, and he hoped their secretaries would reply as promptly as possible.

The Rev. J. O. Bevan thought that the statements made in the report of the Conference of Delegates at Nottingham, that in some county, unnamed, "children attending schools were not taught geography in any way," and that geography was absolutely ignored in secondary schools, were decidedly erroneous, though in some primary schools it was not taught except in connection with reading. The Royal Geographical Society had instituted examinations in geography in secondary schools, and gave gold medals and other prizes.

Section H.

Mr. Hartland said that he was there owing to the very sad bereavement sustained recently by Mr. Brabrook, the Chairman of the Ethnographical Survey Committee, who was consequently unable to attend. The Ethnographical Survey was a matter in which the Corresponding Societies were especially capable of rendering valuable assistance. They had hitherto, however, met with but little response from the local societies. The work had so many branches that some of them could scarcely fail to interest their more active members. If the Committee obtained the grant for which they asked, they proposed to begin work in Galway, and he hoped to report progress at the next meeting. He would be glad if meanwhile the Corresponding Societies would circulate their schedules, and bring the Survey under the notice of their members.

Mr. M. B. Slater mentioned the work done in the neighbourhood of Malton by a sub-committee, of which Dr. Colby was chairman; and Mr. Hartland remarked that the Malton Naturalists' Society was one of those which had responded to their circular.

The Chairman noted the great variety of the work of the Ethnographical Survey, which included questions of physical characteristics, folk-lore, linguistic differences, place-names, traditions, &c. Satisfactory work had been done around Ipswich.

Mr. Hartland wished also to mention the preservation of ancient monuments. He had just received a letter from the Secretary of a local committee in Pembrokeshire, mentioning the recent discovery there of some ancient stones and some pit dwellings.

Mr. Hopkinson thought that the measurements asked for were very elaborate, and the questions were considered inquisitorial. He was sure that a simpler system would be found to answer better in practice, as then more societies or persons would be found willing to undertake the work.

Mr. Hartland hoped that members who objected to the elaborate measurements would take up the subjects of dialect, folk-lore, or prehistoric monuments. Though they hoped to be able to obtain the elaborate measurements in some cases, they were glad to get such measurements as could be procured. They did not consider their standard as of universal obligation.

The Chairman wished to say a few words about another Committee, that concerned with the measurement of school children. Many schools had been doing good work in this way, but unfortunately there had been no uniform system, so that the results obtained at one school could not be compared with those at another. The Committee had drawn up a system which he hoped would prove acceptable to the various schools.

Dr. Brett (Hertfordshire) said that since the York meeting of the British Association, fifteen years ago, it had been his custom as a medical man to record the height, weight, colour of hair and eyes, &c., of children. He had up to that time made about three thousand observations, but had not yet been able to put his records into shape.

The Rev. J. O. Bevan spoke of the desirability of expediting the archæological survey of the kingdom, which had been begun a few years ago. He was then at work at the map of Herefordshire, which was nearly ready for publication. He was surprised that the work had not been taken up more energetically by properly qualified persons in the different districts.

THE AFFILIATED SOCIETIES OF THE AMERICAN ASSOCIATION.

A FEATURE of the meetings of the American Association for the Advancement of Science is the number of affiliated societies which meet at nearly the same time and place, though having no organic connection with it. One disadvantage of this is that the Sections of the Association do not get many of the important papers read before the affiliated societies; in fact, these societies seem almost to take the place of the Sections, and they certainly tend to put the Association in a secondary position. As a large number of the papers were more of local than of general interest, we confine ourselves to a brief statement of the societies which met at Springfield during the recent meeting of the American Association, and of a few of the subjects considered.

The Society for the Promotion of Agricultural Science discussed several papers on spraying as a prevention of the attacks of various insect pests and fungi, and also on cereal culture in the United States. At the end of the proceedings, Mr. R. Lazenby was elected President of the Society.

The attention of the Association of Economic Entomologists was largely directed to the results of experimenting with insecticides, and the methods of placing the knowledge before all agriculturists. A resolution was passed asking the Massachusetts authorities to support the work of the Gipsy Moth Commission. Another resolution was adopted asking that the publication of "Insect Life" by the Department of Agriculture be resumed. The officers for the ensuing year are: President, Prof. C. H. Fernald; first vice-president, Prof. F. M. Webster; second, Prof. Herbert O. Ames; secretary, C. L. Marlatt.

The session of the American Forestry Association was a very successful one. In the course of a short communication, Baron Herman pointed out that Germany has comparatively the most forests in well-regulated administration of all the countries of the world; that is, one-fourth of its whole area is covered with them (all under long and careful management). There is scarcely one tree in the whole of the fatherland which is not known personally to a forest officer, and which has not been sown or planted with more or less great care and labour. The whole area of wooded land is almost equally divided between State, community, and private persons. And it is thought that this is a very good state of affairs, the commonwealth being in that way well interested in its parts as well as in the whole, in the affairs connected with the forest growth. This of course influences legislation, and although laws concerning the forests are not passed in the Reichstag, but in the Parliaments of the individual States, there is scarcely a part of Germany where one is allowed to cut down a forest, and not plant it again, without the permission of the Department of Forestry. The forests are managed by hundreds of forest officers, and these are educated at special colleges for forestry, there being no less than eleven in Germany. The theoretical study at these colleges lasts generally four years, not counting the time a young man has to spend in learning practical work in the woods. This comparatively long time a man wants, for his training shows how very much the science of forestry has been developed in

its different branches in Germany. After a man has passed his examinations he may often have to wait for years and years before he gets an appointment; but the love of the woods, the poetry which time has woven around the solitary *forsthaus* amidst the trees and animals of the woods is so great they do not mind waiting a long time. In conclusion, Baron Herman said he was in America to see what trees could be transplanted with success to Germany.

After a paper on the present condition of the forests of America, the following resolutions were adopted, among others:—

"That the American Forestry Association join with the New York Chamber of Commerce and Board of Trade in hearty advocacy of the establishment of a forestry commission of three members to make a thorough investigation of the public forest lands, and to make recommendations concerning their disposition and treatment, and the executive committee is hereby directed to represent the Association in support of such legislation."

"That the American Forestry Association recognising that a practical advance in rational forestry methods requires the services of men trained in forestry practice, endorse the legislation proposed in the last congress, and expresses the hope that the same will be enacted during the coming congress."

"That the knowledge and extent and conditions of our forest resources is a necessary basis for intelligent forest legislation, and that therefore the American Forestry Association recommends the co-operation of various government departments as far as practicable in ascertaining their areas and conditions, and especially recommends that both a topographical and forestal survey of the national forest reservations be instituted."

Sixteen papers were read before the American Mathematical Society, and two topics were discussed, viz. (1) a general subject catalogue or index of mathematical literature, and (2) the mathematical curricula of colleges and science schools. With reference to the former subject, it was resolved that the Council of the Society consider the desirability of offering their co-operation to the Mathematical Society of France in the work of classifying and indexing mathematical literature.

The American Chemical Society was presided over by Prof. E. F. Smith; and among the subjects of papers read before it were: an electrical process for the production of white lead; the heating effects of coal; speed of oxidation of chloric acid; reaction between copper and concentrated sulphuric acid; use of aluminium for condensers in the distillation of alcohol, ether, chloroform, benzine and similar liquids. Prof. Norton, who read the last-named paper, stated that the equipment of the chemical laboratory of the University of Cincinnati includes aluminium supports, rings, clamps, burners, water-baths, air-baths, hot water funnels, &c., in all of which connections the lightness, conductivity, and freedom from rust render the metal superior to iron or bronze.

The Botanical Society of America, which was organised in Brooklyn last year, held its first annual meeting on August 27 and 28. Mr. William Trelease presided. The officers elected for the ensuing year are: President, C. E. Bessey; vice-president, W. P. Wilson; secretary, Charles R. Bainer; treasurer, Arthur Hollick.

Prof. G. F. Swain opened the proceedings of the Society for the Promotion of Engineering Education with an address on the relation between mental training and practical work in engineering education. The papers read before the Society, and the discussions to which they gave rise, will do much to indicate what should be the scope of engineering and technical schools, and the places of different subjects in an engineering education. The units of force best adapted for use in the teaching of mathematics formed the subject of a discussion between the physicists and engineers. At the end of the meeting, Mr. Mansfield Merriman was elected President.

ON RECENTLY DISCOVERED REMAINS OF THE ABORIGINAL INHABITANTS OF JAMAICA.[1]

THE circumstances under which the human remains now exhibited to the meeting were discovered, are narrated in a communication by Mr. F. Cundall, Secretary to the Jamaica Institute, published in the *Journal* of the Institute for April 1895, and also in a letter by Mr J. E. Duerden, Curator of the Museum, in NATURE of June 20. From the former I extract the following description of the discovery:—"On the 10th April, a labourer, whilst cutting stakes on the Halberstadt Estate (a wild, rocky part of the Port Royal Mountains, about 2000 feet above the sea-level, and two miles from the shore) on the estate of Mr. B. S. Gossett, a quarter of a mile east of the Kalorama Mission Station, discovered on the hillside a human bone. This led the Rev. W. W. Rumsey to make a search on the following day, when he discovered a small aperture 25 inches wide, and less than 2 feet high, in the face of the limestone rock, and blocked by boulders; on removing these, and passing through which, he discovered a cavern with water-worn sides, partially covered with stalactite deposits, penetrating into the rock for a distance of about 20 feet, about 5 feet across at its widest part, and not more than 2 or 3 feet high. The floor was covered with a deposit about 12 inches thick, of a fine light yellowish dust, but the remains were superficial."

In addition to the human bones, to be presently described, were found a considerable portion of a cedar-wood canoe, about 7 feet long, fragments of pottery, including two, nearly perfect, earthenware vessels similar to those known to have been made by the Arawak Indians, an outer portion of the trunk of an *arbor-vitæ*, probably serving at one time as a "mortar," scarcely showing any sign of decay; the perfect skulls and other parts of the skeleton of a rodent (the so-called Jamaica coney, *Capromys brachyurus*); two large marine shells (*Fusus* and *Murex*), the soft parts of which are still eaten by the natives, numerous land shells (*Helix*, &c.). A flint implement is also mentioned in Mr. Duerden's account.

The only portion of the contents of the cavern submitted to me for examination consist of the human bones, and as they only arrived in London a few days before I was leaving town, at present I have only been able to make a general examination of them, without any detailed measurements.

Their principal interest consists in the circumstance, proved both by the conditions under which they were found, and by their own characteristics, that they are the remains of the race which inhabited the island previous to its discovery by the Spaniards, by whom they were in so short a time barbarously and utterly exterminated.

Whatever condition the bones were found in as they lay in the cave, they are now completely mixed up, and it is impossible to put together anything like complete skeletons, or even, except in very few cases, to associate the bones of individuals; and the number of odd bones and fragments show that large portions of the individuals who were buried or died in the cave are now missing. Their general condition of preservation, colour, &c., is nearly the same in all, so there is no reason to suppose that they were not contemporaneous. None of the bones show any wounds or marks of violence, but all appear to be those of persons who have died a natural or slow death. Both sexes and almost all ages are represented, from children of four or five years to very old persons, the proportion of the latter, as will be seen, being remarkable.

Of the crania, there are six complete, all those of fully adult or aged persons, and two calvariæ (without the facial portion), both of children. There are also fragments of six others, giving evidence of fourteen individuals.

Of the adult skulls three appear to be masculine and three feminine in type.

Five of these show evidence of artificial depression of the frontal region in various degrees. In two it is very marked; in the others less so. In the sixth, though the frontal region is low, no effects of artificial deformation are evident. Both the children's skulls are very broad and flat, but whether naturally so, or whether this character has been exaggerated artificially it is difficult to say. The mode of depression, when it occurs, is similar in all, evidently produced by the flat board upon the forehead—the commonest custom throughout so large a portion of the ancient inhabitants of the American continent.

Although there is a considerable general resemblance between these skulls, they present strong individual characters; but their whole aspect, taken together, is characteristic of the American type. The retreating forehead, well marked supraciliary ridges, round broad arch of the palate, round high orbits, narrow nasal aperture, and especially the narrow prominent nasal bones, causing a high bridge to the nose during life, are very characteristic. There are, however, two rather remarkable exceptions to this form of nose, in which the breadth of the aperture and flatness of the

[1] Read before Section H of the British Association at Ipswich, September 12, by Sir William H. Flower, K.C.B., F.R.S.

nasal bones almost recall those of the negro; the nasal index being as high, respectively, as 542 and 563. These are both feminine-looking heads, and one of them is the most and the other the least deformed of the set. Whether this form of nose is met with in any other undoubtedly aboriginal American crania, is subject for investigation. Apart from these, the skulls are remarkably like the majority of those which I have seen of Peruvians, Mexicans, and the ancient mound-builders of the United States.

Of lower jaws there are in all twenty-two, a number which indicates that many of the crania must now be missing from the collection. They are interesting as showing age, and peculiarities of dentition; nineteen are adults, and three young. The youngest has the milk teeth only—the first permanent molar, and first incisors being just about to appear (about six years old). One is a little older, the first molar being fully in place with the two milk molars. Another has all the permanent teeth in place, except the last molars (wisdom teeth), which are still in their alveoli.

In all the others the permanent teeth appear to have been fully in place, but the number of losses sustained during life is remarkable. As so many of the teeth have dropped out since death, it is mainly by the condition of the alveoli that their presence or absence during life can be judged of, for in only two or three do all appear to have been retained. Two are absolutely edentulous. In eight, not one of the true molars remain, the whole available dentition being represented by the incisors, and in a few cases by an isolated canine or premolar. Seven had lost one or more of the true molars. All the teeth, except those of the very young individuals, are much worn, but scarcely any show signs of disease or decay, there being only three small carious cavities among them all. Yet the milk molars in both the child's jaws, which were soon to be shed, have their crowns deeply excavated.

The only dental anomaly is that in one of the skulls the right upper wisdom tooth is placed horizontally, its crown projecting outwards through the surface of the maxillary bone, its lower edge two millimetres above the alveolar border.

The limb bones indicate an average height rather below the middle size, but, as just stated, I have not yet had time to make accurate measurements and calculations.

Clavicles, 7 right, 10 left, all adult. *Scapulæ*, all more or less broken; fragments of 15 right and 11 left adult, and 1 young. *Humeri*, right, 5 adult and 2 young; left, 10 adult, 1 young (not corresponding with either of those of the opposite side). *Radii*, right, 14 adult, 3 young; left, 17 adult, 1 young. *Ulnæ*, right, 14 adult, 2 young; left, 10 adult, 1 young. *Pelvic bones*, mostly very fragmentary, but showing evidence of at least 9 adult males, 5 adult females, and several children. *Femora*, as with the other long bones, there are very few pairs, thus showing that there were more individuals than the actual number of bones would indicate: right, 11 adult and 2 young, 1 nearly full grown, but without epiphyses, 1 younger; left, 17 adult and 6 young of various ages, from quite small children upwards. None of these six have corresponding bones of the opposite side, so there is evidence from the femora of at least 23 individuals. *Tibiæ*, 18 right and 19 left, all adult. *Fibulæ*, 12 right and 11 left adult, and 3 young.

One of the largest of the femora has the head greatly enlarged and deformed by chronic rheumatic arthritis. The lower articular surface was mostly broken away, but the portion that remained appeared healthy.

One of the left tibiæ shows throughout the shaft marked evidence of chronic periostitis, the surface being thickened and vascular. A bone of the opposite side, which might have been of the same individual, shows the same condition in a less marked degree.

These are the only pathological conditions observed in any of the bones.

The question that naturally occurs after the examination of these remains is, How did they get into the cave? The condition of the bones, and of the objects which were found with them all, point to their belonging to the native Indian inhabitants, and not to any of the races which have been introduced into the island during the last four hundred years. A cave of such small dimensions, in which a man could not stand upright, could scarcely have been the regular habitation of such a large number of persons. It might have been a place of sepulture, but from its inaccessible position it seems more likely to have been a refuge to which the young, the feeble and the aged of a tribe had fled for safety, and in a vain endeavour to escape the horrible massacres by which we know the great bulk of the native population perished, had met a scarcely less miserable fate. Other similar discoveries, which will doubtless be made in the future, may throw light upon this question, and it is satisfactory to know that the authorities of the Jamaica Institute are now alive to the importance of carefully examining and preserving all such evidence as may still remain of the ancient history of the island and its inhabitants. The communication was illustrated by sketches of the cave, made by Mrs. Frank Cundall.

ELECTRIFICATION AND DISELECTRIFICATION OF AIR AND OTHER GASES.[1]

§ 1. EXPERIMENTS were made for the purpose of finding an approximation to the amount of electrification communicated to air by one or more electrified needle points. The apparatus consisted of a metallic can 48 cms. high and 21 cms. in diameter, supported by paraffin blocks, and connected to one pair of quadrants of a quadrant electrometer. It had a hole at the top to admit the electrifying wire, which was 5·31 metres long, hanging vertically within a metallic guard tube. This guard tube was always metallically connected to the other pair of quadrants of the electrometer and to its case, and to a metallic screen surrounding it. This prevented any external influences from sensibly affecting the electrometer, such as the working of the electric machine which stood on a shelf 5 metres above it.

§ 2. The experiment is conducted as follows:—One terminal of an electric machine is connected with the guard tube, and the other with the electrifying wire, which is let down so that needle is in the centre of the can. The can is temporarily connected to the case of the electrometer. The electric machine is then worked for some minutes, so as to electrify the air in the can. As soon as the machine is stopped the electrify-

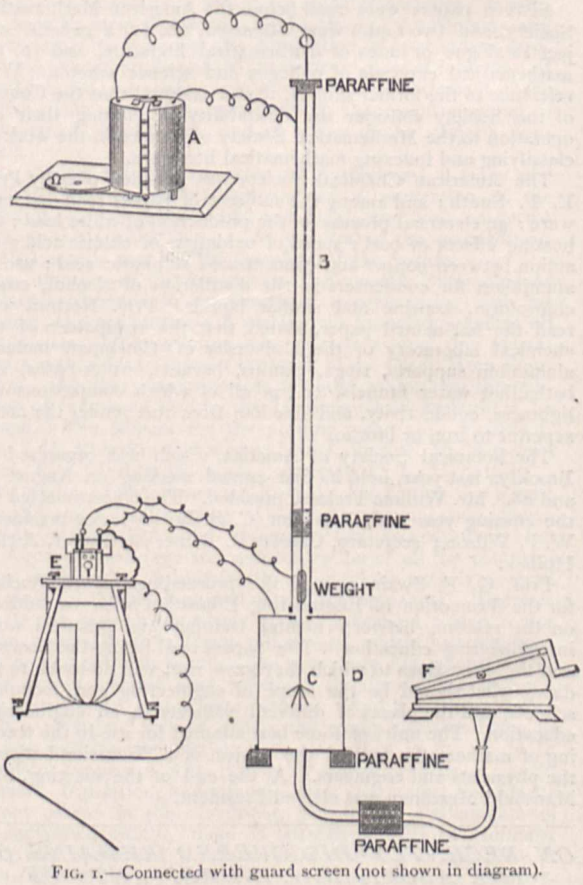

FIG. 1.—Connected with guard screen (not shown in diagram).

[1] Abstract of a paper, by Lord Kelvin, Magnus Maclean, and Alexander Galt, read before Section A of the British Association.

ing wire is lifted clear out of the can. The can and the quadrants in metallic connection with it are disconnected from the case of the electrometer, and the electrified air is very rapidly drawn away from the can by a blowpipe bellows arranged to suck. This releases the opposite kind of electricity from the inside of the can, and allows it to place itself in equilibrium on the outside of the can and on the insulated quadrants of the electrometer in metallic connection with it.

§ 3. We tried different lengths of time of electrification and different numbers of needles and tinsel, but we found that one needle and four minutes of electrification gave nearly maximum effect. The greatest deflection observed was 936 scale divisions. To find, from this reading, the electric density of the air in the can, we took a metallic disc, of 2 cms. radius, attached to a long varnished glass rod, and placed it at a distance of 1·45 cm. from another and larger metallic disc. This small air condenser was charged from the electric light conductors in the laboratory to a difference of potential amounting to 100 volts. The insulated disc thus charged was removed and laid upon the roof of the large insulated can. This addition to the metal in connection with it does not sensibly influence its electrostatic capacity. The deflection observed was 122 scale divisions. The capacity of the condenser is approximately $\frac{\pi \times 2^2}{4\pi \times 1{\cdot}45} = \frac{1}{1{\cdot}45}$. The quantity of electricity with which it was charged was $\frac{1}{1{\cdot}45} \times \frac{100}{300} = \frac{1}{4{\cdot}35}$ electrostatic unit. Hence the quantity to give 936 scale divisions was $\frac{1}{4{\cdot}35} \times \frac{936}{122} = 1{\cdot}7637$.

The bellows was worked vigorously for two and a half minutes, and in that time all the electrified air would be exhausted. The capacity of the can was 16,632 cubic centimetres, which gives, for the quantity of electricity per cubic centimetre, $\frac{1{\cdot}7637}{16{,}632} = 1{\cdot}06 \times 10^{-4}$. The electrification of the air in this case was positive; it was about as great as the greatest we got, whether positive or negative, in common air when we electrified it by discharge from needle points. This is about four times the electric density which we roughly estimated as about the greatest given to the air in the inside of a large metal vat, electrified by a needle point and then left to itself, and tested by the potential of a water-dropper with its nozzle in the centre of the vat, in experiments made two years ago and described in a communication to the Royal Society in May, 1894.[1]

§ 4. In subsequent experiments, electrifying common air in a large gas-holder over water by an insulated gas flame burning within it with a wire in the interior of the flame kept electrified by an electric machine to about 6000 volts, whether positively or negatively, we found as much as $1{\cdot}5 \times 10^{-4}$ for the electric density of the air. Electrifying carbonic acid in the same gas-holder, *whether positively or negatively*, by needle points, we obtained an electric density of $2{\cdot}2 \times 10^{-4}$.

§ 5. We found about the same electric density ($2{\cdot}2 \times 10^{-4}$) of *negative* electricity in carbonic acid gas drawn from an iron cylinder lying horizontally, and allowed to pass by a U-tube into the gas-holder without bubbling through the water. This electrification was due probably not to carbonic acid gas rushing through the stopcock of the cylinder, but to bubbling from the liquid carbonic acid in its interior, or to the formation of carbonic acid snow in the passages and its subsequent evaporation. When carbonic acid gas was drawn slowly from the liquid carbonic acid in the iron cylinder placed upright, and allowed to pass, without bubbling, through the U-tube into the gas-holder over water, no electrification was found in the gas unless electricity was communicated to it from needle points.

§ 6. The electrifications of air and carbonic acid described in §§ 4 and 5 were tested, and their electric densities measured by drawing by an air pump a measured quantity of the gas[2] from the gas-holder through an india-rubber tube to a receiver of known efficiency and of known capacity in connection with the electrometer. We have not yet measured how much electricity was lost in the passage through the india-rubber tube. It was not probably nothing; and the electric density of the gas before leaving the gas-holder was no doubt greater, though perhaps not much greater, than what it had when it reached the electric receiver.

§ 7. The efficiency of the electric receivers used was approximately determined by putting two of them in series, with a paraffin tunnel between them, and measuring by means of two quadrant electrometers the quantity of electricity which each took from a measured quantity of air drawn through them. By performing this experiment several times, with the order of the two receivers alternately reversed, we had data for calculating the proportion of the electricity taken by each receiver from the air entering it, on the assumption that the proportion taken by each receiver was the same in each case. This assumption was approximately justified by the results.

§ 8. Thus we found for the efficiencies of two different receivers respectively 0·77 and 0·31 with air electrified positively or negatively by needle points; and 0·82 and 0·42 with carbonic acid gas electrified negatively by being drawn from an iron cylinder placed on its side. Each of these receivers consisted of block tin pipe, 4 cms. long and 1 cm. diameter, with five plugs of cotton wool kept in position by six discs of fine wire gauze. The great difference in their efficiency was no doubt due to the quantities of cotton wool being different, or differently compressed in the two.

§ 9. We have commenced, and we hope to continue, an investigation of the efficiency of electric receivers of various kinds, such as block tin, brass, and platinum tubes from 2 to 4 cms. long, and from 1 mm. to 1 cm. internal diameter, all of smooth bore and without any cotton wool or wire gauze filters in them; also a polished metal solid, insulated within a paraffin tunnel. This investigation, made with various quantities of air drawn through per second, has already given us some interesting and surprising results, which we hope to describe after we have learned more by farther experimenting.

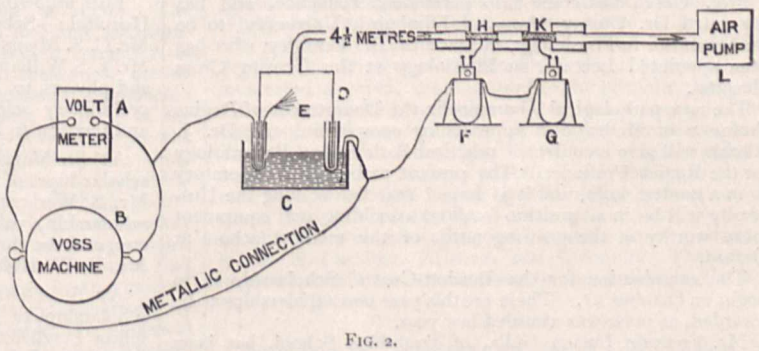

FIG. 2.

§ 10. In addition to our experiments on electric filters we have made many other experiments to find other means for the diselectrification of air. It might be supposed that drawing air in bubbles through water should be very effective for this purpose, but we find that this is far from being the case. We had previously found that non-electrified air drawn in bubbles through pure water becomes negatively electrified, and through salt water positively. We now find that positively electrified air drawn through pure water, and negatively electrified air through salt water, has its electrification diminished but not annulled, if the primitive electrification is sufficiently strong. Negatively electrified air drawn in bubbles through pure water, and positively electrified air drawn through salt water, has its electrification augmented.

§ 11. To test the effects of heat we drew air through combustion tubes of German glass about 180 cms. long, and 2½ or 1½ cms. bore, the heat being applied externally to about 120 cms. of the length. We found that, when the temperature was raised to nearly a dull red heat, air, whether positively or negatively electrified, lost little or nothing of its electrification by being drawn through the tube. When the temperature was raised to a dull red heat, and to a bright red, high enough to soften the

[1] "On the Electrification of Air," by Lord Kelvin and Magnus Maclean.

[2] The gas-holder was 38 cms. high and 81 cms. in circumference. Ten strokes of the pump raised the water inside to a height of 8·1 cms., so that the volume of air drawn through the receivers in the experiments was 428 cubic centimetres per stroke of the pump. This agrees with the measured effective volume of the two cylinders of the pump.

glass, losses up to as much as four-fifths of the whole electrification were sometimes observed, but never complete diselectrification. The results, however, were very irregular. Non-electrified air never became sensibly electrified by being drawn through the hot glass tubes in our experiments, but it gained strong positive electrification when pieces of copper foil, and negative electrification when pieces of carbon, were placed in the tube, and when the temperature was sufficient to powerfully oxidise the copper or to burn away the charcoal.

§ 12. Through the kindness of Mr. E. Matthey, we have been able to experiment with a platinum tube 1 metre long and 1 milimetre bore. It was heated either by a gas flame or an electric current. When the tube was cold, and non-electrified air drawn through it, we found no signs of electrification by our receiver and electrometer. But when the tube was made red or white hot, either by gas burners applied externally or by an electric current through the metal of the tube, the previously non-electrified air drawn through it was found to be electrified strongly positive. To get complete command of the temperature we passed a measured electric current through 20 centimetres of the platinum tube. On increasing the current till the tube began to be at a scarcely visible dull red heat, we found but little electrification of the air. When the tube was a little warmer, so as to be quite visibly red hot, large electrification became manifest. Thus 60 strokes of the air-pump gave 45 scale divisions on the electrometer when the tube was dull red, and 395 scale divisions (7 volts) when it was a bright red (produced by a current of 36 amperes). With stronger currents, raising the tube to white-hot temperature, the electrification seemed to be considerably less.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—There are few changes of importance in the lists of lectures issued by the Board of Faculty of Natural Science for Academical year.

Prof. Gotch has come into permanent residence, and has appointed Dr. Gustav Mann, of Edinburgh University, to be Demonstrator in Physiology, in place of Dr. Pembrey, who has been appointed Lecturer in Physiology at the Charing Cross Hospital.

The new pathological laboratory in the Department of Regius Professor of Medicine is approaching completion, and Dr. J. Ritchie will give a course of practical Pathological Bacteriology for the Regius Professor. The present pathological laboratory is on a modest scale, and it is hoped that before long the University will be in a position to afford a building and equipment more worthy of the growing needs of the medical school at Oxford.

The examination for the Burdett-Coutts' Scholarship is to begin on October 21. There are this year two scholarships to be awarded, as none was awarded last year.

Mr. Frederic Lucien Golla, of Tonbridge School, has been elected to a Demyship in Natural Science at Magdalen College.

Four scholarships are announced for election at Wadham College on December 1, 1895, and in addition the Warden and Fellows have power to give exhibitions of £30 to £40 a year. No papers in Natural Science will be set, but in the case of one of the exhibitions preference will be given to any candidate who shall undertake to read for honours in Natural Science, and to proceed to a degree in Medicine in the University of Oxford.

CAMBRIDGE.—The election to the vacant professorship of botany will take place on Saturday, November 2, at 2.30 p.m. Candidates are to send their names and testimonials to the Vice-Chancellor, Sidney Sussex Lodge, by October 26. The electors are Dr. Vines, Mr. Sedgwick, Dr. Allbutt, Dr. D. Oliver, Dr. Phear, Mr. F. Darwin, Sir J. D. Hooker, and Prof. Foster.

The election of a head of a college to be an elector to the Sadlerian Professorship of Pure Mathematics will take place on Tuesday, October 22, at 1 p.m. The vacancy is caused by the resignation of Dr. Phear, late Master of Emmanuel. The electors are those persons whose names are on the electoral roll of the University. Dr. Ferrers, of Caius, and Dr. Taylor, of St. John's, are the present "heads" on the board of electors to the professorship.

Mr. C. T. R. Wilson, of Sidney Sussex College, has been appointed assistant-demonstrator of experimental physics in the place of Mr. Capstick, resigned.

The Clerk-Maxwell Scholarship in Physics is vacant by the resignation of Mr. Whetham. Candidates are to apply to Prof. Thompson, at the Cavendish Laboratory, by November 1. The scholarship is worth about £180 a year, and is tenable for three years. Candidates must be members of the University who have worked for a term or more at the Cavendish Laboratory.

Among the Fellows of Trinity College elected on October 10, are Mr. C. P. Sanger, bracketed second wrangler 1893; the Hon. W. Russell, bracketed eighth wrangler 1893; and Mr. I. L. Tuckett, first class Parts I. and II. Natural Sciences Tripos, and Coutts Trotter student in physics and physiology. Mr. Sanger and Mr. Russell were also placed in the first class of Part II. of the Moral Sciences Tripos 1894.

THE London University Guide for the year 1895–96 has just been published by the University Correspondence College Press.

DR. DUNN, head master of the Plymouth Technical Schools, has been appointed principal of the Northern Polytechnic Institute, Holloway Road.

MR. HENRY LOUIS has been elected Professor of Mining at the Durham College of Science, Newcastle-upon-Tyne, by a Joint Committee nominated by the College and the Coal Trades Associations of Durham and Northumberland.

THE October *Record* of Technical and Secondary Education contains an illustrated article on the Yorkshire College, Leeds; and also a comparative summary of recent progress in technical education in various counties. This latter article continues and concludes a review of the work done by the Technical Education Committees of the English counties, commenced in the April number of the *Record*.

THE entrance scholarships at the London Hospital Medical School have been awarded as follows:—Price scholarship in science, £120, Mr. H. Balean; Science scholarships, £60 and £35, Mr. O. Eichholz and Mr. A. B. Soltau; Price scholarship in anatomy and physiology, for university students, £60, Mr. R. C. Wall and Mr. J. H. Evans.

THE following awards have been made at St. Bartholomew's Hospital:—Scholarship of £75 in biology and physiology, to Mr. C. S. Myers; scholarship of £75 in chemistry and physics, to Mr. J. S. Williamson; scholarship of £150 in biology, chemistry, and physics, to Messrs. R. C. Bowden and R. H. Paramore; preliminary scientific exhibition of £50 in biology, chemistry, and physics, to Mr. J. C. M. Bailey.

AT St. Mary's Hospital Medical School the two university scholarships, of the value of £52 10*s*. each, have been awarded to Mr. R. Wade and Mr. G. S. Keeling; the first natural science scholarship, value £105, has been awarded to Mr. W. H. Willcox, and the three value £52 10*s*. each to Mr. H. Lovell-Keays, Mr. E. W. Holyoak, and Mr. A. F. Hayden.

AT St. George's Hospital Medical School, science entrance scholarships of £85 have been awarded to Mr. Herbert Stringfellow Pendlebury, to Mr. Henry Goodridge Deller, and to Mr. John Howell Evans.

THE following recent appointments are announced:—Prof. W. A. Setchell to the chair of botany in the University of California; Prof. H. Talbot to be associate professor of chemistry in the Massachusetts Institute of Technology; Dr. O. Jaekel, Privat-docent in geology in Berlin University, to be Extraordinary Professor; Dr. P. Lenard to the chair of physics in the Technische Hochschule at Aacheen.

SCIENTIFIC SERIALS.

American Journal of Mathematics, vol. xvii. No. 4 (Baltimore, October).—On the deformation of thin elastic wires, by A. B. Basset. In the author's previous paper (vol. xvi.) on the deformation of thin elastic plates and shells, whilst commending the novelty, power and elegance of the *geometrical* investigations employed in Mr. Love's treatise on elasticity, he impugned the treatment of the *physical* portion of the subject. It is on the same ground of defective treatment that Mr. Basset considers that a further exposition on the theory of wires is needed, and this is what is furnished in the present paper. A useful table of contents precedes the text.—Investigations in the lunar theory, by Prof. E. W. Brown, is a memoir to which reference has already been made in our columns (No. 1352, p. 533).—The closing paper is by Otto Staude, "Ueber den Sinn der Windung in den Singulären Puncten einer Raumcurve."

Bulletin de l'Académie Royale de Belgigue, No. 6.—The conditions under which hydrogen peroxide is decomposed, by W. Spring. The catalysis of hydrogen peroxide takes place without chemical action by contact with various substances when the formation of water is favoured. Any substance which is more easily impregnated with water than with H_2O_2 brings about the decomposition of the latter. A solution of H_2O_2 containing salts is the seat of a decomposition whose activity increases with the temperature.—Chemical study of eight earths of the Lower Congo, by E. Stuyvaert. The analysis of earths from Boma, Zenze, Banza-Kasi, Mayombe, and Vungu-Mumba proves that the soils of the Lower Congo, sandy as well as calcareous, are provided with reserves of phosphoric acid and potash which insure a high fertility. It is certain that in the territories where the disappearance of forests has not modified the rainfall, as in Mayombe, the cultivation of coffee, cocoa, and other economic plants can be carried on for a long time without the use of manure.—On the critical temperatures of solution and their application to general analysis, by L. Crismer. The critical temperatures of solution may be used for the identification of chemical bodies without the necessity of weighing them, and they form a valuable additional criterion for the purpose of qualitative analysis. The critical temperature of solution is independent of the amount of either body present. It varies very much from one substance to another, but is constant for the same substance. For a mixture of two bodies, it is sensibly equal to the arithmetical mean of those of the constituents taken singly. Just as the surface tension of a liquid is reduced to zero at the critical temperature of vaporisation, so the surface tension of the lower liquid tends towards zero at the critical temperature of solution, and the meniscus separating them becomes a plane. An optical method of determining these critical temperatures may be based upon this fact.

Wiedemann's Annalen der Physik und Chemie, No. 9.—Double refraction of electromagnetic rays, by Peter Lebedew. The author succeeded, by a modification of Hertz's apparatus, in dealing with waves not more than 0·6 cm. long, and in demonstrating the phenomena of polarisation, reflection, and refraction with apparatus of the size ordinarily used in optics. The resonator used was a small thermo couple of iron and "constantane." An ebonite prism 1·8 cm. long showed refraction to within 3° of arc. Rhombic sulphur showed measurable double refraction, and a "Nicoll prism" was successfully constructed of two sulphur prisms with a plate of ebonite in place of the Canada balsam.—Luminescence of organic substances in the three states, by E. Wiedemann and G. C. Schmidt. Many organic vapours show true fluorescence, and some, like naphthalene, give composition spectra under the electric discharge, without being dissociated. Kathode luminescence is shown by many organic liquids, and the colour corresponds to that of the vapour. But the luminescence of the solid bodies often differs from that in the liquid state. Solid anthracene shows green, gaseous anthracene blue luminescence.—A vibration galvanometer, by H. Rubens. This instrument somewhat resembles Wien's optical telephone, and is used for measuring the intensity of alternating currents. It consists of a soft iron armature attached to a stretched wire. This executes torsional vibrations which are timed to the period of the alternating current. The latter traverses four electromagnets ranged round the armature, and when the periods are identical the armature executes strong torsional vibrations whose amplitude is measured by the width of a slit as seen reflected in a mirror attached to the wire. This arrangement is much more sensitive than the electrodynamometer.—Theory of the broadening of spectrum lines, by B. Galitzin. The molecular theory is superior to those based upon Doppler's principle, upon Kirchhoff's law, or upon damping. It admits of a development based upon the electromagnetic theory, that of molecular resonators. The broadening is a consequence of the forced vibrations produced by the collision of molecules. The want of symmetry of the broadening, and the influence of temperature and pressure are immediate consequences of the molecular theory as developed by the author.

THE numbers of the *Journal of Botany* for August–October contain several articles of interest to descriptive botanists. Mr. E. G. Baker concludes his revision of the African species of *Eriosema*, and Mr. A. B. Rendle his description of Mr. Scott Elliot's tropical African orchids, including a large number of new species; Mr. D. Prain continues his account of the genus *Argemone*; Mr. E. A. L. Ballers contributes a list of Marine Algæ new to Britain; and Mr. Arthur Bennett some notes on British Characeæ.—There are biographical notices of the late Profs. W. C. Williamson and C. C. Babington, with a portrait of the latter.

Boll. della Soc. Sismol. Ital., vol. i., 1895, No. 5.—Some observations made on Vesuvius on June 21, 1895, by M. Baratta.—Vesuvian notes (January–June 1895), by G. Mercalli.—Hydrothermal observations at Fiumecaldo from January to April 1895, by C. Guzzanti.—Notices of Italian earthquakes, April 1895. A valuable record of the observations of the first after-shocks of the Laibach earthquake of April 14 from a large number of Italian stations.

SOCIETIES AND ACADEMIES.

LONDON.

Entomological Society, October 2.—Prof. Raphael Meldola, F.R.S., President, in the chair.—Mr. McLachlan exhibited, on behalf of Mr. Bradley, of Birmingham, the specimens of Diptera attacked by a fungus of the genus *Empusa*, of which an account had recently appeared in the *Entomologist's Monthly Magazine*.—Mr. H. Tunaley exhibited specimens of *Lobophora viretata* from the neighbourhood of Birmingham. Specimens of the green dark form were shown in their natural positions on the bark, and specimens of the yellow form were shown on leaves on which they rested.—Mr. J. W. Tutt exhibited cases formed by a lepidopterous insect received from the Argentine Republic, which he said he recognised as being either identical with, or closely allied to, *Thyridopteryx ephemeræformis*, which did great damage to many orchard and forest trees in North America. Mr. Tutt also exhibited a series of *Lycæna ægon* captured by Mr. Massey, of Didsbury, on the mosses in Westmoreland. The males were remarkable in bearing two very distinct shades of colour. The females also differed considerably from the form occurring in the South of England. He also exhibited a long series of *Hydræcia lucens*, captured in the mosses near Warrington, and for comparison a series of *Hydræcia paludis*, and he read notes on the various specimens exhibited.—Dr. Fritz-Müller communicated a paper entitled "Contributions towards the history of a new form of larvæ of Psychodidæ (Diptera), from Brazil."—Baron Osten-Sacken communicated a paper, supplemental to the preceding one, entitled "Remarks on the homologies and differences between the first stages of Pericoma and those of the new Brazilian species."—The Rev. A. E. Eaton also contributed some supplementary notes to Dr. Fritz-Müller's paper.—Lord Walsingham, F.R.S., read a paper entitled "New Species of North American Tortricidæ." In this paper twenty-nine species were dealt with, of which twenty-six were described as new, from Florida, California, N. Carolina, Arizona, and Colorado. The paper also included certain corrections made by the author in the nomenclature of genera.

PARIS.

Academy of Sciences, October 7.—M. Janssen in the chair.—On an ascension to the summit of Mont Blanc, and on the work carried out during the summer of 1895 on the "massif" of this mountain, by M. J. Janssen. The ascent is described, together with an account of the cloud phenomena observed during a day in the higher regions. Passing on to describe the 0·33 m. telescope about to be erected at the observatory, it is remarked that the parts, now all assembled at the summit, will be mounted as a polar siderostat. A 0·6 m. mirror is to be mounted with the telescope. The observer will control all movements from a chamber of observation, which will be heated as may be required. As the instrument could not be taken down and remounted, it was bodily moved on to a new base formed of strong plates frozen on to the ice, and its pendulum then beat as regularly as at Paris. Observations with a Duboscq two-prism spectroscope in this very dry atmosphere failed to show any rays of aqueous origin in the solar light. The observatory has suffered a slight downward settling towards Chamounix; this took place in 1893 and 1894, and the movement is now insignificant. (See Our Astronomical Column.)—Study of some meteorites, by M. Henri Moissan. Iron from Kendal county in Texas contained amorphous carbon, but neither graphite nor diamond. Iron from Newstead (Roxburghshire) yielded amorphous carbon and graphite, but not diamond. Déesite, found in 1866 in the Sierra Déesa in Chili, contained a form of graphite only. Caillite, iron from Toluca-Xiquipilso,

Mexico (fall of 1784), contained no variety of carbon. Iron from Novy-Urej, Krasnoslobodsk, Penza, Russia (fall of August 23, 1886), yielded black diamond only. A further sample of meteoric iron from Cañon Diablo gave transparent diamond. All three varieties of carbon have been found in this meteorite.—On hyperglycæmia and glycosuria following ablation of the pancreas, by M. R. Lépine.—On the integration of Hamilton's differential equation, by M. Paul Staeckel. Concerning the results shown in the paper, the author remarks: "There is the true generalisation of Liouville's theorem, which allows the utilisation of all progress in the integration of Hamilton's equations to find new types of integrable equations, that is, to form new linear elements of which the geodesic lines can be determined."—On parasitic electrodes, by M. G. Delvalez.—On the mechanical properties of alloys of copper and zinc, by M. Georges Charpy. The tensile strength increases with the percentage of zinc, attains a maximum at 43 per cent., and then decreases rapidly; the elongation before rupture also increases with the zinc, passes through a maximum at 30 per cent., and then rapidly diminishes.—On a carbide of glucinum, by M. P. Lebeau. Pure crystallised glucinum carbide has been prepared at the high temperature of the electric furnace. The properties of this carbide, more particularly its reaction with water resulting in its decomposition in the cold with the production of methane, resemble those of aluminium carbide C_3Al_4, hence support is given to the formula C_3Be_4. The atomic weight of glucinum must be near 14, and glucina becomes Be_2O_3.—Researches on the combinations of mercury cyanide with iodides, by M. Raoul Varet. A thermochemical paper dealing with iodocyanides. Iodocyanides in solution yield the isopurpurate reaction on addition of potassium picrate at 30° C. and turn red-litmus paper blue. These salts must then be of the type $HgCy_2.MCy_2.HgI_2$, and not like the chlorocyanides $MCl_2.2HgCy_2$. The transformation of the system $2HgCy_2 + MI_2$ into $HgCy_2 + MCy_2 + HgI_2$ absorbs on the average − 9·3 Cal. in solution, a quantity surpassed by the heat of formation of $HgCy_2.MCy_2$, + 12·4 Cal., with that of its union with yellow HgI_2 giving + 2·3 Cal. —On the double decompositions of mercury cyanide and salts of alkaline and alkaline earthy metals, by M. Raoul Varet.—Action of air on grape must and on wine, by M. V. Martinand.—Deep dredgings made on the Caudan coast in the Gulf of Gascony during August 1895, by M. R. Kœhler. Much material, which has not yet been thoroughly examined, was obtained from (*a*) depths of 300 to 600 metres, illustrating the change from littoral to profound faunas; (*b*) coralligenous depths on the abrupt cliff running parallel to the French coast; (*c*) the bottom of the deeper part of the Bay of Biscay.—On the effects of the winter of 1894–5 on the fauna of the coast, by M. Jourdain.—M. Resel communicated an extract from a memoir to the Minister of War on the storm at Besançon on July 1.

NEW SOUTH WALES.

Linnean Society, August 28.—Mr. Cecil W. Darley in the chair.—On the homology of the palatine process of the mammalian premaxillary, by R. Broom.—Botanical notes from the Technological Museum, Sydney. No iv., by J. H. Maiden and R. T. Baker.—The Silurian Trilobites of New South Wales, with reference to those of other parts of Australia. Part iii. *Phacopidæ*, by R. Etheridge and John Mitchell. This important family is represented in the Silurian rocks of Australia by five species of *Phacops*, and one of *Hausmannia*; of these four are described as new. The Tasmanian forms are at present undescribed.

DIARY OF SOCIETIES.

LONDON.

SATURDAY, OCTOBER 19.

ESSEX FIELD CLUB (High Beach), at 6.30.—Annual Fungus Meeting, and Address by A. B. Rendle.

SUNDAY, OCTOBER 20.

SUNDAY LECTURE SOCIETY, at 4.—Tyndall as Worker and Teacher: Prof. Sir Frederick Pollock, Bart.

TUESDAY, OCTOBER 22.

ROYAL PHOTOGRAPHIC SOCIETY (Technical Meeting), at 8.—The Art of Lantern Slide Making: John A. Hodges.

FRIDAY, OCTOBER 25.

PHYSICAL SOCIETY, at 5.—The Radial Cursor: F. W. Lanchester.—The Development of Arbitrary Functions: J. Perry and H. F. Hunt.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

BOOKS.—Guide Zoologique (Helder, De Boer, jun.).—Rural Water Supply: A. Greenwell and W. T. Curry (Lockwood).—Dog Stories: edited by J. St. Loe Strachey (Unwin).—Mesures Electriques: Prof. E. Gerard (Paris, Gauthier-Villars).—Index Kewensis, Part 4 (Oxford, Clarendon Press).—Metallurgy, an Elementary Text-Book: E. L. Rhead (Longmans).—Die Mechanische Bedentung der Schienbeinform: Dr. H. H. Hirsch (Berlin, Springer).—Polarisation et Saccharimétrie: D. Sidersky (Paris, Gauthier-Villars).—The Beginnings of Writing: Dr. W. J. Hoffman (Macmillan).—London University Guide and University Correspondence College Calendar, 1895-96 (Clive).—Cours Elémentaire de Manipulations de Physique: A. Witz, deux edition (Paris, Gauthier-Villars).

PAMPHLETS.—The Case against Butcher's Meat: C. W. Forward (Insurance Publication Depôt).—Neuere Forschungen über das Gebiss der Sänger: Dr. R. Dewoletsky (Czernowitz).—The Elephants: Prof. R. J. Anderson (Belfast, Mayne).—Die Oberflächen-oder Schiller-Farben: Dr. B. Walter (Braunschweig, Vieweg).

SERIALS.—Journal of the Chemical Society, October (Gurney).—Proceedings of the Physical Society, October (Taylor).—Record of Technical and Secondary Education, October (Macmillan).—Journal of the Franklin Institute, October (Philadelphia).—American Journal of Science, October (New Haven).—Journal of the Royal Statistical Society, September (Stanford).—Proceedings of the Royal Society of Edinburgh, Vol. xx. pp. 385-480 (Edinburgh).—Engineering Magazine, October (New York).—Zeitschrift für Physikalische Chemie, xviii. Bd. 1 Heft (Leipzig, Engelmann).—Himmel und Erde, October (Berlin, Paetel).—Strand Magazine, October (Newnes).—Strand Musical Magazine, October (Newnes).

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