THURSDAY, OCTOBER 30, 1902.

MODERN SCIENTIFIC GEOGRAPHY.

The Nearer East. By D. G. Hogarth, M.A. (The Regions of the World. Edited by H. J. Mackinder, M.A.) Pp. xvi+296. (London: Heinemann, 1902.)

IT has long been a reproach to the British nation that it, the greatest, if not the only real, colonising nation of the West, undoubtedly also the most travelled nation of the world, devotes less time and trouble to the study of geography than any other people. The manner in which geography is taught, or rather is not taught, in our great public schools is indeed more than a reproach to England, it is a disgrace. Great geographers we have had and have; our disgrace lies in the fact that geographical instruction is well-nigh omitted from the curriculum of the schools which our upper classes are accustomed to patronise, our reproach in the fact that the average English "classical" schoolmaster would probably prove ill-fitted to impart such instruction were he given the opportunity and the means of doing so. What average "educated" Briton could answer a series of simple questions on the geography, commerce and politics of the Persian Gulf? Yet a German observer would probably consider it remarkable that the citizen who may have ere long to cast his vote this way or that as to whether Russia is to be peacefully allowed to extend her sway by Teheran to Bushire and Bandar Abbas, or is to be forcibly prevented from doing so by war, should know practically nothing of a matter which may have an outcome most vitally affecting his empire and himself!

Of late, however, we seem to be trying to improve ourselves a little in this matter of general geographical knowledge. The University of Oxford has created a Readership in Geography, and it could have found no better man to fill the post of Reader than Mr. Mackinder, whose energetic geographical propaganda is deserving of the highest praise. The series of handy and useful books entitled "The Regions of the World," of which he is editor, does indeed "supply a long-felt want," for it is calculated to supply, not only valuable books of reference to the merchant and the politician, and interesting manuals for *Selbstunterricht* to the don and the schoolmaster, but also readable and informing volumes which will reach the average patron of Mudie's Select Library, which is exactly what one wants.

The preparation of the volume which deals with the "Nearer East" has been confided by Mr. Mackinder to hands in all respects fitted to deal with it. Few know the lands of the Levant better than Mr. Hogarth, and though he may not have seen the Arabian waste or the wall of Elburz with his own eyes, yet no reader of his book can doubt his capacity to use the eyes of others to the best advantage, and it can certainly be said that the portions of his work which deal with Arabia and with Persia suffer in no way from the fact that he himself has not yet visited those countries. They emphatically give the lie to the pretension that no man may write a book about a country unless he has been there himself.

As to the limits of the "Nearer East" opinions may differ. Mr. Hogarth rules out the whole north coast of Africa west of Egypt; yet Cyrenaica and Tripoli are of the Nearer East, and, though we may consent to omit Algeria because Algiers is a French city, surely Morocco is of the East Eastern. But Mr. Hogarth sets his frontier in the Libyan Desert, and, all things considered, we have no fault to find with him for having done so.

The boundary-line of his territory runs eastward from the northernmost limits of Albania across the "Balkan Peninsula" to the Black Sea coast of Eastern Rumelia; thence to the Caucasus and the Caspian, and then south-eastward across the desert which divides Khorasan from Kerman and Irak to the limit of Baluchistan on the Indian Ocean; thence round Arabia and up the Red Sea to a point on a line with Aswân; then along the historical southern boundary of Egypt proper to the Western Desert, and so northwards west of the Oases up to and across the Mediterranean and up the Adriatic to his starting point.

The author deals with the various lands comprised within this boundary in this order: first, "The Balkan Belts," then "The Asian Ascent," then "The Central Upland," then "The South-western Plains," lastly "Egypt." In the "First Part" of the volume these lands are thus generally described; then follow three chapters on their geological structure, their climates and their "Physical Circumstance." In the "Second Part" the human inhabitants of the Nearer East first appear upon the scene, in chapters dealing with their distribution and grouping, the products of their lands, their communications, and their life under the varying conditions which obtain in the various regions described. A chapter on "World Relation" finishes the book. Maps are frequent and, on the whole, good.

This is a modern scientific geography book, systematic in plan, clear and picturesque in description, and, above all, "giving to think."

Upon the excellence of the general plan of the work we need enlarge no further. So far as description is concerned, what could be better than the following impression of the great island which fences in the Hellenic world to the south with its mighty mountain barrier:—

"A serrated and shaggy wall, rising from a wind-tormented, inhospitable sea, and interrupted by three main depressions, of which two are low; little locked pans and long verdant valleys, hidden inland behind spurs; spontaneous vegetation wherever the north wind is shut away—such is the impression left by Crete" (p. 123)?

Or take this, of the Egyptian desert (p. 142):—

"The Egyptian wastes are of limestone formation from the sea to Silsileh. . . . Accordingly, except between Silsileh and Aswan, the traveller will expect to find in the desert all varieties of contour, hill and cliff, valley and gorge, beds of streams and of tributary rivulets; yet neither verdure nor water, but a skeleton of earth, such a landscape as may be imagined in the moon. . . . And here and there in the hollows and wadis will be even such tussocky vegetation as camels love, drawing its life from a hidden humidity . . ."

Space forbids our giving the whole of the description which follows of the prospect which greets the desert traveller on his arrival on the brink of the Nile valley; we must therefore content ourselves with the following:—

"Small clumps of palms mark the villages, and now and again, but rarely, lengthen or widen out into larger plantations. What other trees there are, sycamores, tamarisks, or thorns, stand for the most part singly near the desert edge. The squat mud cabins, dominated often by the white 'Italianate' house of a *sheikh*, are raised a little on their own débris. The long line of a curving dyke, carrying beside a canal a cultivation road or a railway, cuts the horizon. The angles of white sails or a smoky funnel indicate the river; the chimney of a sugar factory is a landmark for miles. The rest is one flat stretch of varying hues, brown, green, red or yellow, according to the season, or is for two months a burnished sheet of inundation, now wider, now narrower, now defined by high cliffs, now melting into an easy gradient of desert, now more to east, anon more to west of the central stream. . . . Serious change in the landscape occurs only far south and far north. Above Silsileh the green belt narrows to a thread. Golden ruin of the sandstone slides on the west almost to the margin of Nile, and low cliffs rise steeply to east with little interval of plain; and presently, with the intrusion of plutonic rocks, the scenery loses all amenity and the river flows with obstructed current between beetling crags which only recede to admit the naked waste within a few yards of the stream. Far northward again the deep lands grow ever more salt and sodden, till reedy marsh supervenes and passes insensibly into permanent inundation; and shallow and slimy meres with few intervals stretch all the length of the Delta base, washing their wavelets on the low sand hills and bars of stony beach, which scarcely keep out the discoloured sea."

Mr. Hogarth does not say much of the peculiar beauties of Egypt, beauties of distance and of light: the Arabian wall above Gîrga seen from the Libyan cultivation-border, nine or ten miles away, through and over a noonday haze; the bastions of Kaṣr es-Sayad or the three peaks of Gebel el-Geir at sunset, salients aglow with richest rose, recesses blue with deepest indigo; Luxor approached across the western sands towards evening, when even that abominable castellated villa-residence which flies the Dutch flag cannot spoil the marvellous effect; things not only not to be forgotten, but to be seen again, for no country excites in the minds of most such a *Sehnsucht* as Egypt. Greece does not; were it not for her historical associations she would be of no more interest to the average man than is Albania; she possesses naturally no such fascination as Egypt, beautiful as she is.

"The natural beauties of Greece," says Mr. Hogarth (p. 122), "are those of distance, beauties of outline on a large scale, beauties of white snows and grey rocks in juxtaposition to an ever present sea of deepest blue, beauties of opalescent lights cast by oblique rays shining through suspended dust raised by the daily winds."

Beauties of detail there are few; all is so patchy and scrubby. Yet what can be more delightful than the view as one descends to Marathon from above Araphên, looking over the broad Gulf of Petali to where Ocha raises its mighty snow-clad mass into the sky? Of the views of Greece from Lykabettos or from the splendid Frankish castle which crowns the Lárissa of Argos we need not speak; the first at least, or its smaller edition from the terrace of Niké Apteros, is almost too well known, especially at sunset; but the second enables one to realise very well the small geographical extent of continental Hellas, for from the keep of the Lárissa the eye can range from Parnon to Parnassus, roughly then from Sparta to Delphi.

Greece plays impudence to Egypt's dignity. Monotonous this dignity may be, yet this very monotony only serves to make it the more impressive. Such beauty as Greece has Egypt does not possess, beauty of sea and snow-mountain; yet nothing in Greece can so subdue the beholder to its fascination as can those interminable bastioned hills with the sand-billows washing half-way up their sides, those curving, branching wadis behind them where on the sand the once water-worn boulders lie blackened by ages of exposure to an unpitying sun, or that monotonous fen which with its palm-clumps, its strings of laden donkeys or camels winding their dusty way along the raised *gisrs* or causeways, its innumerable *saḳiyas* each with its boy (in charge of the motive power, a pair of oxen or buffaloes), chanting his monotonous song in duet with the groaning of his machine as he is carried round and round, stretches away to where in the hazy distance a shimmering line of cliff marks the opposite limit of Egypt. Greece always interests and often charms; Egypt *imponirt*.

We have said that Mr. Hogarth's book gives the reader much to think about. Naturally this is very much the case when he touches on political matters. His touch is light, as befits a book of this kind; his intention is simply to draw the reader's attention to matters with regard to which it is necessary that he should form some opinion for himself. The Persian Gulf, for one example, the future of Arabia for another. Is the Power which holds Aden and Cairo and dominates Muscat and Kowêt eventually to hold sway at Er-Riadh and Hayil either as she now rules at Ajmír or as she controls Bikanír or Baluchistan? This is a question which will have to be faced in the future.

Mr. Hogarth's appreciations of the peoples who inhabit the region which he describes are interesting; his note on the modern Greek character (p. 241) is worth quoting:—

"Unprejudiced appreciations of the character of South Balkan peoples are very rare. The Greek character, especially, is seldom treated justly by a northern observer, apt to remember the ancient Hellene too much or too little. The Oriental element does not give endurance and dignity to Latin decadence in Greece as in Spain, because it is not due to the intrusion of a strong Oriental race. To be fair, the Briton must overcome his strong aversion to ideas without works. . . . In published accounts of the Greeks one has usually to do with social, religious, or scholarly idealists with little knowledge of the realities. To their views a course of Byron's letters from Greece and Finlay's final volume supplies a salutary corrective."

Strictly speaking, we might cavil at Mr. Hogarth's attribution of modern Greek want of stedfastness and want of dignity to the intrusion of an Oriental race not so strong as that which has intruded into Spain. Dignity Spain has, but grit she has no more than Greece; surely also the Turk is, as an Oriental, really stronger than, if not so dignified as, the Arab.

An editorial note at the beginning of the book tells us that

"Owing to Mr. Hogarth's absence in Crete at the time when it was necessary that this book should go to press,

a few errors have unfortunately remained uncorrected. These he has noted on p. xvi."

One or two have still escaped the author's notice. Muscat is ordinarily spelt by him "Maskat," but once "Mascat" appears; and no regular rule is followed with regard to the hyphening of Arabic compound names; thus we have "Roba-el-Khali" (p. 73), but "Wadi er Rumma" (p. 71), which is spelt "Wadi-er-Rumma" in the index. So in other cases. The correct form, of course, is Roba el-Khali, Wadi er-Rumma; only one hyphen is necessary.

We are at one with Mr. Hogarth as to the undesirableness of too pedantically accurate a transcription of Oriental names, but it seems to us that "Hadramut" and "Riad" would be better replaced by Hadhramut and Riadh, which we can pronounce even if the Germans cannot. And though Mr. Hogarth defies the pedant with his "Bedawins," we are unable to back him up in his defiance; "Bedouins" or "Beduins" may be all very well, but not "Bedawins"; either "Beduins" or "Bedawîn," one or the other.

In the maps there are one or two mistakes which need correction; for instance, in Fig. 36, "Yidda." In Fig. 16 the railway is made to cross the Nile immediately south of Siut, which is itself placed much too far south. In reality the railway crosses further south than in the map, at the Nag' Hamâdi bend. South of Aswân, spelt here and in other maps "Assuan," the railway gets wrong again. There is no line between Shellal and Wadi Halfa, and there *is* a line along the Nile bank south of Wadi Halfa, which runs as far as the Third Cataract, to Kerma. In Fig. 49 the Athens-Kephisia-Lavrion line is not inserted at all, nor is the new Athenian "underground" from the Theseion *viâ* Monasteráki to the Omonoias. It is true that these are only sketch-maps, but if the railways are inserted in them at all, they should be inserted correctly. In the fine ethnographical map opposite p. 176, we do not quite like the unhesitating colouring of Egypt with the Semitic yellow; there should be some brown or other coloured stripes across it. Nor do we think that pure brown should begin with the Wadi Hammâmât; Nuba is not spoken north of Darâw, south of the 25th parallel, so the line should run north-eastward from Darâw to Ḳuṣêr. Should there not also be some Magyar, Szekler and Teutonic stripes and spots in the portion of Hungary and Siebenbürgen which comes into the upper left-hand corner of this map and is entirely coloured with Rumanian purple? It is true that the book does not deal with these parts at all, but if they are coloured in the map, the coloration should be correct.

For these cartographical slips Mr. Hogarth, of course, cannot be held entirely responsible. We point them out merely that they may be corrected in the second edition. They in no way detract from the value of the maps as a whole.

One thing we regret, the absence of photographs. A few pictures of salient features of the land—a Greek isle, a desert wadi, a Cilician gorge—would have added greatly to the interest of the book.

We welcome Mr. Hogarth's work, then, not only as a notable contribution to geographical literature, but as a book which will—as is the idea of the series—appeal to a larger public than the members of scientific societies, and will probably not only cause its general readers to take an unwonted interest in geography, but will also direct their attention to threatening political questions for which sooner or later they will be called upon to help to devise a solution. H. H.

CHEMISTRY AND LIFE.

Das Eisen als das thätige Prinzip der Enzyme und der lebendigen Substanz. Von N. Sacharoff. Pp. 83. (Jena: G. Fischer, 1902.) Price M. 2.50.

THIS philosophical treatise, originally written in Russian, is presented to us in a translation by Dr. Rechtsamer. Without going so far as to say it is of the first importance, it may be safely affirmed that it will be welcomed by physiologists as a contribution to the discussion of the more obscure chemical processes connected with the life of the protoplasm. The author at the outset reviews the different hypotheses that have been advanced as to the intimate constitution of living matter, and finds them all unsatisfactory. He holds that the behaviour of protoplasm cannot be attributed to either its organisation, or its chemical composition or structure, and suggests that all the vital processes must be regarded as arising from a decomposition or splitting of the living substance in consequence of the access of oxygen, followed by a series of recombinations. Hence he turns to a study of the nature of this auto-decomposition with a view to determining its cause.

Proceeding to the action of oxygen in the animal and vegetable cell, and seeking for something universally present therein which is capable of easy oxidation, and of yielding compounds which can be reduced again or further decomposed with comparative ease, he considers he has found it in minute traces of iron. He puts forward accordingly a hypothesis of his own, to the effect that the various vital phenomena of protoplasm are set up by the oxidation of a minute trace of iron contained in the living substance, with subsequent or concurrent hydrolysis.

This theory is examined at some considerable length in the subsequent chapters, attention being given first to enzyme action, which he takes as one of the most remarkable of the metabolic processes. His views on this point will not commend themselves to all physiologists, but he argues in favour of them with some skill. After reviewing the theories of enzyme action advanced by Liebig, Nägeli, Berzelius, Würtz and more recent writers, and quoting published experimental evidence of the action of several of these bodies, he suggests that the active principle of enzymes is a substance which is capable of auto-oxidation and auto-reduction, and that the working which they exhibit depends upon alternate oxidation and reduction of this active principle. An experiment of his own with papaïn may be quoted in illustration of his view. He prepared a solution containing 2 per cent. of papaïn and heated it to boiling. Taking another solution of the same enzyme, containing 10 per cent., he prepared three tubes. No. 1 contained two drops of this active extract and 10 c.c. of the boiled extract; No. 2 two drops of the active extract with 10 c.c. of water; No. 3 10 c.c. of the boiled extract alone. He added to each a

measured amount of gelatin, on which papaïn works. No. 1 digested the gelatin much more rapidly than No. 2, while No. 3 was inactive. As both Nos. 1 and 2 contained the same amount of active enzyme, he considers it certain that the boiled solution contained some constituent necessary for the action of the papaïn. The solvent action of papaïn on gelatin thus requires the presence of two substances, the enzyme itself, which is split up and destroyed by heating, and another substance which is contained in the heated enzyme.

He considers subsequently at some length the group of oxidases, possessing in such a great degree the power of taking up oxygen and communicating it to the bodies which they attack.

The conclusion is that there exists in all enzymes the substance already alluded to, and that this is an iron-containing nuclein. He gives the name *bionuclein* to this hypothetical body.

It would be too long a task to follow the author through all the developments of his theory. They may be gathered from the statement he makes in his third chapter, that since the chemistry of all vital phenomena must be fundamentally the same, the processes which are the foundation of enzyme action must be also the foundation of all vital phenomena, and all must alike depend upon the oxidation of bionuclein. In his later chapters he deals with the behaviour of the cell substance, the fusion of sexual cells, the phenomena of karyokinesis, the phenomena presented by muscle and nerve and by the central nervous system.

The treatise is one which is deserving of careful consideration, though it is doubtful how far many of the author's conclusions will be held deserving of support.

TWO ASPECTS OF THE THEORY OF PROBABILITY.

Probabilités et Moyennes géométriques. By Emmanuel Czuber. Translated into French by Herman Schuermans, with a preface by Charles Lagrange. Pp. xii + 244. (Paris: A. Hermann, 1902.) Price Fr. 8.50.

Philosophical Essay on Probabilities. By Pierre Simon Marquis de Laplace. Translated from the sixth French Edition by Frederick Wilson Truscott, Ph.D., and Frederick Lincoln Emory, M.E. Pp. iv + 196. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1902.)

WE have here two books dealing with widely different aspects and applications of the theory of probability.

Prof. Czuber's treatise is a collection of problems relating to probabilities in which the number of cases of success and failure, instead of being finite or at any rate discrete, is continuously infinite. The cases considered relate to points chosen arbitrarily on a line, in a plane or in space, to lines drawn arbitrarily in a plane or in space, to surfaces taken arbitrarily in space, and to mean values depending on such random constructions. Such problems have a great interest for the pure mathematician, and they lead to a number of apparent paradoxes depending chiefly on what is meant by "taken at random," and many of these have been the subject of much controversy. No better preparation for the study of such paradoxes can be suggested than a comparison of the results of choosing a point so that all values of its Cartesian coordinates are equally probable with the corresponding results when all values of the polar coordinates are equally probable. The author has made an extended study of the problems proposed by various English writers in the *Educational Times*, of the writings of French mathematicians, and in particular of the important memoir of 1868 by Crofton. The result of this study has been the insertion of a number of historic notes and remarks, including a brief but full discussion of the famous "needle problem" of Buffon, *i.e.* the problem of calculating the probability that a needle dropped at random on a sheet of ruled paper should cross one of the ruled lines when the needle is too short ever to cross two lines. The author quotes Dr. Wolf's experimental tests, which gave a result falling well within the limits of probable error.

The second book is a translation of the famous philosophical essay by Laplace, which was originally based on a course of lectures given by him in 1795 at the École Normale when he was appointed professor of mathematics with Lagrange as a colleague. It is purely philosophical, and deals with general questions arising out of probabilities and hope, their applications to natural philosophy, to prediction of the decisions of juries and other assemblies, to problems of life insurance and to the dispersion of superstitions. In regard to the latter use, Laplace's words may well be quoted :—

"All these prejudices and the terrors which they inspire are connected with physiological causes which continue sometimes to operate strongly after reason has disabused us of them. But the repetition of acts contrary to these prejudices can always destroy them."

There are few illusions arising from a failure to appreciate the calculus of probabilities which have done so much harm in the world as that which has given rise to the confirmed gambler or speculator. The very definite mental impression produced by a valuable prize and the difficulty to form a tangible conception of the probability factor which reduces the expectation to one of loss have proved fruitful sources of revenue to organisers of lotteries. But there is another cause which prevents a study of the theory of probability from saving the gambler from ruin. If in a game of even chances red turns up twenty times in succession, it is still an even chance whether red or black turns up on the twenty-first time; but no amount of mathematical reasoning will enable the confirmed gambler to realise that a previous run of bad luck gives no grounds for the expectation of recovering his losses by a run of good luck in the future.

OUR BOOK SHELF.

Upland Game-Birds. By E. Sandys and T. S. Van Dyke. Pp. ix + 429; illustrated. (New York: the Macmillan Company; London: Macmillan and Co., Ltd., 1902.) Price 8*s.* 6*d.* net.

THIS is the first of a series of ten volumes on American game and fish, published under the title of the "American Sportsman's Library," which has come under our notice; and if its companions are anything near so good as the

one before us, the series ought to command a large sale among both sportsmen and naturalists. Indeed, the mere fact that all the volumes are to be issued under the editorial supervision of Mr. Whitney, the well-known editor of *Outing*, ought of itself to be a sufficient guarantee that they will be all such works should be. The greater part of the volume under consideration is by the first of the two authors whose names appear on the title-page, Mr. Van Dyke merely contributing a small section—considerably less than 100 pages—on the game-birds of the Pacific coast.

Throughout the work, the authors appear to have hit the happy mean between a strictly scientific treatise and a purely sporting manual, each species being carefully described in accurate and, at the same time, popular language, while the rest of the space devoted to each is a pleasantly blended mixture of sport and natural history, enlivened by a number of racy anecdotes. Mr. Sandys evidently loves his subject, and, being himself an enthusiastic sportsman with a strong bias towards natural history and a delightful style of writing, it is little wonder that he has succeeded in producing a most interesting book. The volume commences with the "bob-white," the so-called American quail, and embraces all the species and varieties which can be classed as game-birds up to, and inclusive of, such a magnificent bird as the wild turkey, which the author calls the king of wild birds. The scientific nomenclature is thoroughly up-to-date—perhaps, indeed, almost too much so, as Mr. Sandys follows those authorities who consider it necessary to separate the American woodcock generically from its European relative. A notable instance of the extreme degree of refinement to which modern American zoology is carried occurs in the case of the plumed partridge, which is stated to differ from the typical *Oreortyx pictus* chiefly by its predilection for a mountain habitat.

As an example of Mr. Sandys's powers of accurate observation and induction, we may refer to his account, p. 223, of the resemblance of the ptarmigan in winter dress to its surroundings. After mentioning that every projection above clean snow is apt to cast a more or less decided shadow and thus cause a darker spot, he observes that the black tail of the crouching ptarmigan so closely imitates this effect that the intelligent observer cannot fail to detect Nature's purpose in the one peculiar mark. In such a brief notice as our space allows, we cannot quote further, and can only say that the authors and the artists have combined to produce a most attractive and interesting little volume. R. L.

Wild Fruits of the Country Side. Figured and described by F. Edward Hulme, F.L.S., F.S.A. Pp. viii + 259; with thirty-six coloured plates by the author. (London: Hutchinson and Co., 1902.) Price 12*s.* 6*d.* net.

THIS work forms one of the "Woburn Series of Natural History," published under the auspices of the Duke of Bedford, and intended, as His Grace's preface shows, to supply to those who, from various circumstances, cannot devote themselves to the scientific study of natural history, some knowledge of the processes and products of Nature in a form at once easily assimilated and scientifically accurate.

The author himself amplifies this statement of his editor, and declares "Our purpose to be a very simple one, to deal with the principal typical forms that one may reasonably expect to meet with during a country sojourn, and to deal with them in the simplest way—caring but little to send our readers to the dictionary in a wild quest for six-syllabled words of weird appearance, but caring much if the result of the perusal of our pages be to so far interest them as to send them to seek for themselves in the great Book of Nature."

The class of people for whom this book is intended is further defined as including those who need to be told that "a privet berry and an acorn are distinguishable one from the other, that a beech nut and a blackberry are not so identical in form and colour but that practice and observation will enable us to tell which is which."

A much less pretentious book would surely have answered the purpose as well as this handsome volume. The nature of the text may be inferred from what has been said—it contains much pleasant gossip, but little information, and no pains have been taken to correlate or classify what there is.

The illustrations are pretty and well executed, but scrappy and wanting in detail; for instance, a fragment of the common yew and a similar morsel of the dogwood (Cornus) are placed together on the same plate without any particular reason and with no details. We can only suppose this has been done for the benefit of those who cannot distinguish a beech nut from a blackberry. The table of contents of the three chapters into which the book is divided is very full, but very unsystematic. The index is copious, but displays the same absence of method; for instance, the first entry runs thus, "Abnormal Chestnut Cluster, 128," but there is no corresponding reference under Chestnut or under Cluster, both more important words for the user of the index than that chosen to direct his research. In fine, we can but regret the expenditure of so much time, labour and money which might with so much greater profit have been bestowed on a work of a different character.

A word of praise is due to the printer and publisher, for paper, typography and illustrations (so far as they go) are all good.

Einführung in die Theorie der Doppelbrechung. By Heinrich Greinacher. Pp. 64; numerous figures. (Leipzig: Von Veit and Co., 1902.) Price M. 1.20.

THIS is a simple account of some of the leading phenomena of double refraction considered by the help of geometric methods. These are of the simplest type, no attempt being made to give rigorous proofs where any difficulty would be encountered. The booklet can, therefore, only be recommended to those who are unable to grasp the theory as usually given, but desire some explanation of the phenomena which they have met with experimentally. They are presumably acquainted with such phenomena, as no diagrams of the effects described are provided; these might be added with great advantage. The description is lucid, but meagre. If the attack were concentrated on the ellipsoid of elasticity and the wave surface instead of spread out over four surfaces, greater success would be achieved. A. W. P.

Physical Geography. By Margery A. Reid, B.Sc. With maps and illustrations by Bertha Reid. Pp. iv + 148. (London: Allman and Son, Ltd.) Price 2*s.* 6*d.*

THOUGH this little book contains so few pages, it is divided into twenty-four chapters, in each of which new subjects are introduced. The reader is thus hurried from one subject to another without explanation enough to make the work intelligible. Rivers and glaciers are described in a little more than two pages. Rain receives scarcely any attention and the rain-gauge is not described at all. When the author seriously attempts an explanation she is successful, but the limited space has prevented her from doing justice to herself or her subject. Especially in the descriptions of experiments is the guidance insufficient. For instance, we read on p. 35, "Submerge a shoot of watercress in water. Bubbles of gas collect on it; if some of these be tested as they ascend through the water, they are found to be oxygen." How to catch one of these bubbles and test it under water would puzzle older students than those for whom the book is intended.

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 Hydrography of the Faeroe-Shetland Channel.

IN that portion of the programme of international investigation of the North Sea (as finally drawn up by the conference at Copenhagen last July) which provides for a coordinated series of hydrographic cruises at intervals of three months, it falls to Scotland to investigate the Faeroe-Shetland Channel and adjacent waters. It was important that the work should be begun as soon as possible, and especially so in order that the sea-temperatures, &c., should not go unrecorded in this abnormal season; but it would have been impossible to begin at so short notice had not Dr. Hjort, the director of the Norwegian investigation, helped by the loan of apparatus and by permitting his hydrographic assistant, Mr. Helland-Hansen, to come over and inaugurate the work. The Admiralty gave the use of H.M.S. *Jackal*; Lieutenant and Commander Sharpe and Mr. Helland-Hansen were conjointly responsible for the observations, and the report will be drawn up by Mr. Helland-Hansen, who has sent me the preliminary account which follows. The *Jackal's* course lay from the Moray Firth to Lerwick, thence in a north-easterly direction nearly to the Norwegian coast, then west to the Faeroes, thence to Fair Isle and out into the North Sea again; and it was so planned as to give, over each of the more important areas, double and approximately parallel lines of observations. Between August 25 and September 1, hydrographic observations were taken at twenty-six stations, and in addition surface-temperatures were taken every hour. A small number of plankton samples was collected also, but not to the extent that will be done on future cruises.

D'ARCY W. THOMPSON.

The Cruise of H.M.S. "Jackal," August, 1902.

The following short account is only a preliminary one and is given with some reservation, as the time has not yet permitted to draw the final results. In some weeks, however, we shall know the results of the investigations of the Norwegian fishery steamer *Michael Sars* from the neighbouring seas during the same period, and then we shall be able to work out the material from the *Jackal* very completely.

The best result from the *Jackal* expedition is, perhaps, that for the time in question we shall be able partially to solve the problem, equally important to hydrographers and biologists, of *the quantity of Atlantic water entering the North Sea and the Norwegian Sea.* Many years ago, and by different investigators, it was demonstrated that a large quantity of Atlantic water moved to the north between the Faeroes and Shetland (the Gulf Stream), and also that Atlantic water to the north and north-east of Scotland flowed in a south-westerly direction into the North Sea. Now we have undoubtedly found some unknown details of great importance.

(1) *The Gulf Stream is in the Faeroe-Shetland Channel divided from beneath by a deep wedge of cold and less salt water coming from the north.* The influence of this cold water is traced even to the surface. Thus we have really two parallel branches of the Gulf Stream from the Faeroe-Shetland Channel to the north. This fact may be shown by the following table. Station xii. (61° 2′ N., 1° 10′ W.) is situated near Shetland, and station xvi. (61° 47′ N., 6° 4′ W.) near the Faeroes. The temperatures and salinities at, for instance, 300 metres' depths—stations xiii. (61° 12′ N., 2° 5′ W.), xiv. (61° 25′, 3° 24′ W.) and xv. (61° 35′ N., 4° 39′ W.)—are very typical.

Stations.

Depth in metres.	xii.		xiii.		xiv.		xv.		xvi.	
	Tem. °C.	Salin. ‰	Tem. °C.	Salin. ‰	Tem. °C.	Salin. ‰	Tem. °C.	Salin. ‰	Tem. °C.	Salin. ‰
0	11·3	35·33	11·2	35·31	9·5	34·96	8·9	34·98	9·2	35.19
40	10·8	35·32	10·7	35·31	10·0	35·07	8·4	35·11	8·7	35·17
100	9·4	35·32	9·4	35·31	*ca.* 8·5	*ca.* 35·14	8·2	35·20	8·5	35·19
200	Bottom		8·9	35·32	6·3	35·10	7·7	35·20	Bottom	
300			8·5	35·32	3·6	34·97	6·9	35·14		
400							6·4	35·09		
500			6·6	35·17	1·2	34·95				

As the cold water from the north and the warm water from the south have very different influences upon organic life, the discovery of such a division of the Gulf Stream will probably be of importance in understanding the distribution of the organisms.

(2) *In August comparatively little Atlantic water enters the North Sea in the surface between Scotland and Shetland.* The influx of Atlantic water chiefly takes place *close to the coast of Scotland*, at a distance of about twenty to forty nautical miles away from the coast. [Further away, at about eighty miles' distance, the surface-water seems to move in a northerly direction. This cannot be certainly decided, however, until a minute examination of the hydrodynamic conditions has taken place.]

(3) *Another branch of Gulf Stream-water enters the North Sea between Shetland and Norway.*

(4) In the north-western part of the North Sea we find *at the bottom* (below thirty to forty fathoms from the surface) *a layer of remarkably cold and salt water*; it is much salter than the surface-water. It is too salt to be Arctic water and too cold to be summer water from the Atlantic Ocean. I think it probable that this bottom layer consists of Atlantic water that has been at the surface in winter time. Our hydrographical observations, then, seem to indicate that *the influx of Atlantic water into the North Sea in winter time takes place to a much greater extent than in summer time.* To find the laws of the variations of this influx, however, we must have autumn and winter observations.

The regions where the *Jackal* collected her material this year were previously incompletely explored. I have only now had an opportunity to compare our observations with those found in Mr. H. N. Dickson's excellent paper on "The Circulation of the Surface-Waters of the North Atlantic Ocean" (published 1901). Unfortunately, Mr. Dickson's observations are limited to the surface. It seems as if the influx of the cold water from the north and the east Icelandic Polar current this year were much stronger than in, *e.g.*, 1896. In the western part of the channel, the surface-temperatures this year were about 1°–1½° C. lower than in 1896, and the Gulf Stream seems to have been narrower. This may probably be connected with the unusually cold weather of this year.

B. HELLAND-HANSEN.

Matriculation Requirements in Scottish Universities.

IN reference to a remark made in my address published in NATURE last week, Prof. A. Gray tells me that matriculation in the Scottish universities is no longer the simple matter it was in my time. Before entering on his qualifying course of study, every candidate for a degree in arts or science must now pass a preliminary examination.

JOHN PERRY.

Royal College of Science, London, October 27.

The Neglect of Anthropology in British Universities.

THE recent publication in NATURE (August 28, p. 430) of an abstract of Prof. Haddon's presidential address to the Anthropological Institute, affords an opportunity of bringing before the scientific public, by way of contrast, a concise statement of what is being at present done in Britain to forward anthropological science.

Of all the universities in Britain, two only attempt systematic teaching in this subject, viz. Oxford and Cambridge, while in a third, viz. Aberdeen, there has existed since 1899 a society having for its object the promotion of anatomical and anthropological research. In Oxford there is a poorly paid professorship of anthropology, but in Cambridge even this scanty recognition is not vouchsafed to the subject, for in that University there are two lectureships of but 50*l.* a year each, established in 1899 and 1900 respectively for five years. One of these lectureships is devoted to physical anthropology and is attached to the School of Human Anatomy. The other, held by Prof. Haddon himself, is for ethnology, and covers the wide field of all relating to the industries, customs and beliefs of primitive peoples, now in many cases approaching extinction, and the loss by disinterestedness of their primitive customs and unwritten records. It cannot be expected that any real advance in these branches of science can be made in Britain while they are so pitifully starved, and while the men holding mere precarious appointments are not deemed worthy of their hire.

Now that the war is over, cannot some appeal be made to remedy this state of things? Is it too much to hope that a chair for ethnology might be endowed by private benefaction for the new teaching University of London, or at least that subscriptions might be secured sufficient to place the existing lectureships in Cambridge on a sounder and more satisfactory basis?

ANTHROPOTAMIST.

Phosphorus versus Lime in Plant Ash.

THAT in the mineral constituents of leaves a strong proportion of lime is an obstacle to the presence of a considerable quantity of potass has been recognised as a feature of calcifugous species of plants. It has been sought, indeed, to explain, apparently on this ground alone, the existence of special plants which shun lime soils, or at least to account for the difference between their habitat and that of calcicolous species. A certain proportion of lime in the soil, say about 12 per cent. carbonate, is sufficient for the needs of a certain number of calcicolous species and banishes the calcifugous species from it. If, however, we carefully examine the ash constituents of the leaves of herbs growing and seeding in a soil (such as here in this valley) with only about 1 per cent. lime (CaO) in its finer particles, we recognise a large ratio both of potass and of lime, as the annexed table will attest.

Leaves of	Date.	Per-centage of Ash.	Constituents of the Ash.		
			Soluble Salts.	CaO.	P_2O_5.
Hawkweed	July 15	12·6	24·7	28·4	4·3
Figwort	,, 24	8·9	31·7	24·7	8·35
Bracken (stem)	,, 24	—	63·8	4·1	3·04
Cranesbill (lamina)	,, 27	7·5	38·3	24·9	9·5
Hazel	,, 29	6·3	18	30·4	7·7
Rowan	,, 31	6	38·5	23	5·6
Dock	Aug. 1	11·7	43·4	20	6·3
Water Flag	,, 5	8·7	42·2	29	6
Sycamore	,, 5	10·5	33·6	25·7	4·7
Great Knapweed	,, 12	10	37·1	29·4	3·6
Ragwort	,, 19	12·2	44·5	23·7	5·15
Foxglove	,, 21	9·1	40·7	25·3	5
Heather (whole plant)	Sept. 19	2·2	25	16·3	7·3
Sycamore fruit	,, 24	5·5	37	25·7	8

These figures are taken from my own analyses, the percentages being calculated on the crude ash minus charcoal. The sphere of experimental observation is, perhaps, too narrow or restricted, but a suspicion is awakened by the results that the need for phosphorus is a direct or indirect agent operative in the case. That is to say, a strong proportion of lime in the ash seems rather an auxiliary or accompaniment than an obstacle to a strong proportion of potass (as computed by the soluble salts). On the other hand, we see a rough approximation to an inverse ratio between the lime and the phosphorus, *i.e.* roughly 28 or 29 per cent. of lime with 3 or 4 P_2O_5, and 23 or 24 lime with 8 or 9 P_2O_5; and where this does not prevail, the whole percentage of ash is below the average (as in water flag and the woody plants). That a poor yield of certain plants on calcareous soils appears to be due to the effect of the lime in preventing the assimilation of phosphorus is a result of the experiments of MM. Dehérain and Demoussy. Moreover, it is known that the ash of seeds, which is invariably very rich in phosphorus, contains also a comparatively very small proportion of lime. It would seem, therefore, to be legitimate to conclude that a certain proportion of lime in the soil (say 3 or 4 per cent.) is inimical to the life of certain plants which require a definite amount of phosphoric acid for the healthy performance of their physiological functions. The fact that some plants will grow, but not flourish or propagate, in certain localities or habitats is a pretty certain indication that a sufficient amount of phosphorus is not available to the seed for purposes of germination and development. The analyses would seem to indicate that a too liberal supply of lime is the preventative agent in the case.

P. Q. KEEGAN.

Patterdale, Westmorland.

ALUMINIUM AND ITS ALLOYS.

THE electrolytic process for the extraction of aluminium, which was patented in 1887 by Héroult in Europe and by Hall in America, has resulted in such a great diminution in the cost of production that the price of the metal has fallen from about twenty shillings to one shilling a pound. It is not surprising that, in the early days of the electrolytic industry, this circumstance, combined with the many very valuable properties of aluminium, caused extravagant hopes for its future to be raised.

The experience that has been gained in the past five or ten years has enabled us to form a truer estimate of the value of the metal, though it would be difficult to say even now to how great an industrial importance it may ultimately develop. A very good idea of the present position and prospects of the industry may be obtained from two papers recently published in the *Journal* of the Institution of Electrical Engineers.[1] The first of these, by Prof. E. Wilson, gives the results of an elaborate series of tests of the physical properties of a number of aluminium alloys; we shall have occasion to refer to this paper later. The second paper is by Mr. W. Murray Morrison, and contains a description of the British Aluminium Company's works at Foyers and an account of the applications of the metal, its use as an electrical conductor being considered at some length. We are enabled by the courtesy of the British Aluminium Company to give an illustration showing the turbo-generators in the power-house at Foyers.

The Hall and Héroult processes for the electrolytic extraction of aluminium are practically identical and are too well known to need lengthy description. The aluminium is obtained as the result of the electrolysis of alumina dissolved in melted cryolite ($6NaF.Al_2F_6$). The electrolysis is carried out in a carbon-lined crucible, at the bottom of which the separated metal collects, the liberated oxygen combining with the carbon of the anode and passing off ultimately as carbon dioxide. It is interesting to note that, whereas the specific gravity of solid aluminium is less than that of solid cryolite, in the fused condition this order is reversed; but for this the process in its present form would be unworkable. Some figures showing the cost of production by the Héroult process are given by Mr. Blount in his "Practical Electrochemistry," as follows:—

Cost of power	... 2·2	pence per lb.	of aluminium.	
Cost of alumina	... 4·0	,,	,,	,,
Cost of electrodes	... 2·0	,,	,,	,,
Cost of labour, &c.	... 2·0	,,	,,	,,
Total cost	... 10·2	,,	,,	,,

It is probable that this estimate is somewhat high, but it is sufficient to show that the cost of power is a very important item, which explains the necessity for the use of water-power. The cost of power per lb. is higher than in any other electrolytic manufacture; it forms, it will be seen, about one-fifth of the total cost; in the manufacture of calcium carbide, another electrochemical industry requiring cheap power, the ratio of cost of power to total cost is about 1 to 7·5.

The product of the electrolytic furnace is very pure. According to Mr. Morrison, commercial aluminium is 99·5 to 99·6 per cent. pure, the impurities being iron (about 0·25 per cent.) and silicon (about 0·17 per cent.). A sample of pure commercial aluminium analysed by Prof. Wilson contained 0·31 per cent. Fe and 0·14 per cent. Si, which agrees pretty closely with Mr. Morrison's figures.

[1] "The Physical Properties of certain Aluminium Alloys, and some Notes on Aluminium Conductors," by Prof. E. Wilson. (*Journal* I.E.E., vol. xxxi. p. 321.) "Aluminium: Notes on its Production, Properties and Use," by W. Murray Morrison. (*Ibid.* p. 400.)

This standard of purity has only been gradually attained, and we may hope for further improvement. The purity is a matter of importance, as it affects the value of the metal as an electrical conductor in two ways, for impurities not only lower the conductivity, but also increase the liability to atmospheric corrosion. The evidence as to the power of aluminium to withstand atmospheric influences, especially in towns or places where the air is bad, is somewhat conflicting, but on the whole it seems that the metal is fairly satisfactory in this respect. The thin film of oxide which immediately forms on the surface of the metal in air acts as a protective coating. Mr. Morrison quotes an interesting illustration of the tenacity of this oxide film; if the metal is cast into a mould and allowed to overflow, the film of oxide adhering to the molten metal that has run over acts as a syphon tube, and will syphon out a considerable quantity of the aluminium.

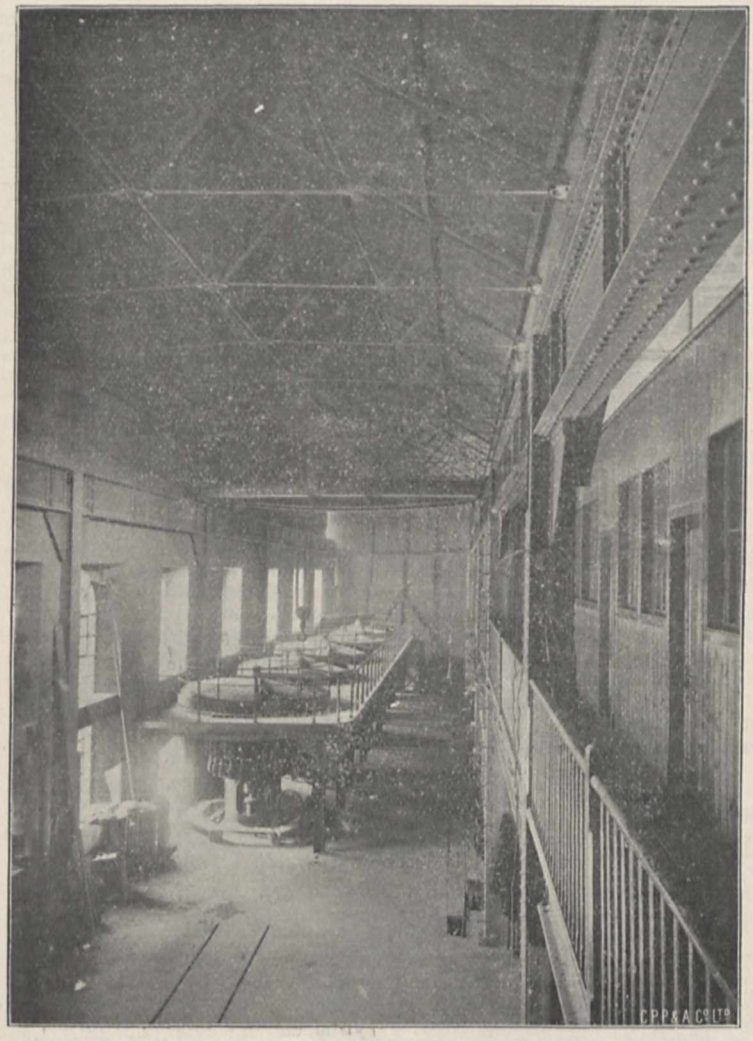


FIG. 1.—The British Aluminium Company's Power-house at Foyers.

The two most marked characteristics of aluminium, on which its principal applications depend, are its high affinity for oxygen and its low specific gravity. The former of these properties causes aluminium to play a part of considerable importance in the metallurgy of other metals. Thus in the casting of steel, iron, brass, &c., the addition of a small quantity, two to five pounds per ton, of aluminium is found greatly to improve the finished casting; the aluminium, by combining with the occluded gases, reduces the blowholes and renders the metal being cast more fluid and ultimately more homogeneous. Though the actual quantity used in this way is but a small percentage of the metal to which it is added, the total consumption of aluminium for this purpose is very large. A second use for aluminium depending on the same principle has been devised by Dr. Goldschmidt for producing high temperatures, and has been applied to the welding of iron rails, pipes and so forth. A mixture of iron oxide and finely divided aluminium is used, and is ignited by means of a magnesium ribbon; a very high temperature is immediately reached by the oxidation of the aluminium at the expense of the oxygen of the iron oxide. This process, having been only lately introduced, has not yet become of much commercial importance, but is full of promise.

The extremely low specific gravity (2·6) of aluminium has naturally resulted in its use in cases in which weight is a drawback. Thus in naval and military equipments, in motor-car construction and like applications, the metal already finds considerable and increasing employment. For cooking utensils the use of aluminium is steadily increasing; the metal is eminently suited for this purpose, as, apart from its lightness, it is a good conductor of heat, is not liable to deteriorate in use and gives rise, if dissolved, to perfectly harmless compounds. Applications of this kind may seem small individually, but in the aggregate they constitute no mean field for the metal to capture.

The chief drawback to aluminium is its low tensile strength, which, for the cast metal, is only from five to eight tons per square inch; but for this weakness its utility would be enormously increased. A certain amount of improvement can be effected by alloying a small quantity, generally less than 10 per cent., of some other metal, such as nickel or copper, with the aluminium. The specific gravity of these alloys is only slightly higher than that of the metal itself, but the tensile strength may be made two or three times as great. Exceedingly valuable data relating to a number of these light alloys are contained in the paper by Prof. Wilson to which reference has been made above. It is impossible to enter at all fully into the results obtained by Prof. Wilson, as the paper is itself so condensed as to be little more than a summary, but a few of the more interesting conclusions may be briefly tabulated. In the accompanying table is shown approximately the effect of alloying different metals on the conductivity, specific gravity and strength of aluminium.

Aluminium is now finding considerable employment as a substitute for copper as an electrical conductor, especially in America, where it is used to a large extent in connection with the transmission of power over long distances. One of the most important of these installations is the transmission of 12,000 h.p. from the Snoqualmie Falls to Seattle and Tacoma, a distance of more than forty miles. In this scheme an alloy of aluminium with 1½ per cent. of copper has been used, the lightness

Aluminium.	Principal Impurity.	Other impurities.	Specific Gravity.	Conductivity.	Limit of Elasticity: lb. per sq. in.	Breaking Load: lb. per sq. in.
99·5 per cent.	Commercial aluminium	Fe (0·31), Si (0·14)	2·715	61·5	19,376	28,200
98–97 ,,	Copper, 1·6–2·6 per cent.	Fe (0·4), Si (0·4)	2·75	51	33,000	41,000
98–97 ,,	Zinc, 1·2–2·4 ,,	Fe (0·4), Si (0·43), Cu (0·2)	2·74	56	20,500	28,000
98–96 ,,	Nickel, 1·2–2·2 ,,	Fe (0·6), Si (0·35), Cu (0·1)	2·745	52·5	22,000	36,000
98·3 ,,	Iron, 1·2 ,,	Si (0·4), Cu (0·1)	2·73	57·1	20,300	31,300
97 ,,	{Copper, 1·1 ,, / Nickel, 1·3 ,,}	Fe (0·43), Si (0·37)	2·75	49·7	36,600	45,900
Hard drawn copper			8·9	98	28,000	64,000

and strength of this alloy enabling spans of 150 feet to be made with safety. A great saving in the number of poles is thus effected, which is one of the principal advantages gained. Numerous other important transmission schemes might be quoted in which aluminium is used, or in which it has been decided to use it. As has been just pointed out, the use of aluminium effects a great saving in the number of poles required; it also involves dealing with a much smaller weight of conductor, and is, finally, cheaper than copper. In round numbers, for equal conductivity, the section of an aluminium cable is one and a half times that of a copper one, the weight is half and the tensile strength three-quarters. It is the decreased weight which, in spite of the smaller tensile strength, allows longer spans to be used, and this effect can be made more marked by the use of a suitable alloy possessing increased strength without much diminished conductivity or much higher specific gravity. Mr. Morrison gives an interesting table showing the variation, according to the price of copper, in the price per lb. that can be paid for aluminium for equal conductivity and equal cost. From this it appears that with copper at its present price of about tenpence per lb., twenty-one pence per lb. could be paid for aluminium, which is two or three pence above its market price, showing that aluminium conductors are cheaper.

It is to be noted that the above remarks apply only to bare conductors. Where insulated cables are needed for low-tension work the increased diameter of an aluminium conductor involves increased cost in insulating material; moreover, with lead-covered cables the increased weight of the lead would almost, if not quite, cancel the decrease in weight gained by substituting aluminium for copper. For high-tension cables it is possible that aluminium may in some cases be cheaper than copper. Thus in a paper by Mr. M. O'Gorman[1] it is shown that increasing the diameter of the conductor may produce such a diminution in the depth of insulation necessary as to lessen the total price; in such circumstances a tubular copper conductor, or an aluminium conductor, could be used with advantage. There seems, therefore, a possibility that aluminium may some day successfully invade the field of insulated cables, hitherto regarded as peculiarly the property of copper. M. S.

RECENT WORKS ON SYSTEMATIC BOTANY IN GERMANY.

IT was in the year 1887 that, following on the publisher's announcement, the first parts of "Die natürlichen Pflanzenfamilien" appeared under the joint editorship of Drs. Engler and Prantl. The announcement does not seem to have attracted much attention, as there was no mention of it in many botanical journals until several numbers following each other rapidly came under notice. Strange as it may seem, De Bary's name does not appear as one of the collaborators, nor did he have any share in the work. His remarks, therefore, as set forth in *Die Botanische Zeitung* in October, 1887, besides providing a criticism of the general scheme, also enable one to form an idea of the attitude displayed towards the undertaking.

He says, "the object is to present by means of illustrations and descriptions a corporate picture of the plant world which shall be strictly scientific and at the same time generally intelligible. Under each family, and for each genus of that family, mention will be made of any points that call for description or that have a practical bearing."

That there was some uncertainty as to its successful completion may be gathered from what he says later, after congratulating editor and publisher:—

"If the book is only carried through as it has been started, then it will have no equal . . . since it gives information shortly and objectively, not in the abstruse and learned manner of Bentham and Hooker, nor yet in the form of the subjectively learned monograph touched up with popular varnish which characterises the otherwise life-like history of plants by Baillon." Undoubtedly the terse and vigorous descriptions, the careful choice of matter, and the wealth of illustration which elicited favourable comment for the earlier numbers have, on the whole, been consistently maintained. Now that the work is almost completed, and as one looks back on the enormous labour entailed, congratulations may again be offered to Dr. Engler, who has been the sole editor since Dr. Prantl died in 1893.

The responsibility of such a vast undertaking might well be sufficient, but in the year 1900 Dr. Engler announced the publication of a new work, "Das Pflanzenreich"—adopting the title suggested by De Bary—which will amplify the information given in "Die natürlichen Pflanzenfamilien." As Dr. Engler announces in his introduction, "Das Pflanzenreich" is not a revised edition of "Die natürlichen Pflanzenfamilien," for appendices to the latter will continue to appear from time to time, and whereas "Die Pflanzenfamilien" gives a complete account of the orders and genera, but only enumerates a few species, "Das Pflanzenreich" will furnish a full and comparative account of all authenticated species.

Eleven parts have already been issued—"Musaceæ," by K. Schumann; "Typhaceæ and Sparganiaceæ," by P. Graebner; "Pandanaceæ," by O. Warburg; "Monimiaceæ," by J. Perkins and E. Gilg; "Rafflesiaceæ and Hydnoraceæ," by H. Graf zu Solms Laubach; "Symplocaceæ," by A. Brand; "Naiadaceæ," by A. B. Rendle; "Aceraceæ," by F. Pax; "Myrsinaceæ," by C. Mez; "Tropæolaceæ," by Fr. Buchenau; and "Marantaceæ," by K. Schumann.

As regards the general arrangement, the citation of important literature and the review of the main characters of the order are similar to the method adopted in "Die Pflanzenfamilien," and, together with a certain number of illustrations, will be more or less the same. But, apart from new facts which may be added, it will be observed that the orders are not necessarily taken up by the same authors in the two works. English botanists may be

[1] "Insulation on Cables," by Mervyn O'Gorman. (*Journal* of the Institution of Electrical Engineers, vol. xxv. p. 608.)

allowed to express their satisfaction with the inclusion of one of our ablest systematic workers.

The key and description for each species are given in Latin, in order that, as the author remarks, they may be available to the botanists of all nations. The parts will not be issued in any particular sequence, the only proviso being that no order will be forthcoming until at least twelve years have elapsed since it was treated either in "Die Pflanzenfamilien" or in De Candolle's "Suites au Prodromus." Each part dealing with one order will be complete in itself and will contain an index.

Apart from the memoirs incorporated in these two works, many of the studies in systematic botany, the results of which have been published in Germany within recent years, have been controlled more or less by Dr. Engler in his position as director of the Botanical Museum in Berlin. The "Flora of Africa," which has reached the twenty-third instalment, represents mainly the investigations of workers in the Berlin Museum. One of the assistants, Dr. L. Diels, has written an able memoir on the "Flora von Central China." It is especially noticeable how distant and comparatively unknown are many of the countries in which the herbaria have been formed which are finding their way to the museums in Germany. The same spirit of unflagging energy which has made famous the names of many German collectors, whose object has been to acquire fame by sending home flowers previously unknown, may here be found, but the incentive is merely scientific enthusiasm.

NOTES.

THE Huxley Memorial Tablet represented in the accompanying illustration was unveiled at the Ealing Public Library on Thursday last by the Mayor of Ealing, Alderman H. C. Green. The inscription upon the tablet is, "The Right Honourable Thomas Henry Huxley. Born at Ealing, 4th May, 1825. Died at Eastbourne, 29th June, 1895. Try to learn something about

everything, and everything about something." The whole memorial was designed by Mr. Frank Bowcher, with the assistance of Prof. G. B. Howes, F.R.S. The background of the tablet is "Dove" marble; the frame, top row of lettering, wreaths and medallion are bronze; the rest of the inscription is in incised gilt letters. The movement to establish this memorial originated with Mr. B. B. Woodward, who brought it before the Ealing Natural Science Society, and a committee was formed with him as hon. secretary. Altogether about eighty subscriptions were received, mainly from Ealing residents, hence the tablet shows that the memory of Huxley is cherished at his birthplace. Among those present at Thursday's ceremony, in addition to the Mayor, were Prof. G. Henslow, Mrs. T. H. Huxley, Mr. and Mrs. Leonard Huxley, Mr. L. Fletcher, F.R.S., Mr. B. B. Woodward, and Mr. F. E. Beddard, F.R.S. (representing the Zoological Society of London). Letters regretting inability to attend were read from Prof. Howes and Lord George Hamilton. Prof. Henslow gave a short address, in the course of which he related some personal reminiscences of Huxley; and the Mayor of Ealing afterwards unveiled the tablet. The accompanying photograph having been taken before the tablet was erected, an error of the mason's, undetected at the time, but since corrected, gives the date of Huxley's death as the 25th instead of the 29th of June, 1895.

WE regret to see the announcement of the death of the Rev. Dr. Wiltshire, formerly professor of geology and mineralogy at King's College, London.

THE opening meeting of the Institution of Electrical Engineers is fixed for Thursday, November 13, when the premiums awarded for papers read or published during the session 1901–1902 will be presented, and the president, Mr. James Swinburne, will deliver his inaugural address.

AT the recent conference of Colonial Premiers, a resolution in favour of the metric system of weights and measures was adopted. Referring to this action, Mr. Chamberlain has informed a correspondent that he fully recognises the importance of the matter, and is in correspondence with the Colonial Governments and the Board of Trade on the subject.

IN reply to a question in the House of Commons on Thursday last, Mr. Austen Chamberlain said:—A new cable has been laid to Belgium, and telephonic communication between London and Brussels will be opened as soon as the necessary arrangements can be completed. The establishment of communication between London and Berlin is not at present feasible.

ENERGETIC measures are being adopted at Odessa to prevent the spread of plague from the cases which have occurred there. The outbreak of the disease in May of this year is attributed to the presence of rats, which have carried the means of infection since the last case of plague was treated in Odessa in November, 1901. Systematic efforts are therefore being made to destroy the colonies of rats and carry out strict sanitary regulations.

THE chief members of the Scottish Antarctic Expedition about to start for the South Polar regions were entertained to dinner in Edinburgh on Thursday last by the president of the Royal Scottish Geographical Society, Sir John Murray. Replying to the toast proposing success to the expedition, Mr. W. S. Bruce, the leader, remarked that the work undertaken would be supplementary to that of the three expeditions already in the Antarctic, and would be largely oceanographical. The Scottish area of activity would be around that part of the Antarctic where Sir James Ross, sixty years ago, took one sounding, attaining a depth of 4000 fathoms without reaching bottom.

THE Home Secretary has appointed a committee to inquire into the use of electricity in mines and the dangers attending it, and to report what measures should be adopted in the interests of safety by the establishment of special rules or otherwise. The committee consists of Mr. H. H. S. Cunynghame, C.B. (chairman), Mr. Charles Fenwick, M.P., Mr. Archibald Hood, past president of the Mining Association of Great Britain, Mr. James Swinburne, president of the Institution of Electrical

Engineers, and Mr. W. N. Atkinson and Mr. A. H. Stokes, H.M. Inspectors of Mines. The secretary of the committee is Captain A. Desborough, H.M. Inspector of Explosives.

THE Berlin correspondent of the *Standard* announces that the International Conference on Wireless Telegraphy will be held in Berlin about the end of March or the beginning of April next. England, the United States, France, Austria-Hungary, Italy and Russia have all responded to the invitation from Germany, and have intimated that they will accept an invitation to a conference in Berlin on condition that the programme is fixed beforehand and sent with the invitation. It is hoped to draw up a programme shortly, if possible before the end of February.

THE Paris correspondent of the *Times* reports that investigations by the Lacroix expedition to Martinique have shown that the immense opening on the south-west side of the crest of Mont Pelée has grown to formidable dimensions, and the White River is choked near its source. The dangerous portion of the mountain is the south-west slope.

MR. A. W. CLAYDEN writes to direct attention to the close resemblance between recent sunset effects and those which followed the eruption of Krakatoa in 1883. At Exeter, on Friday last, he observed very high cirrus clouds which passed through the various shades of yellow and red to grey, and then changed to brown, golden yellow and vivid crimson. The double series was as pronounced as in any of the sunsets of 1883. On Sunday evening, faint cirro-stratus became visible just before sunset, exactly resembling those seen at sunrise and sunset in 1883. The afterglow on Tuesday was richer in tone than any Mr. Clayden remembers since the Krakatoa effects. It will be remembered that similar observations of remarkable sunsets since the West Indian eruptions of May last have been made elsewhere and recorded in these columns (see pp. 199, 221, 294, 390 and 540).

THE third annual Huxley memorial lecture was delivered at the Anthropological Institute on October 21 by Prof. D. J. Cunningham, F.R.S. The subject was "Right-handedness and Left-brainedness," and Prof. Cunningham referred to the general interest which it presents to all students of anthropology. So far as available evidence goes, it seems probable that right-handedness was a characteristic of man at a very early period in his evolution. It is an inherited quality in the same sense that the potential power of articulate speech in man, and of song in the bird, are inherited possessions. Investigation shows that right-handedness is due to a transmitted functional pre-eminence of the left brain, and this factor prevents an oscillation of the condition from one side to the other in those curious cases in which the right and left sides of the body are reversed and the thoracic and abdominal viscera transposed. The greater part, if not the whole, of the motor incitations which lead to articulate speech go out from the speech centre which resides in the left cerebral hemisphere. In left-handed people, the predominance of the right cerebral hemisphere is accentuated by the transference to it of the active speech centre. Left-handed people, therefore, speak from the right brain. Prof. Cunningham concluded by pointing out that before definite conclusions could be arrived at upon many aspects of the subject, it is necessary that detailed observations should be made of the development and growth-changes of the cerebral cortex of the ape and man.

THE International Conference on Tuberculosis was held in Berlin on October 22–26, about four hundred members being present at the opening ceremony. At the final meeting, the following officers were elected for the international union against tuberculosis:—President, Prof. Brouardel, Paris; vice-presidents, Prof. Andword, Christiania; Sir William Broadbent, London; Dr. Dewez, Mons; Prof. Espina y Cayo, Madrid; Prof. von Leyden, Berlin; Prof. Linroth, Stockholm; Prof. Margliano, Genoa; Prof. Schirwinsky, Moscow; and Prof. von Schrötter, Vienna. The executive committee consists of Dr. Althoff (president); Prof. Fraenkel, Berlin; Dr. Calmette, Lille; Dr. Chyzer, Budapest; Dr. Noerdam, Copenhagen; and Dr. Raw, Liverpool; with Dr. Pannwitz, Berlin, as secretary.

FROM a note in the *Times* we learn that a resolution of the Government of India on the report of the Imperial Bacteriologist for the past official year describes the chief work of the department for the year as the testing and production of the rinderpest serum. The experiments were directed to improving its protective quality and perfecting the process of manufacture. The results obtained at Jacobabad, Madras and Rangoon showed that the initial protective value of sera is materially diminished by exposure to high temperatures. Experiments relating to anthrax are said to have been brought to a successful issue by the discovery of a protective serum, and researches have been prosecuted into other animal diseases. A scheme recently sanctioned for enlarging the laboratory will, it is hoped, lead to the production of 100,000 doses of the serum per annum, while the plan for training veterinary assistants at the laboratory in the inoculation of cattle against rinderpest has been successful. It has been decided to discontinue the issue of fungus tubes for exterminating locusts, the results not having been successful in any of the provinces; meanwhile, investigations and experiments on the subject will be conducted in the agricultural department as well as by the bacteriologist.

A LIST of the earthquakes and volcanic eruptions recorded from April 10 to September 23 of this year has been compiled by the *New York Times* and is reprinted in the *Scientific American* of October 11. Serious disturbances of the earth's crust have occurred on the following dates in various parts of the world:—April 10, 18; May 3, 7, 8, 12, 13, 15, 18, 20, 21, 24, 28, 30, 31; June 2, 4, 6, 8, 9, 14, 15, 19, 20, 21, 22, 24; July 1, 7, 8, 9, 10, 11, 12, 17, 27; August 13, 14, 15, 25, 27, 30; September 1, 6, 8, 9, 16, 17, 22, 23. Reports have since been received of disturbances on September 25, October 4, 6 and 16–25. With reference to the last of these records, when both Mont Pelée and the Soufrière of St. Vincent were in eruption, it is perhaps worth remark that a postcard posted at Greussen was received from Herr Nobbe on October 16 predicting that disturbances would occur on October 17 and 18, not only at Martinique and St. Vincent, but also in Europe and America.

THE Odessa correspondent of the *Standard* quotes from the *Turkestan Gazette* some further details with regard to the Kashgar earthquake of August 22. It appears that the earthquake was far more disastrous than was supposed from the first accounts. The populous settlement of Nijni-Artish, lying to the north-east of Kashgar, was practically razed, many of the houses were wholly or partially engulfed in huge fissures, and 1700 persons perished. In Kashgar itself and in the immediate neighbourhood, the earthquake was less destructive to property, but 600 persons were killed. The village of Besh-Kerim, consisting of eighty houses, was entirely destroyed, with the whole of its inhabitants, in number about 550. The total loss of life is estimated at a little above 3000. Undulations of the surface, like sea-waves, were observed in the Chatar-Kula Hills; and the wooded banks of the Scharikhanskaia at Sultan-Abada are riven into immense chasms.

IN a paper read before the Institution of Mining and Metallurgy on October 16, Messrs. T. H. Leggett and F. H. Hatch collate the facts on which estimates can be based of the gold

production and life of the Main Reef Series, Witwatersrand, down to 6000 feet, and then deduce what, in the circumstances, they consider to be a fair estimate. They conclude that it must be assumed that the annual production will increase for a few years to a maximum, will be maintained for a second period, and that then there will be a third period of decline. For the three years preceding the war, the average increase of production was at the rate of 4,000,000*l.* per annum, the production for 1899 having a value of about 19,000,000*l.* Allowing eighteen months from January 1, 1902, for the industry to be restored to the conditions existing in August, 1899, a similar increase of production will bring the output to at least 30,000,000*l.* per annum by June 30, 1906, and if this rate of production were to be maintained from then on, the total production of 1,233,560,709*l.* would give a life from January 1, 1902, of 42½ years. But as the production will decline gradually instead of coming to a sudden stop, this length of life will be increased, unless the annual output should for any considerable period exceed 30,000,000*l.*, when the increase in length of life due to declining output would be neutralised.

MR. C. J. WOODWARD, Municipal Technical School, Birmingham, sends us a photograph, from which the accompanying

illustration has been reproduced, showing Indians in the art of producing fire by means of the fire drill. The photograph is a copy of one in the possession of Mr. Henri d'Este, and was taken in the Orinoco region of South America.

IN a recent number of the *Sitzungsberichte* of the Vienna Academy of Sciences, Dr. J. Hann contributes an important paper on the meteorology of the equator, based on observations taken by Dr. E. Goeldi, director of the museum at Pará. Very few stations exist near the equator, and especially equatorial South America; the observations now in question extend from August, 1895, to August, 1901, and, although they are still continued, Dr. Hann considers them to be of such exceptional value that he has preferred to submit them to an elaborate discussion rather than to wait for later materials. In this note we shall refer only to temperature and rainfall. The results show that the temperature is extremely uniform throughout the year; the annual variation amounts only to 1°·4 C., while the mean daily variation is 8°·8. The lowest temperature occurs in the beginning of the year, and the highest at the end of the year; from May to September the mean temperature is almost constant. The yearly mean is 25°·7 C. The rainfall is characterised by a wet season, January to April, and a relatively dry period, from May to December, although rain is somewhat frequent during the dry season. The falls occur almost exclusively in the afternoon and evening, during thunderstorm weather. The mean annual rainfall is about 102 inches.

A SURVEY of the principal changes that have occurred in the birth and death rates in Italy during the last forty years has been given by Prof. Giuseppe Sormani in the Lombardy *Rendiconti*, xxxv. 16. The principal conclusions are as follows:—The birth rate fluctuated between the limits 39·34 per 1000 in 1876 and 33·49 in 1898, while the corresponding limits of the death rate were 34·39 in 1867 and 21·87 in 1899. The fluctuations are thus seen to be less marked in the birth rate than in the death rate, but both show a downward tendency, which occurs to a great extent concurrently with the introduction of improved sanitary conditions. Still, the birth rate has in every year exceeded the death rate, the excess varying from 2·40 in 1867 to 12·80 in 1897. During the period 1862–1899, the population increased by 10,000,000. In connection with the decreased death rate, the author estimates an annual saving of eight lives per thousand in the period 1897–99 as compared with the period 1862–75. Taking account of the influence of the diminished birth rate, and assuming that the reduction of the death rate is due to progress in checking the spread of infectious diseases, it is considered that at least 200,000 people have been effectively saved from death, and that the number of those saved from illness must be at least twenty times as great.

IN "Notes on the Geology of the Eastern Desert of Egypt," by Mr. T. Barron and Dr. W. F. Hume (Dulau and Co., 1902), there are some interesting remarks on the later physical changes which the country has undergone. Attention is drawn to certain "igneous gravels" which in reality are gravels containing in places fragments of granite, gneiss and other stones derived from the Red Sea hills. They are probably Pleistocene and of earlier date than the Nile, as its bed has been cut through them and its alluvium overlies them, so that this river could not have begun to flow until late Pleistocene times. A study of the raised beaches and coral reefs affords evidence of important movements which ushered in the present conditions. During the Pliocene period, minor fault-valleys were formed, and likewise great rifts such as the Red Sea (with the invasion of the fauna of the southern seas), the Gulf of Suez and other features. Miocene strata afford evidence of the former extension southwards of the Mediterranean; Oligocene strata have not been recognised; while the earlier Eocene strata, preserved here and there from destruction by faults, point to the Eocene sea having covered the entire area examined. These Eocene strata are Londinian in age, but they comprise two series, an upper, mainly composed of limestones with nummulites, and a lower, of shales and marls. The lower series rests unconformably on Upper Cretaceous limestones, which are characterised by abundant oysters and well-marked bone-beds. Certain gypseous deposits near the Red Sea have resulted from the chemical alteration of Cretaceous and Eocene limestones. The Nubian Sandstone, which underlies the Cretaceous limestones, is also regarded as of Cretaceous (Santonian) age, and it rests on smoothed surfaces of Plutonic, volcanic and metamorphic rocks, planed down by marine erosion.

WE have received a copy of a paper by Dr. J. Beard, from the *Zoologischer Jahrbuch*, entitled "The Determination of Sex in Animal Development."

THE *Revue générale des Sciences* of October 15 contains an admirably illustrated account of a discourse on "extinct monsters" recently delivered by M. Marcellin Boule in the

Paris Museum. Among the illustrations, especial interest attaches to a reproduction of a photograph of the skeleton of *Mastodon angustidens* lately acquired by the museum, showing the remarkable downward flexure of the upper tusks and the great length of the symphysis of the lower jaw in which the lower pair are implanted. It seems certain that this species could not have been provided with a long trunk.

AMONG a batch of articles from the *Proceedings* of the U.S. Museum, attention may be directed to one by Major E. A. Mearns on the ocelot cats, of which five distinguishable forms (regarded as species) are recognised. In a second fasciculus (No. 1292), Mr. W. P. Hay describes the crustaceans inhabiting "Nickajack" Cave, Tennessee. In other parts (Nos. 1293 and 1296), Messrs. Jordan, Snyder and Fowler continue their description of Japanese fishes, treating in the former fasciculus of the blennies, and in the latter of the gorgeously coloured chætodonts and their allies.

WHEN discussing the extent to which the posterior vertebral segments of the body have been suppressed and transmuted during the evolution of man and the higher apes, Dr. A. Keith (*Journal of Anatomy and Physiology*, vol. xxx. p. 18) calls attention to the fact that naturalists are wrong in describing the larger apes as quadrupedal. They are so only when on the ground, which is not their proper habitat. When at home among the trees they carry the body upright, and may thus be called *orthograde*, in contradistinction to the lower Primates, which are *pronograde*.

THE third part of the first volume of Mr. J. S. Gardiner's "Fauna and Geography of the Maldive and Laccadive Archipelagoes" contains articles by five contributors, in addition to a continuation of the editor's general description of these islands and the coral-reefs of the Indian Ocean generally. In the first article, Prof. F. J. Bell discusses certain groups of echinoderms; in the second, Mr. M. Burr describes the orthopterous insects; while the third, by Mr. L. A. Borradaile, treats of certain crabs. The fishes of the Maldives fall to the lot of Mr. C. T. Regan, and for the identification of the turbellarian worms Mr. F. F. Laidlaw is responsible. A full notice of the work is reserved until its completion.

To the October number of the *Zoologist* Mr. Graham Renshaw contributes an interesting series of notes on various zoological gardens. A plate, from photographs, illustrates the remarkable difference between the summer and winter coats of the addax antelope. Attention is called to the fact that the attitude generally given to the South American maned wolf in museums and figures is incorrect, the creature carrying its head very low.

IN Gegenbaur's *Morphologisches Jahrbuch*, vol. xxx. part iii., Herr L. Tobler points out that the so-called axillary bands Achselbogen) of the human subject are vestiges of the panniculus carnosus (skin-muscle) of the lower mammals.

THREE reprints from the *Yearbook* of the Department of Agriculture, and *Bulletin* No. 32 from the Bureau of Forestry in the same Department, all dealing with forestry questions, have been received. The work, mainly of supervision or providing expert advice, which is carried on by the Department is here emphasised on three distinct lines. Two of the pamphlets give working plans for forests, the one in Arkansas drawn up by Mr. F. E. Olmsted for a lumber company, and the other arranging for economic lumbering of land belonging to the University of Tennessee, on a system suggested by Mr. J. Foley. In Arkansas, 85 per cent. of the company's holding consists of pine lands, where about 50 per cent. of the trees are pines, of the varieties short-leaf and loblolly (*Pinus echinata*, *Pinus taeda*), but both furnishing timber known as yellow pine. The remaining 50 per cent. are hard woods, commercially less valuable, and it is recommended to increase the pines by leaving trees to furnish seed and to decrease the number of hard-wood trees. The cutting limit recommended for pines is 14 inches on the stump, and for hard-wood 20 inches. Mr. W. L. Hall deals with the "Timber Resources of Nebraska," and points out that not only is the amount of planted timber satisfactory, but that the natural timber is increasing both in area and density. The gain in area represents the encroachment of the forest on the prairie, particularly along the creeks and in the ravines, and may in places amount to as much as 100 acres during a period of fifty years. Pine again forms the staple product, except near water, where oak, elm and walnut thrive. "Grazing in Forest Reserves" is the title of the report by Mr. F. Roth, and this furnishes an account of the existing arrangements under which farmers may graze sheep, cattle or horses on the Government forest reserves. The success of this regulated grazing seems to be due to the simple though fairly stringent rules drawn up, combined with the level-headedness of the average American. All the reports call attention to the great damage wrought by fires, and grazers are compelled by their agreement to aid in extinguishing fires, though Mr. Roth combats the prevalent idea that many fires are to be laid to the charge of the shepherds, because fires are quite as frequent where grazing is not allowed.

AMONG the lectures to be delivered at the Royal Victoria Hall, Waterloo Road, S.E., during the next few weeks are the following:—November 4, Mr. Herbert Rix on "To Palestine and Back"; November 18, Mr. Rudler on "Volcanoes."

MESSRS. SANDERS AND CROWHURST, Shaftesbury Avenue, have sent us five lantern slides reproduced from the remarkable photographs of young cuckoos in nests, mentioned in NATURE of October 9 (p. 574). These and other lantern slides of birds and plants photographed direct from nature provide a pleasant means of creating interest in natural history.

THE first two of the three volumes of "The Elements of Physics," by Profs. Edward L. Nichols and William S. Franklin, have been revised and published as a second edition by the Macmillan Company of New York (London: Messrs. Macmillan and Co., Ltd.). The first volume deals with "Mechanics and Heat" and the second with "Electricity and Magnetism."

THE Zoological Society has just issued a new (fifth) edition of the catalogue of the Society's library in Hanover Square, prepared by Mr. F. H. Waterhouse, the librarian. The volume contains the titles of about 11,000 different works, exclusive of periodicals. The whole library contains about 25,500 different volumes. The Zoological Society is also issuing an index-volume to the *Proceedings* of their scientific meetings for the last decennial period 1891–1900, in correspondence with similar indexes for former decennial periods.

THE additions to the Zoological Society's Gardens during the past week include a Vervet Monkey (*Cercopithecus lalandii*) from South Africa, presented by Mr. J. D. Tannahill; a ——— Monkey (*Cercopithecus*, sp. inc.) from West Africa, presented by Mr. A. J. Lyttleton Turner; a Spotted Ichneumon (*Herpestes auropunctatus*) from Nepal, presented by Mrs. F. Cameron; a Collie's Squirrel (*Sciurus collioei*) from Mexico, a Ruffed Lemur (*Lemur varius*, var. *ruber*), a Fringed Gecko (*Unoplates fimbriatus*) from Madagascar, a Gould's Monitor (*Varanus gouldi*), three Limbless Lizards (*Pygopus lepidopus*) from Australia, deposited; a Golden Eagle (*Aquila chrysaëtus*) from Scotland, presented by Mr. J. Baxendale.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN NOVEMBER :—

Nov. 2. 13h. 6m. Minimum of Algol (β Persei).
4. 1h. 0m. Mercury at greatest western elongation (18° 50′).
5. 9h. 55m. Minimum of Algol (β Persei).
6. 5h. 0m. Saturn in conjunction with the moon. Saturn 5° 33′ S.
9. Predicted perihelion passage of Swift's comet (1895 II.).
14–15. Epoch of Leonid meteoric shower.
15. Venus. Illuminated portion of disc = 0·998, of Mars = 0·914.
20. 12h. 6m. to 13h. 7m. Moon occults 60 Cancri (mag. 5·7).
20. 18h. 42m. to 19h. 51m. Moon occults κ Cancri (mag. 5·0).
23. Epoch of Andromedid meteoric shower.
23. Perihelion passage of Perrine's comet (1902 *b*).
23. 14h. 14m. to 15h. 0m. Moon occults υ Leonis (mag. 4·5).
24. 2h. 21m. to 6h. 4m. Transit of Jupiter's Sat. III. (Ganymede).
25. 11h. 37m. Minimum of Algol (β Persei).
28. 8h. 26m. Minimum of Algol (β Persei).
28. 14h. 0m. Venus in superior conjunction with the sun.
29. 7h. 43m. to 12h. 37m. Transit of Jupiter's Sat. IV. (Callisto).

THE LEONID SHOWER.—Two articles in *Popular Astronomy*, No. 98, by Prof. Pickering and Mr. R. B. Taber respectively, deal with the reports of different observers of the Leonids during the shower of 1901, which, although not seen in this country, appears to have been a brilliant one as seen by the observers in the United States on the morning of November 15.

Prof. Pickering records the following six observations :—

Station.	Latitude.	Longitude.	No. of meteors per hour.
	°	°	
Trinidad, W.I.	10 ...	63 ...	290
Steamer *Admiral Dewey* ...	26 ...	73 ...	420+
Tuape, Sonora, Mex. ...	30 ..	110 ...	countless
Tucson, Arizona	32 ...	111 ...	225
Claremont, California ...	34 ...	118 ...	800
Mount Lowe Observatory ...	34 ...	118 ...	300

The position of the radiant point seems unchanged, the Harvard report giving it as R.A. = 10h. 6m., Dec. = 22° 16′. Mr. Upton, of Providence, estimated it to be R.A. = 10h. 2m. ·8., Dec. = 21° 19′, whilst M. Eginitis, director of the Athens Observatory, suggests "a sensible displacement in right ascension." Mr. Upton thinks that "the radiant is probably a point, rather than a spot 2″ or more in diameter."

OBSERVATIONS OF ζ GEMINORUM.—During the period March 10 to May 23 of this year, forty-two observations of the variable star ζ Geminorum were made, by Argelander's method, at the Princetown University Observatory by Mr. F. P. McDermott, junior.

The observations indicate that there is a secondary maximum about 3·0d. before the principal maximum, and that the object attains a brightness of 3·88m.; a secondary minimum, when the object has a magnitude of about 3·93, is also indicated 1·6d. before the principal maximum.

THE FIFTH SATELLITE OF JUPITER.—Writing to *Popular Astronomy* (No. 98) on September 9, Prof. Barnard recalls the fact that it is exactly ten years since Jupiter's fifth satellite was discovered.

From the spring of 1899 until the spring of this year, Prof. Barnard was unable to see this object, but several good elongations have been observed this year; the satellite can, however, only be seen under very good observing conditions and with large instruments.

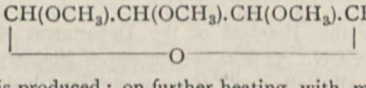
SEARCH FOR AN INTRA-MERCURIAL PLANET DURING THE TOTAL SOLAR ECLIPSE OF 1901.—In *Bulletin* No. 24 of the Lick Observatory, Prof. Perrine describes the photographic search for the intra-Mercurial planet which, according to Leverrier and others, might be the disturbing influence that causes the considerable motion observed in the line of apsides of the orbit of Mercury.

Reduction of the negatives obtained during the 1901 eclipse has led to a negative result. There is just a possibility that at the time of the eclipse the hypothetical planet may have been in a direct line with the bright corona, and so have escaped notice; but, as the corona only covered 1/200th of the area photographed, this is not very probable.

A planetary body 34 miles in diameter would have appeared as having a magnitude of $7\frac{3}{4}$ in the existing circumstances, and, as it would need seven hundred thousand such bodies, each having the same density as Mercury, to produce the observed movement in the orbit of the latter, it seems highly improbable that these changes are due to the interference of an intra-Mercurial planet. Prof. Perrine suggests that perhaps the finely divided matter which produces the zodiacal light may, when considered in the aggregate, be sufficient to cause the perturbations in the orbit of Mercury.

CHEMISTRY AT THE BRITISH ASSOCIATION.

IN a paper on experiments to ascertain the amount of carbonic anhydride absorbed from sea water, Prof. E. A. Letts and Mr. W. Caldwell stated that they are experimentally testing the validity of Schloesing's theory that the ocean serves as the regulator of atmospheric carbonic anhydride, with the aid of a specially devised piece of apparatus. Prof. E. A. Letts also read a paper on the corrosion of copper by sea water and on the detection of traces of impurity in the commercial metal, in which it was suggested that rapid corrosion of copper by sea water may be due to electrolytic action between particles of a copper-arsenic alloy embedded in the copper plates and the copper itself. Prof. F. Clowes, in a paper on the action of distilled water upon lead, showed that dissolved oxygen first acts upon the lead, and the oxidation product is subsequently converted into a hydroxy-carbonate by carbonic acid. Dr. C. E. Fawsitt gave a paper on the decomposition of urea, showing that on heating urea in aqueous acid or alkaline solution at 99°, the decomposition does not proceed in accordance with a bi- or tri-molecular reaction as would be expected theoretically, but in accordance with the formula of a monomolecular reaction. The apparent anomaly is explained by the formation of ammonium cyanate as an intermediate product; on heating with water, urea first undergoes isomeric transformation into ammonium cyanate, and this then decomposes into ammonia and carbonic anhydride. In a paper on the telluric distribution of the elements in relation to their atomic weights, Mr. W. Ackroyd employs the purchasing power of a given sum as an indication of the abundance or rarity of the different elements; he shows that in each of the natural groups the rarity of the element increases with the atomic weight. In a paper on the proposed standardisation of methods of chemical analysis, Mr. B. Blount protested against the growing tendency to apply the principle of standardisation to analytical methods for the determination of chemical entities, such, for instance, as the constituents of steel; at the same time, he agreed that arbitrary methods, such as those applied to the examination of waters, oils, milks, &c., should be standardised. Prof. T. Purdie, F.R.S., and Dr. J. C. Irvine, in a paper on the alkylation of sugars, described a method for alkylating hydroxyl groups in methylglucosides. On boiling methylglucoside in methyl alcohol with methyl iodide and dry silver oxide, the trimethyl ether of methylglucoside,



is produced; on further heating with methyl iodide and silver oxide, it is converted into a tetramethyl ether. Under similar treatment, acetonerhamnoside yields a dimethyl ether. In dealing with the synthetical action of enzymes, Dr. E. F. Armstrong showed that the enzyme lactase is capable of converting glucose into a disaccharide, to which the name isolactose was given. The same author gave a paper on recent synthetical researches in the glucoside group; the pentacetylglucoses are converted into aceto-halogen-glucoses by anhydrous hydrogen chloride or bromide, the acetyl group attached to the aldehyde group being replaced by halogen. These substances are converted into alkylglucosides by treatment with alcohols. A report of the committee appointed to collect

statistics concerning the training of chemists employed in English chemical industries, of which Prof. G. G. Henderson is secretary, was read; information concerning their course of training had been received from 502 managers and chemists employed in English chemical industries, 111 of whom are fellows or associates of the Institute of Chemistry. The following figures give more detailed information:—

Number of graduates of a British University	59
Number of graduates of both a British and a foreign University	16
Number of graduates of a foreign University.....	32[1]
	107
Number of non-graduates trained in a British University or University College	137[2]
Number of non-graduates trained in a British Technical College	165
Number of non-graduates trained in a foreign University or Technical College	8
Number of non-graduates trained in Evening Classes, analysts' laboratories, works' laboratories, or otherwise	85
	395

The committee on isomorphous sulphonic derivatives of benzene, of which Prof. H. E. Armstrong, F.R.S., is secretary, reported that Dr. Jee has completed the crystallographic study of the 1:3-dichloro-, chlorobromo- and dibromo-benzene 5-sulphonic chlorides and bromides, and finds that this group of compounds constitutes an isotetramorphous group. In discussing the colour of iodine-containing compounds, Miss Ida Smedley called attention to the fact that two classes of such compounds are known, namely, colourless and coloured. In a paper on colloids of zirconium compared with those of other metals of the fourth group, Dr. J. H. Gladstone, F.R.S., and Mr. W. Hibbert stated that zirconium gives a colloid of well-marked properties resembling those of silicon, tin, titanium and thorium; Dr. J. H. Gladstone also gave a paper on fluorescent and phosphorescent diamonds. The following papers were also read:—Note on a fourth methylmorphimethine, by Mr. J. Hawthorne; on the absorption of ammonia from water by algæ, by Prof. E. A. Letts and Mr. J. S. Totton; on determinations of atmospheric carbonic anhydride made on board the *Discovery* on the voyage to the Cape and thence to New Zealand, by Prof. E. A. Letts; a new method of causing isomerisation, by Prof. R. Meldola; acid esters of methyl-succinic acids, by Prof. J. J. Sudborough and Mr. W. A. Bone; compounds of trinitrobenzenes and alkylated naphthylamines, by Mr. H. Hibbert and Prof. J. J. Sudborough; action of alkalis on cinnamic acid dibromide and its esters, by Prof. J. J. Sudborough and Mr. K. J. Thomson. An interesting feature of the proceedings of Section B was the reading and discussion of two important monographs, one on our present knowledge of diazo-compounds, by Dr. G. T. Morgan, and the other on hydro-aromatic compounds with single nucleus, by Dr. A. W. Crossley.

ANTHROPOLOGY AT THE BRITISH ASSOCIATION.

THE papers read before the Section covered, as will be seen, a considerable portion of the field that is usually embraced by anthropology.

Archaeology.—Mr. W. J. Knowles exhibited some Irish flints mostly with a dark brown patina and "the fashion of chipping the flint perpendicularly through the thickness," some of which came from "interglacial gravels." Two questions were asked: (1) What useful object could the perpendicular chipping serve to man? (2) If not artificial, what force in nature can dress so many objects alike with chipping that has all the appearance of being artificial in character? Miss Nina F. Layard described and exhibited a number of variously shaped Palæolithic implements from a small pit in the plateau gravels of Ipswich, and Messrs. W. and W. A. Cunnington gave an account of the recent discovery of Palæolithic implements from Knowle, Wiltshire; these implements and the ordinary flints of the gravel pit are remarkable for the very high polish that many exhibit, and some are marked with peculiar striæ. There are two views to account for the polishing, (1) a redeposit of silica, which was favoured by the authors, and (2) sand action, which was emphatically advocated by Prof. Boyd Dawkins; as a matter of fact, the sand of this quarry is exceptionally fine and entirely siliceous. Mr. S. B. Dixon also exhibited some of these polished implements. No satisfactory explanation was given of the striæ. Mr. W. J. Knowles described some important stone-axe factories that he had discovered near Cushendall, co. Antrim; axes in all stages of manufacture and innumerable chips were found where boulders of a certain rock occurred in the drift. The conditions were somewhat similar to those Mr. W. H. Holmes has described in the United States. Mr. Knowles also exhibited leaf-shaped stone blades from co. Antrim, which were probably a stage in the manufacture of spear- and arrow-heads, like the stone blades from America.

A remarkable series of underground, tunnel-like dwellings (souterrains) in Ulster was shown in lantern slides by Mr. W. J. Fennell, and similar remains from various parts of the British Isles were copiously illustrated by Mr. D. MacRitchie. Mr. G. Clinch also described the subterranean dwellings recently discovered at Waddon, near Croydon.

The report on the excavations at Arbor Low Stone Circle in Derbyshire was read by Mr. H. Balfour. The evidence as to its age was not decisive, but it pointed to the monument having been erected at the close of the Neolithic period, or at the beginning of the Bronze age. A Belfast antiquary endeavoured to prove that the Irish elk survived into the Bronze age, but the bones exhibited belonged to oxen, not to deer.

A note from Mr. R. A. S. Macalister on a prehistoric cemetery-cave in Palestine recorded the first discovery yet made of the pre-Israelite inhabitants of Palestine who burnt their dead; above these were found unburnt remains of the earliest Semitic stock. The recent Cretan excavations at Knossos by Mr. A. Evans and those at Palæokastro by Mr. R. C. Bosanquet were illustrated by lantern slides; at the latter site there is an exceptional opportunity for a craniological study of Mycenæan and recent Cretans.

The Hon. John Abercromby read a very important paper on the oldest Bronze age earthenware vessel, which is usually called a "drinking cup" and for which he proposed the term of "beaker." By the aid of numerous photographs, he demonstrated that it came into Britain from the Rhine and in all probability had its origin in Central Europe. Bronze objects of the Hallstatt culture phase have been recognised in Ireland, but it was not until Mr. G. Coffey drew the attention of the Section to the fact that the abundance of them was realised. This he did in a very convincing manner, drawing his examples mainly from the wonderful collection of the Royal Irish Academy in Dublin. Iron was probably known before the close of the Hallstatt period in Ireland. Mr. Coffey also exhibited lantern slides of some remarkably fine carved Irish monuments belonging to the La Tène, or so-called Late Celtic, period. These stone monuments, which are ornamented with the "trumpet" design, are unique. Reports were read on excavations in the Roman fort at Gellygaer, near Cardiff, and in the Roman city of Silchester. The survival of certain Pagan sepulchral symbols on early Christian monuments in Ireland was abundantly illustrated by lantern slides by Mr. P. J. O'Reilly. The significance of these symbols is, however, unknown. A note was presented by Mr. F. P. Mennell on the Khami ruins twelve miles from Bulawayo, Rhodesia. It is satisfactory to find that these monuments are being investigated and the specimens preserved in the Rhodesia Museum.

Anthropography, or *Physical Anthropology.*—A new departure was made at this meeting in the formation of a subsection to discuss matters relating to this branch, and a demonstration was made by Prof. Symington in the anatomical museum of the College. Mr. J. F. Tocher read his report on the pigmentation survey of Scottish school children. Preparations are now being made for an exhaustive inquiry into the distribution of the hair and eye colour of Scottish children analogous to that made by Virchow for German children. Mr. Tocher also presented a note on some measurements of Eskimo. Mr. J. Gray gave measurements of the Indian Coronation contingent, and drew therefrom some interesting conclusions. Dr. C. S.

[1] Thirteen of whom studied also in a British University or Technical College.

[2] Twenty of whom studied also in a foreign University or Technical College.

Myers presented his report on the very numerous anthropometric investigations he has made among the native troops of the Egyptian army, and at the same time described a method of radial craniometry. The skeleton of Cornelius Magrath, the Irish giant, was exhibited, and the subject of giantism was lucidly explained, by Prof. J. D. Cunningham; Prof. A. F. Dixon also exhibited a skull modified by acromegaly. Prof. J. Symington exhibited some ancient Irish crania collected by the late John Grattan, of Belfast, and described the methods of cranial investigation adopted by that gentleman; the president also alluded in eulogistic terms to the acumen of Mr. Grattan, who, though he was engaged in business and had not received a scientific training, yet was in his time in advance of every European craniologist so far as methods were concerned.

Psychology.—Miss A. Amy Bulley read a paper on the psychology of primitive man; while primitive man had no absolute mental deficiency, he "sensed" objects singly and without anything more than a hazy perception of their relation to one another. The results of this deficiency were:—(1) Inability to generalise; (2) no distinction recognised between essential and non-essential characteristics; (3) imperfect understanding of cause and effect. These imperfections were employed as tests for certain religious ideas that have been attributed to primitive man, such as one supreme God, phallic worship, the ghost theory and the theory of the *continuum* in religion. Dr. W. Graham's paper on the mental and moral characteristics of the people of Ulster led to a very lively debate which was fortunately free from excess, although the author referred to the increase of insanity due to religious excitement in the north of Ireland. The main valid criticism was the pointing out that the author fell into the common mistake of calling the non-Teutonic element in Ireland "Celtic," thereby entirely ignoring the vastly preponderating Mediterranean strain.

Ethnography.—There were several papers, illustrated with lantern slides, which described certain peoples who had been studied by the lecturers. Dr. W. H. Furness gave an entertaining and instructive discourse on the Nagas, whom he visited with the special purpose of investigating whether they had a connection with any of the interior tribes of Borneo; he came to the conclusion that there was no positive proof for this view. The Lolos and other tribes of western China were dealt with by Mr. A. Henry. A comparison of the Lolo and Mias-tze speech with the Chinese suggests that the tonal monosyllabic languages form a distinct primitive group and are not the result of linguistic degradation; the peculiar script of the Lolos may be due to early Nestorian missionaries; the surnames of the Lolos always signify the name of a tree or animal, which may not be touched. Messrs. Nelson Annandale and H. C. Robinson described the wild and civilised tribes of Malay Peninsula. No distinction could be drawn between the Malays and Siamese of the district between Singora and Jambu; there is evidence of an admixture of aboriginal blood; the savage tribes are the Semangs, Sakais and Orang Laut Kappir of Trang. The report on the ethnological survey of Canada was presented. The Canadian Committee itself has not yet got beyond the "resolution" stage; the long report of more than ninety pages is solely the work of the secretary, Mr. C. Hill-Tout, who has investigated, mainly linguistically, the Lower Fraser Indians of British Columbia. The Royal Society of Canada has at last undertaken to prosecute with vigour the important and pressing objects of this committee.

Comparative Religion.—The human souls and ghosts of the Malays of Patani were described by Mr. N. Annandale, as well as the ghosts of inspired magicians, the giving in marriage of the son of such a ghost, and the marriage procession (a cyclone); the evolution was traced of a local god from such a ghost. Two papers by the Rev. J. H. Holmes were read by the president. The first described the sacred initiation ceremonies undergone by the lads of the Papuan Gulf. The boy is isolated in the "eravo," or club house, until his hair has grown to its full length. His body must not be exposed to the sun, and he is subject to several taboos. The bull-roarer is shown and explained, and masks play a great part in the more important ceremonies. The second paper dealt with the religious ideas of the Elema tribe of the Papuan Gulf. From certain customs and taboos, it is evident the natives were totemic people, but they appear to have partially passed beyond this phase. There are four classes of ghosts—those who have died a natural death, who have been killed in a fight, who have been murdered, and who have been killed by a crocodile. Every family of living things, from man downwards, has its special god or guardian spirit, for whom there is a feeling of respect; for example, the banana has two gods. The Toaripi or Elema recognise a good and an evil supreme god and a number of subsidiary ones. Mr. F. T. Elworthy exhibited a number of perforated stone amulets from Lincolnshire, Dorset, Somerset, co. Antrim, and southern Italy which are used as prophylactic agents against witchcraft in houses, cattle byres, or in gardens. An important paper on the Lia Fail of Tara and election of kings by augury was communicated by Mr. E. S. Hartland. The famous Lia Fail, or Stone of Destiny, often, but erroneously, identified with the Coronation Stone, was a stone on which were enchantments, for it used to roar under the person who had the best right to obtain the sovereignty of Ireland at the time the men of Ireland were in assembly at Tara to choose a king over them. It was thus an oracle, and the choice of king was made by the augury which it gave. Kingship was something more than human; it was thus necessary to ascertain the will of the gods. Other examples from diverse times and places were given as proofs of the widespread character of these customs.

Survivals.—Mr. E. Lovett discoursed in an interesting manner on tallies; these are records kept by cutting notches in sticks of wood, and are a survival of probably the earliest appliance of a commercial nature made by man. There are two varieties: (1) the contract tally, formed by a stick split through the notches, and (2) the simple or memorandum tally, a single notched slip of wood. The simple or folk tally has survived the complex form as elaborated in the banker's and exchequer tallies. Numerous modern examples were exhibited. Mr. Hartland exhibited two wooden "swords" formerly worn as professional emblems by medical practitioners in Japan; one represented a bean pod, and the other was a rough piece of wood.

Museums.—On the last morning, a very interesting discussion on the classification and arrangement of exhibits in anthropological museums was started by the reading, by the recorder, of a very suggestive paper by Dr. W. H. Holmes, of the U.S. National Museum. The chief methods of arrangement are the ethnographical on a geographical basis, and the evolutionary and distributionary. It was generally agreed that no hard and fast rule could be laid down, but that it was desirable that every museum should develop along its own lines, subject to a controlling idea along one of these chief directions. It was held essential that museums should be liberally labelled, and rendered at the same time instructive and interesting; more attention should be paid to these points, as the success of a museum depends upon the interest that it awakens.

Classification.—The business of the Section terminated with a discussion of the classification of the subject-matter of anthropology; this was opened by Mr. E. N. Fallaize with a suggested scheme which was offered for future consideration.

A popular feature of the Section was the interesting museum mainly of local archæology and ethnographic survivals which, thanks to the courtesy of Prof. Symington, were exhibited in the dissecting room and anatomical museum. Mr. R. Welch exhibited numerous photographs and other objects, notably a series of remarkable primitive vehicles from co. Antrim, which illustrated several stages in the evolution of the Irish jaunting car. Many of the papers read at the meeting will be published in full by the Anthropological Institute either in their *Journal* or in *Man*.

PHYSIOLOGY AT THE BRITISH ASSOCIATION.

PROF. HALLIBURTON, president of the Section, read a paper on the regeneration of nerves, contributed by Dr. Mott and himself. Two opinions existed in regard to the regeneration of nerve-fibres. One set of observers concluded that the new nerve-fibres sprout out from the central stump of the divided nerve-trunk. This was the opinion of by far the larger number of workers. The other opinion was that the new nerve-fibres were of peripheral origin. Those who held the latter view relied almost entirely upon histological evidence. But a strand of cells that looked like a nerve-fibre to the microscope might nevertheless be not physiologically a nerve-fibre, inasmuch as it might be quite unable to be excited as a true nerve-fibre is or to conduct nerve impulses as a nerve-fibre can. These functional performances were the true criteria for nerve-fibres. Among recent

observers, Howell and Huber, who had used both histological and experimental methods, had arrived at the conclusion that the axis cylinder, the essential portion of a nerve-fibre, had an exclusively central origin; they admitted that the peripheral tissues in which it was embedded were active in preparing and generating a nutritive scaffolding for it. With Dr. Mott he had come to experimental results which, so far as they at present went, confirmed those by Howell and Huber. One experiment they had performed was to divide a large nerve and suture the ends together. After a sufficient length of time had passed, restoration of function occurred, and this was taken as a sign that regeneration had successfully ensued. Then they exposed the nerve-trunk anew. The union of the two ends was then found to have been accomplished, and on testing the nerve it was found to be excitable by faradisation when the stimulus was applied either below or above the point of reunion of the divided trunk. A piece of the nerve-trunk was then excised some little distance below the point of reunion; on microscopical examination of this, new nerve-fibres were discovered within it. Subsequent to this second operation, the wound was closed up and the animal was finally sacrificed ten days later. When the animal was finally then examined, the nerve both above and below the second section was once more tested for response to electric stimulation. The peripheral piece was then found to have become once more inexcitable. Degeneration had also set in within the fibres of the peripheral piece of the nerve-trunk. Prof. Halliburton urged that this showed that the degenerative process which followed the direction of growth had occurred in a peripheral direction only and had not started at the periphery. Observations were also mentioned indicating that normal functional activity exercised an important influence on the speed and perfection of the process of nerve repair. Paralysis was induced in the arm of the monkey by section of a number of the cervico-brachial afferent spinal roots. By this device, the motor cells of the cord in that region, namely, the cells whence originate the motor nerve-fibres of the limb, are cut off from the influence of all impulses coming to them reflexly from the sensory nerves of the limb itself. A large nerve-trunk in the arm is then divided and the corresponding nerve-trunk of the opposite non-paralysed limb is likewise cut, the latter as a control experiment. Union of the ends of the divided nerves occurred on both sides, but on the side on which the afferent roots had been cut the union was much slower and less perfect, as shown both by histological and by electrical examination of the nerve.

Prof. Schäfer communicated the results of a series of experiments executed with the object of analysing further the mechanism connecting the muscular apparatus with the centres for willed movement having their seat within the brain. He compared the relative effects of transection of the pyramidal tracts and of the ventral columns of the spinal cord. The observations had been made on monkeys. Section of the ventral columns of the spinal cord produced paralysis of voluntary movement in the parts of the body lying behind the segmental level of the lesion. The descending fibres of the ventral columns of the cord were in the main derived from the cells of the nucleus of Deiters in the bulb, a group of fibres that were, on the other hand, related to the impulses entering the brain from the labyrinth organ, namely, the semicircular canals and the otolith organ. It had been proved by Ewald and others that the destruction of the labyrinth organ entailed diminution and impairment of the "tonus" of the voluntary muscles of the body. Prof. Schäfer proposed to account for the paralysis ensuent upon transection of the ventral spinal columns by the removal of the bracing influence of Deiter's nucleus from the ventral horn cells of the spinal cord, the tonus of muscles being certainly primarily a tonus of the ventral horn cells of the cord. The paralysis produced by section of the ventral columns of the cord would on this explanation be comparable with that described by Sherrington and Mott in the monkey consequent on section of the afferent roots, which seems to take effect by producing loss of tonus in the motor nerve-cells.

A paper on some new features in the intimate structure of the human cerebral cortex was read by Dr. John Turner. His specimens showed (1) a beaded network enveloping the pyramidal cells of the cortex and their dendrites; (2) an intercellular plexus of nerve-fibrils not previously demonstrated to exist. The preparations demonstrating these points had been made by placing pieces of the brain tissue directly on removal from the body, and without previous hardening or fixing, into a staining solution containing methylene blue and hydrogen peroxide. From this mixture, after a sufficient time had elapsed, the tissue was transferred to a solution of molybdate of ammonia. The tissue was then after this fixation dehydrated, embedded in paraffin and cut into sections. The beaded network is a network, not of neuroglial fibres, but of processes of true nerve-cells. This network loosely invests the pyramidal cells and their dendrites. The network is made up of the finer ramifications of stouter fibres which can be traced from certain pyriform dark cells in the cerebral cortex; these cells are generally small, and no signs of any network can be seen around them. There seem, in fact, in the cortex of the cerebrum to be at least two systems of nerve-cells present, the pyramidal variety, which are pale under the method of examination here employed, and the smaller darkly stained pyriform nerve-cells. These latter possess branches which ramify and form by a fusion a network enveloping the pyramidal cells. Since the network is a true network formed by actual anastomosis, the system of dark cells constitutes a *continuum*. Dr. Turner urged that in all probability collaterals arising from the axons of the pyramidal cells also joined on to the network. If that were so, all the nerve-cells of the cortex would be practically in organic continuity. He suggested that the differences observed in staining, shape, arrangement, &c., of the two varieties of cells indicated a difference in function. There was good ground for associating the pyramidal cells with motor functions; he was therefore inclined to ascribe to the dark pyriform cells sensory functions. They were in all likelihood, he urged, the bearers and distributors of afferent impulses. This method might therefore afford a means of showing where ingoing currents ended and where outgoing currents started. On this view, however, the impulses must flow in a centrifugal direction in the dendrites of the dark cells and in a centripetal direction in the axons of those cells; this was against the views generally in acceptance which regard the axon as always a cellulifugal conductor and the dendrites as always conducting in a direction toward the perikaryon.

Prof. Schäfer corroborated the description of the microscopical structures described and discovered by Dr. Turner. He suggested, however, that the course of conduction was not cellulifugal in the dendrites of the dark cells. He argued that it was more probable that the nervous pericellular network took up impulses brought by the afferent fibres coming to the cortex in such large numbers from the optic thalamus; that these impulses in part were carried through the pyramid cells and in part through the dendrites of the dark cells to the perikarya and axons of these latter.

Dr. Page May communicated a paper upon the movements and innervation of the stomach. His investigation had been an experimental one, and the animals employed had been cats, dogs and monkeys. A short time after taking food, movements of a rhythmic character arise in the muscle of the wall of the organ. These movements are waves of contraction, each of which commences near the œsophageal end of the stomach. The waves succeed each other at a rate of about three times per minute, and they slowly increase in strength as they pass toward the pylories. The contractions have their origin in the wall of the organ itself, because they will continue for half an hour or more after removal of the viscus from the body and its preservation in a bath of warm saline solution. The small ganglia in the wall of the stomach probably coordinate the contractions. Although the gastric contractions are of autocthonous origin, they are subject to control of the central nervous system by means of the vagus nerve, especially of the left vagus nerve. On stimulating the peripheral end of the vagus nerve, the tone of the gastric muscle is usually at once much diminished. Any gastric contractions are usually then abolished. Shortly after this, on the contrary, renewed movements set in, often very vigorous in character, and usually about four times as powerful as the contractions during ordinary digestive activity. Thus the first effect of stimulation of the vagus is inhibition of the gastric tone, the second is increase of tone and augmentation of movement. Stimulation of the central end of the vagus produces a slight inhibitory effect upon the stomach if the other vagus nerve is intact. The splanchnic nerve was not found to exert any influence upon the musculature of the stomach, either in the direction of augmentation or of inhibition. Occasionally some inhibition of gastric movement is excited by the stimulation of the splanchnic, but this not usually; such occasional results are due probably to the vaso-constriction produced by the splanchnic

stimulation. Anæmia of the stomach experimentally produced by blocking the thoracic aorta cuts short the normal contractions of the organ. The cerebral centres for the gastric movements and tone, which have been described by many observers, notably by Bechterew and Opendowsky, were not found, although diligently searched for. No definite result upon the movements of the stomach seemed to result from any cerebral stimulation.

Prof. Schäfer contributed a communication on the diuretic action of pituitary extracts, based on recent researches by Dr. Magnus, of Heidelberg, and himself. He showed a series of tracings exhibiting by the graphic method the effect that intravenous injection of extract of pituitary body has upon the activity of the kidneys. The epithelial part of the pituitary body yields an extract which causes a marked increase in urinary secretion. This part of the gland had always previously been supposed inert. The diuretic action now proven to be exerted by the gland had, Prof. Schäfer urged, a direct bearing upon the disease called acromegaly, in which the pituitary body was enlarged and diuresis was present.

Prof. Gotch brought forward an experiment upon fatigue and nerve. It had long been held that repeated or excessive activity caused fatigue of nerve-endings, but had no effect upon the fibres which conduct the nervous impulses. Herzen had recently questioned the truth of the above generally adopted view. Herzen stated that after a nerve-trunk had been subjected to repeated stimuli, the subsequent response of the nerve shows signs of impairment when examined by electrical tests. This impairment it had been the object of the present observations to examine, and they showed that the impairment was a change which was confined in its situation to the neighbourhood of the place of the electrodes by which the electric currents used for fatiguing the nerve were applied to the nerve. Were the effect a true fatigue effect, its locus should not be confined to the electrode region, but should be distributed throughout the nerve, because the process of conduction of nerve-impulses occupying the whole length of the nerve, the true fatigue which arose as their after effect must have a similar distribution. The changes which were confined to the immediate neighbourhood of the electrodes by which the long series of "fatigue"-producing currents were introduced were those to which much attention has long been devoted as electrotome. Probably the process involved was one of electrolysis, and certainly its relation to fatigue in the true sense was at most extremely remote. For the experiments the capillary electrometer had been employed; the electric differences studied had been given by the nervous impulse in response to a single induction current.

Dr. Edridge-Green brought forward evidence regarding the distribution in the retina of the photo-sensitive pigment, the visual purple. This pigment belongs to the "rods" only, and is not present in the "cones." Nevertheless, Dr. Edridge-Green finds that it is present in the central region of the retina, a region in which there are cones only and no rods. On examining the retina of the monkey, when that animal had, in order to increase the amount of visual purple, been kept in the dark for twenty-four hours, the central region of vision, the yellow spot, instead of being free from visual purple was the most purple part of the whole retina. The purple was, however, seen by microscopic examination to be around and not actually in the cones. He advanced the theory that the cones were only sensitive to changes in the visual purple, not to light itself.

Dr. Osborne communicated the results of researches on glycogen carried out in conjunction with Dr. Zobel. Glycogen when hydrolysed by a diastatic ferment gives rise to bodies very similar to those derived from starch. Amongst these is the so-called isomaltose, shown by Brown and Morris to be a mixture of maltose and a dextrin-like body. When acted on by saliva, glycogen gives dextrins, dextrose and maltose.

Dr. C. S. Myers referred to observations on the smallest perceptible musical tone-difference as examined in the people of Scotland and of the Torres Straits. The investigations had been conducted by means of tuning-forks. The least perceptible tone-difference among the children of Murray Island was not widely different from those of the children of Aberdeenshire. But with practice the Aberdeenshire children improved more readily and uniformly. The adult Murray Islanders for the most part failed to detect a semi-tone interval. The average difference of vibration-frequency just distinguishable by the Adult Murray Islanders was fifteen vibrations per second, whereas for the adult Scotch examined it was nine vibrations.

Dr. Page May gave an excellent demonstration of sections of the brain and of the spinal cord of the camel.

Mr. Barcroft described work dealing with a series of observations on the quantitative estimation of urea.

MAGNETIC WORK OF THE UNITED STATES COAST AND GEODETIC SURVEY, OUTLINED FOR JULY 1, 1902—*JUNE* 30, 1903.

(*a*) *LAND Magnetic Survey Work.*—The determination of the three magnetic elements at 400–500 stations distributed principally in Virginia, New Jersey, Pennsylvania, Ohio, Michigan, Kansas, Nebraska, Texas, Arkansas and Florida.

(*b*) *Magnetic Observatory Work.*—The continuous operation of the four magnetic observatories situated at Cheltenham, Maryland; Baldwin, Kansas; Sitka, Alaska; and near Honolulu, Hawaiian Islands; also the selection of sites and preparations of plans of an observatory in Porto Rico or vicinity, and another in the extreme western part of the United States. [The International Committee on Terrestrial Magnetism and Atmospheric Electricity at the Bristol Conference in 1897 recommended Porto Rico as a suitable and favourable site. The recent magnetic disturbances experienced simultaneously with volcanic eruptions in Martinique will now make the vicinity of Porto Rico an especially important location for a fully equipped magnetic observatory.]

(*c*) *Ocean Magnetic Survey Work.*—The inauguration of magnetic work on board ship in connection with regular trips of vessels engaged in coast survey work. [In this connection it is also proposed during the coming winter to make some trial investigations of the distribution of the magnetic elements over the frozen portions of Lakes Michigan, Superior and Huron in the vicinity of the Straits of Mackinac. The necessary observations at shore stations and on islands will be made in the fall and spring.]

(*d*) *Special investigations* conducted at the magnetic observatories and at certain educational institutions by persons available as "associate magnetic observers."

(*e*) *At the office at Washington* a special effort will be made to bring all computations of field work performed and investigations conducted since July 1, 1899, up to date and prepare results for publication.

THE "SUDD" OF THE WHITE NILE.

A RECENT number of the *Geographical Journal* contains a paper on the "sudd" of the White Nile, by Dr. Edward S. Crispin, explaining the method of opening up the true river bed employed by Major Matthews, who commanded the Sudd Expedition of 1901–1902. The first difficulty is to find the position of the river bed; this is done by probing, the depth suddenly increasing to 15 or 20 feet. Next the top growth, consisting mostly of papyrus, is cut down or burnt; and it was noted that when the papyrus was fired the fire frequently spread along what was afterwards found to be the true bed of the river. Men are then landed on the cleared surface and the sudd cut along the river banks with saws; next transverse cuts are made, dividing the sudd into blocks of size convenient for the steamer to tear out. The bows of the steamer are run into the block, and the loop of a steel hawser, both ends of which are made fast to the steamer, is passed over the bows and trodden into a trench cut on the surface of the block. The steamer then goes full speed astern, men standing on the hawser to keep it in position, and after a number of trials the block is torn away. The block is then towed clear and cast adrift to float down stream, when it is gradually disintegrated. We reproduce figures illustrating (*a*) the steamer towing out a block of sudd, showing the men standing round and holding the hawser in position, and (*b*) the block let go in open water and floating down stream.

The chief growths in the sudd are papyrus and tiger or elephant grass, a kind of bamboo growing to a height of 20 feet or more. Up these climbs a creeper of the convolvulus species. There is also abundance of ambatch and a long

sword-grass that cuts like a knife, known as "oom soof." The steamer could cut its own way through the latter in the presence of a current, as it would break up and float down stream. In the absence of current it does not float away, and obstructs the steamer by fouling the paddle-wheel. Another source of obstruction is a very light kind of duckweed which covers some of the small open pools.

FIG. 1.—Steamer towing out a block of sudd.

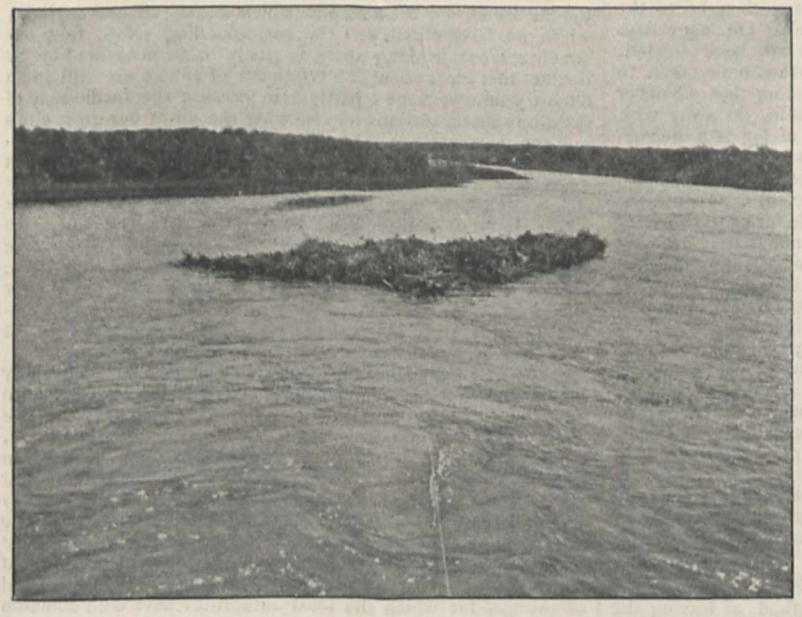


FIG. 2.—Block of sudd let go in open water.

THE TREATMENT OF SMOKE: A SANITARY PARALLEL.[1]

Introductory.

IN accepting the suggestion that I should take as my subject some aspect of the fog question, I have allowed the importance of the question to override the many considerations which I could adduce in opposition thereto. I propose to consider what demands sanitary reformers may fairly make upon practical men of science and others in regard to the mitigation of the evil effects of fog in towns, and incidentally to point out what demands in this connection, desirable in themselves, must be regarded as beyond the scope even of scientific ambition.

For the sake of clearness, what I have to say is cast in the form of a parallel or analogy. The smoke in fog is the element of the problem to which special attention is directed, and the smoke is regarded as a species of domestic or industrial refuse which has to be removed somehow or other. The removal of smoke is a problem not dissimilar in its fundamental character from that of the removal of sewage, and in what I have to say I keep in view the analogy that exists between the elements of these two problems. I choose the problem of the removal of sewage for this purpose, because it is a problem in which sanitary reformers have achieved gradual but conspicuous success during the nineteenth century, and even within the memory of the present generation, to the great advantage of the whole community.

In all matters concerning the disposal of refuse, we progress by slow degrees from an individualist to a socialist point of view. Occasional illustrations of reckless indulgence of the extreme individualist view as regards the disposal of other forms of refuse might be quoted, and at this day it is no great exaggeration to say that we all act with similar recklessness with regard to our smoke; we throw it into the atmosphere and leave to beneficent chance the question whether or not it injures our neighbours.

In large towns, we have travelled very far in the path of development from the original instinct as regards the problem of the disposal of sewage-polluted water, but there has been no corresponding progress in the disposal of smoke-polluted air. In London, at a cost to the community of 211,000*l.* a year, or 1·38*d.* in the pound on rateable value, nearly a million tons of sewage are removed day by day for about 600,000 houses—about a ton and a half on the average for each house. In the same period, viz. each day, in winter, each house throws into the atmosphere on the average perhaps ten tons of smoke-laden air, or a total quantity of five million tons of smoke-laden air for the inhabited houses of London per day, or possibly seven millions of tons per day if we include factories. The actual weight of solid soot which gives colour and body to the smoke is a very uncertain quantity; it may in the worst cases amount to nearly 3 per cent. of the coal consumed, and the houses of London probably get rid of 300 tons of solid refuse every day by throwing it up the chimney. It is mixed with much larger quantities of other more or less injurious products of the combustion of coal, complete or incomplete, but it is with the soot, which alone darkens and defiles, that I am primarily concerned.

The Initial Stages of the two Problems.

The difference of our attitude towards these two problems is very conspicuous, yet physically speaking the whole difference between the problem of the removal of sewage and that of the removal of smoke on similar lines lies in the distinction that sewage naturally goes downwards, whereas, in the first instance, smoke goes upwards. If the smoke of our fires had been in the habit of falling downwards and finding a lower level instead of rising to a higher level and making its way up the chimney, we should

[1] Abstract of a lecture to the Sanitary Congress at Manchester by Dr. W. N. Shaw, F.R.S.

long ago have been driven into solving the problem of its disposal, as we have been driven to deal with the disposal of sewage, no matter how great the volume might be.

In days not so very remote, the arrangements for the disposal of smoke might be regarded as comparatively in advance. The genius who first put in practice the idea of confining smoke to a narrow flue specially built for it wrought a revolution in house-building. There are still archæological survivals which show that before his day there were architects who were satisfied with the more simple provision of a hole in the roof, and there are even traces extant of a still earlier architectural style of inhabited dwelling in which such rudimentary provision as a special opening for smoke did not exist. I do not attempt to describe the corresponding stages in the development of the means of disposal of other kinds of refuse; they could be traced—*gardy loo* is the survival of a warning with special meaning in the Scottish capital—and examples of present-day practice might be adduced in illustration. But while the disposal of sewage has been generally though slowly progressive since the first commissioners of sewers were appointed in 1531, the invention of the chimney seems to have been so successful as to paralyse mechanical enterprise in that department until the subject was taken up in later years by cowl makers, who have devoted much ingenuity to the improvement of the terminal outlet. For domestic purposes, the simple chimney, with or without the assistance of a cowl, remains a sufficiently effective apparatus; the practice of using it to throw smoke into the atmosphere to be carried away by any currents of air that may arise is universal.

Demands beyond the range of Scientific Ambition.

One of the incidental obstacles to a scientific treatment of the smoke question is that at first sight the atmospheric currents appear to perform the duties of general scavenger with such exemplary efficiency that few people give any thought to the general success or failure of the method itself. On foggy days we become aware of the nuisance which we have created, and accordingly desire that steps should forthwith be taken to remove or prevent fogs, with the understanding that whatever does away with the fog will, at the same time, do away with the smoke nuisance. Now the prevention of fog as a meteorological phenomenon is one of the demands which I think we are not legitimately entitled to ask of practical men of science; it is beyond the ambition even of physical science. To use the parallel further, it would be just as reasonable for us to throw all our refuse into the streets and, when we found that it accumulated beyond endurance, demand of men of science that they should provide showers at suitable intervals to wash it all away. The well-known meteorological conditions for the formation of inland fog are my justification for this opinion.

Nor can we hope for the removal of fog by the actual removal of the foggy air of London. I have on several occasions seen suggestions which seemed to regard such a scheme as possible, but I have never been able to understand where the air would be sent to and by what it would be replaced. Any such proposal has always seemed to me to come perilously near to a scheme for sweeping away the Atlantic with a mop. The removal of foggy air from the streets is as hopeless a matter as the prevention of fog, and when once smoke has been allowed to be discharged into the free atmosphere, all chance of removing it is gone.

Gravity of the Smoke Nuisance.

It is not only on foggy days that the method of leaving the atmospheric currents to act as the smoke scavengers fails. In large towns, the system is generally speaking inefficient. In support of this assertion, I quote from the figures giving the average amount of sunshine recorded at a large number of stations in the British Isles during the twenty years from 1881 to 1900, a comparison between the records for London and the average of those for other places in the southern district of England. The amounts given as percentages of the possible duration of sunshine for the several months are as follows:—

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
London	10	15	23	31	38	36	38	39	34	24	14	9	per cent. of possible duration.
Average for the southern district of England	21	28	38	42	46	43	46	47	44	37	24	21	do.
London loss in approximate figures	½	½	⅓	¼	⅛	⅛	⅛	⅛	¼	⅓	½	½	

It appears that in summer London loses one-sixth of its sunshine, and presumably also about the same fraction of its daylight, on account of its smoke, while in winter its loss amounts to one-half for a similar reason.

The contrast of the figures for summer and winter is remarkable. As regards smoke, the difference rests chiefly on the fact that there are fewer domestic fires in summer, and we may therefore legitimately conclude that the domestic smoke is the most serious item to be reckoned with in considering the smoke question. It is, in fact, two-thirds of the problem.[1] Anyone who wishes to satisfy himself as to this aspect of the question can easily do so. During the past winter, Captain Carpenter, R.N., D.S.O., who has been conducting an inquiry for the Meteorological Council into the prevalence and distribution of fogs in London, found that the Victoria Tower at Westminster and St. Paul's Cathedral—two buildings a mile and a half apart as the crow flies—are invisible the one from the other until March is well established. There is here no question of persistent fog in the meteorological sense; even on windy days, when fog is meteorologically impossible, there is no possibility of seeing a distant object in London on account of the domestic smoke from the thousands of chimneys, each using the primitive plan of pouring its refuse into the atmosphere. Not only is the magnitude of the task too great, but the manner in which the atmosphere deals with it is not by any means satisfactory. It does not consume or annihilate the smoke, or render it harmless; it carries its load a little way, longer or shorter according to the state of the weather, and then drops it regardless of consequences. The results are easily recognised. Sooty rains are not by any means an unusual phenomenon, and that is not all. A special type of heavy, dull, oppressive atmospheric condition may generally be noticed on the lee side of all great smoke centres.

That we endure the presence of all this burden of refuse in the air which we breathe, and which carries all our daylight, while we have eliminated the corresponding refuse from our streets and our drinking-water, is partly to be accounted for by the fact that ideas about the treatment of smoke are still in an almost primitive stage; partly also because the inefficiency of the atmospheric currents for renewing the air of our great cities in ordinary weather is not fully realised. It is only during persistent fog that the failure is complete and unmistakable. On foggy days when we thrust our refuse into the atmosphere, it simply descends upon our heads and into our houses. We might almost as well have no chimneys at all. The experience of Sir W. Thiselton-Dyer at Kew could easily be shown to be the experience of all of us who live in large towns if we were able to make such measurements as he made in 1891, when after a week of fog he found upon the greenhouses at Kew—a comparatively favoured atmospheric position for London—a deposit of tarry matter at the rate of six tons to the square mile.

So far as I know, the only practical suggestion put forward by those interested in the abatement of the smoke nuisance is to invite householders and compel factory owners not to make smoke, or to consume it if they make it, or, in the third event, to make as little as may be, consistently with their own interests. As regards factories, very considerable improvement has followed these efforts, and I do not wish to be adversely critical when I point out, first, that the distinction drawn between the factory and the domestic establishment is unscientific if the smoke nuisance is to be really removed, and secondly, that that was not the plan adopted in the parallel case of the removal of sewage, for which the local authorities have used common funds.

Further Development of the Analogy.

In following the analogy somewhat further, I suppose it agreed that the proper course to be pursued is, not merely to

[1] The corresponding figures for Glasgow as compared with Douglas (Isle of Man), the only other station in the same meteorological district, indicate that domestic smoke is only responsible for one-half of the smoke problem in the Glasgow district, though the want of stations makes the comparison incomplete. The figures are as follows:—

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Glasgow sunshine	10	17	24	30	33	31	28	28	26	22	11	8	per cent. of possible duration.
Douglas sunshine	21	26	37	43	46	43	39	38	38	32	24	18	do.
Glasgow, loss in approximate figures	½	½	⅓	¼	¼	¼	¼	¼	⅓	⅓	½	½	

prevent smoke by penal legislation, but to encourage the interception of smoke and the removal of the sooty particles before the air is allowed to escape, and I will subsequently call attention to the share which a local authority could fairly take in such an enterprise. I do not say that this is the only or the best mode of dealing with the question; I only consider whether it is, *prima facie*, practicable enough to justify our including inquiries with regard to it in the demands that sanitation may reasonably make upon science. I offer a few considerations in mitigation of criticism of this venturesome proceeding.

First, I am only practically recalling a suggestion made many years ago. A proposal for the treatment of smoke by the erection of municipal chimneys was made in Manchester by Mr. Peter Spence (*Proceedings* Manchester Lit. and Phil. Soc., 1857). It is precisely in such a city as Manchester—a city of fogs and smoke, but also the city of Dalton and of Joule—where the facilities for the association of scientific experiments with real practical life have been so wonderfully developed that an enterprise of this character could be taken in hand.

Secondly, the present method of dealing with smoke is by no means final, although, as I have said, it has marked a most important stage of progress. One of the most conspicuous features of London architecture is the enormous variety of smoke cowls, in all stages of dilapidation, to be seen surmounting the roofs. Almost every chimney stack is a sort of museum of contrivances for improving the action of chimneys. The mere exhibition of so many contrivances can only mean that smoky chimneys are not by any means so rare as they might be under more favourable mechanical conditions. On that very account, if on no other, the separate chimney method of dealing with smoke is not suited to the circumstances of large towns.

Thirdly, the designer of a factory takes a further step in advance in the treatment of smoke, and provides a single smoke stack for a considerable number of independent fires. The separate opening of each chimney of the domestic house into free air is, therefore, not absolutely required for the removal of smoke. The factory builder is not always successful in using his chimney for preventing smoke, but he is successful in leading the foul air of many flues into one channel which might afford an opportunity for depriving the smoke of its soot.

Moreover, arrangements for propelling air mechanically are becoming every day more extended. Some of them as employed in various systems of ventilation are quite as elaborate as any that would be required to deal with the smoke of an ordinary house or block of houses. There is no sufficient distinction to be drawn between coal smoke and other forms of refuse that foul the air to make it necessary to use one system for the former and a different one for the others. It thus seems almost certain that if the domestic architect had sufficient encouragement to make the attempt, he would not find the plan of dealing with household smoke by the method of the factory chimney or by mechanical propulsion beyond the range of practical physics.

Some Particulars of the Smoke Problem.

For purposes of comparison, I next consider what is the amount of smoke-laden air with which we have to deal. It is difficult to give any but the roughest estimate. I assume that on the average every house of the 600,000 rated for the municipal purposes of London has two fires burning, and therefore two chimneys emitting smoky air, for twelve hours each day, and that each chimney uses and defiles 10,000 cubic feet of air per hour. If these estimates are inaccurate, we can at least ask scientific men to correct them. On these assumptions, every "working chimney" delivers 4·2 tons of smoky air per day; every house, on the average, 8·4 tons. We thus obtain the estimate of five millions of tons of smoky air sent up the household chimneys of London in one day. Allowing for the 14,500 factories of London, which are not altogether innocent in the matter of smoke, as equivalent each to thirty house chimneys, we get an additional two million tons of air fouled with smoke; that is, in the aggregate about seven million tons of air are used per day in London to carry away smoke[1] as compared with about a million tons of water to carry away sewage. The cost of dealing with the sewage is about 600*l.* per day. Supposing that a ton of dirty air could be "treated" for the same cost as a ton of sewage, the cost of clearing the air of London might be set down at 4200*l.* a day, equivalent to to a rate of 10*d.* in the pound.

To move air is a comparatively cheap matter. An electrically-driven fan will do the day's work of a single chimney, as regards smoky air, at a cost of about a penny, under suitable conditions. A single colliery fan has been made to deliver as much as 200,000 cubic feet of air per minute, and its output therefore amounts to about 10,000 tons a day, or sufficient to carry the smoke of more than 1000 London houses on the scale mentioned above. Five hundred of such fans would carry the household smoke of the whole of London. It would mean a huge aggregation of power, but London means the same.

These figures show that although the volume of smoky air is vastly larger than the volume of sewage, yet the cost of dealing with it for the purpose of treatment may not be of an altogether different order of magnitude from the cost of the manipulation of London sewage, and the point at which I wish to arrive is, that we are justified in asking practical men of science, as a first question, whether the treatment of smoky air, on a plan somewhat similar to the treatment of sewage, is mechanically possible within reasonable limits of original outlay and current expense.

Limitation of the Analogy.

Beyond this point it would be necessary to diverge in the treatment of smoke from the plan adopted with sewage, both as regards the special method of dealing with it and as to the part which the local authorities should take in encouraging and assisting the purification of air.

I do not suppose that it is possible to establish a few main drains for smoky air corresponding to the main sewage drains, and to use one or two cleansing stations for purifying the air from smoke; but it might be possible to achieve a similar result by a large number of systems on a correspondingly small scale, and the systems might be some of them municipal and some private. A single block of houses might have means for drawing off the smoke from all its fires into a chamber wherein the smoke could be treated,[1] before the fouled air was allowed to pass into the atmosphere, and if such a system were mechanically feasible we should then be able to put a second question to practical men of science, viz., whether it is not possible completely to deposit from the air as it passes on its way the solid particles which form the smoke. It has been shown that sooty particles coagulate under mechanical action, and some years ago Sir Oliver Lodge showed experiments on the deposition of smoke in a closed chamber by means of electricity. I should now like to ask whether it is not possible to make a further advance in this direction. I do not demand that no smoke shall be produced. I think that people may prefer to pay the cost of abstracting the smoke if they enjoy the free use of open fires, to which, in England, we are so much attached.

The Question of Cost.

If men of science give us satisfactory answers as to the physical possibilities, the question then becomes one of cost. Suppose that the cost amounts to the equivalent of a tenpenny rate. Would ratepayers be willing to expend a sum of that magnitude for the purpose of eliminating smoke from the atmosphere of London or Manchester?

In considering this aspect of the question, it should be remembered that the result, if successful, would have some economies to set down per contra.

A bad fog in London, according to the *Times*, may cost 5000*l.* a day for additional gas alone; to that we have to add the loss due to interference with traffic and other incidental items. I have seen the cost of a day's fog estimated variously at from 20,000*l.* to 50,000*l.*, and the cost per annum is set, I think by Mr. Rollo Russell, at from three to five million pounds. If any of these estimates be true, the equivalent of a tenpenny rate would obviously be a very cheap substitute for the smoke of London. Certainly, whatever may be the material damage of a day's fog, the moral and intellectual damage should be reckoned as no inconsiderable addition, and if the indirect results of the dirt of London smoke could be avoided, even an additional tenpenny rate might be found acceptable to a majority of ratepayers.

[1] A layer of air 60 feet thick over the 75,000 acres comprised within the administrative county of London would weigh about 7,000,000 tons. The calculation suggests that on a day of dense fog, when there is very little horizontal movement of air, there is a more or less complete circulation of the air through the chimneys and back again to the streets and houses during the hours when chimneys are active. Dr. W. J. Russell's analyses of air during fog lend support to this suggestion.

[1] The plan of using a single chimney for a building comprising a chemical laboratory and suite of offices—sixteen rooms—has been carried out at the Manchester Alum Works in pursuance of Mr. P. Spence's idea.

Incidental Advantages.

A system such as that indicated would have some incidental advantages. It would provide a persistent and calculable system of ventilation that would enable hot water or steam pipes to be used advantageously much more generally than they can be at present, and afford other facilities corresponding to those of an efficient system of drainage with a copious water supply.

Contribution of Local Authorities to the Solution of the Problem.

Hitherto the powers of local authorities have been restricted to fining conspicuous offenders, and the system of penalties for conspicuous failure is not fully effective; it might be replaced advantageously by a system of rewards for success. For the sake of definiteness, I have set down the contribution of the local authority as equivalent to a tenpenny rate, though it would not seem practicable for it to contribute in the same way as it does to the solution of the sewage question by maintaining a single municipal system. It might contribute effectively by allowing a specific *reduction of rate* on those properties within its area which were so arranged as not to add to the pollution of the atmosphere by smoke.

If the questions which I have mentioned are to be asked, it is essential that they should be put in such a manner that practical men of science may be encouraged to work out effective answers, and for that purpose they must make experiments. In the practical applications of science on the large scale, experiments are very expensive, and the only way of getting them performed is to take care that they are remunerative to somebody if successful. In this matter the local authorities could be of great assistance if they were willing to adjust their rating in what seems to me a reasonable manner. At present the incidence of rating is such as to discourage all experiments of this kind. If an enterprising architect were to erect a block of buildings and provide it with means of delivering its used air free of smoke at a substantial outlay, I presume the local authority would increase the rateable value of the property on account of the outlay, and thus fine the owner some considerable sum per annum for his enterprise. The owner would also be placed in the unfortunate position that whereas by avoiding smoke he had conferred as much benefit upon all his neighbours as upon himself, he would have to pay the whole fine of increased ratal himself, and would still have all the disadvantages of his neighbours' smoke.

I would suggest that instead of pursuing so unreasonable a course, the local authorities might recognise public spirit of this kind by reducing the assessment of a property that, to the satisfaction of its neighbours as well as of a surveyor or inspector, produced no smoke, so that the rates upon such a property should be decreased by, say, 6*d.* or 1*s.* in the pound instead of being increased. This would afford direct encouragement to practical men of science to design and keep in action means for the prevention of smoke, and would lead to gradual improvement.

It would naturally appeal with the greatest force in those quarters where rateable value is high and the advantage of open fires relatively small, and in such places it would be really worth while for practical men to make a serious effort to qualify for the reduction of rate. In the City of London, for example, there must be many properties with very high rateable value the facilities of which for contributing smoky air are already limited to one hot-water furnace and a few open fires. For such establishments it would be an experiment on a very small scale to arrange matters to obviate smoke altogether and satisfy the surveyor or inspector that the property was smokeless, and thus secure the reduction of rate. There might be some difficulty at first in establishing a qualification, but it could not be greater than the difficulty of establishing a right to a parliamentary vote. In the course of time, the smoke producers would be a few exceptional persons paying exceptionally high rates, a very rational state of affairs; and when the City of London had by the gradual extension of such experiments freed itself from its own smoke, I think we might safely rely upon the citizens to take care that the indirect economies to which they would be legitimately entitled by their public spirit were not destroyed by the unrestricted smoke production of the surrounding boroughs.

I have made the system of the general collection of smoke by mechanical means for the purpose of treatment the basis of my remarks, but I have already disclaimed any desire for exclusive privileges for that particular form of experiment in the purification of smoky air. If it be feasible on the commercial scale, it has the advantage in an especial manner of making successive improvements possible. The smoky air of London is injurious, not only on account of its visible soot, but also on account of the sulphurous acid and other invisible products of combustion which accompany the soot in the first instance. If it be found possible in the first place to deposit the soot particles, attention might next be turned to some means of dealing with the noxious acid fumes, at least, in those cases where they are specially abundant.

Such a system would thus be, in the first instance, a direct encouragement to progressive experiments, and in the end would enlist the active support of all those possessing arrangements for avoiding smoke in favour of effective compulsion for those who had not.

To put the questions I have indicated to men of science in this way would be merely a matter of business, and if the questions were so put, the science of the twentieth century would probably give as satisfactory an answer to the question of the treatment of smoke as the science of the nineteenth has given to the question of the treatment of sewage.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The Hon. C. A. Parsons, M.A., F.R.S., whose scientific work in connection with the development of the steam turbine has excited much interest, has been elected to an honorary fellowship at St. John's College, of which he was formerly a scholar.

Mr. L. Doncaster, King's, has been appointed to work at the University table in the Naples Zoological Station.

A conference on the training of teachers for secondary schools for boys will take place in Cambridge, under the presidency of the Vice-chancellor, in November.

The Gedge prize for research in physiology has been awarded to Mr. S. W. Cole, King's.

ON Wednesday, October 22, Mr. Andrew Carnegie was formally installed to the rectorship of St. Andrew's University. In his rectorial address, Mr. Carnegie dealt with the economic changes in the relative position and power of nations which either have taken place or are impending. Among honorary degrees conferred on the occasion was one bestowed on Mr. Alexander Graham Bell, the inventor of the telephone.

WHILE agricultural education is in a flourishing condition in the colleges of the United States, it is not yet doing as much for the welfare of the American farmer as is desirable. This, at least, we infer from the vigorous address delivered by the Secretary of Agriculture before the National Educational Association, which is briefly referred to in an editorial article in vol. xiv. part i. of the "U.S. Experiment Station Record." Mr. Wilson pleads not so much for technical instruction in agriculture as for the *education* of "half the people under our flag, who till the soil and furnish 65 per cent. of our exports." The importance of this class warrants the special adaptation of the educational system to its needs. "The four-year college course does not begin soon enough nor continue long enough to meet the requirements of our day." Study should begin in the primary school and continue through life. Teachers and the organisers of education in rural districts should understand the farmer's requirements, should themselves know something of agricultural science, and to this end Mr. Wilson recommends that teachers in primary and secondary schools should be sent to agricultural colleges at State expense to get the necessary knowledge. While much might be done to awaken the interest of the rising generation in agriculture were the teachers in elementary schools possessed of an agricultural bias, it is doubtful if any such "entirely new" system as Mr. Wilson refers to in the following sentence would be practicable or desirable. "Five thousand students attend agricultural colleges, but these colleges are feeling their way in the dark along untravelled paths. . . . They will at last forge out a system that will meet the requirements of producers and be entirely new and suitable to our conditions as a people."

IN the *North British Agriculturist* of October 22, a different and more direct method of awakening the interest of the young farmer in his work is described. Under the auspices of the

Berkeley Hunt Society, a competitive examination in agriculture, and especially in the arts of hedging, thatching, judging stock, &c., is held. The examination is open to young farmers and labourers of the district, is partly written, partly practical and oral. Three valuable prizes are offered and certificates are awarded for satisfactory work. The fall in prices and the scarcity of labour have made farmers less careful in details than formerly, and as a consequence their labourers are less skilled. Any kind of competition which revives the interest of masters and men in arts so necessary to good farming is much to be commended. If country districts held more competitions of this sort, if skill in rural arts were fostered with a tenth of the energy bestowed on foxes or football, we would hear less of rural depopulation and of agricultural depression.

THE last annual report of the Glasgow and West of Scotland Technical College shows that the high standard of the work accomplished in the institution is fully maintained. During the session 1901–2, the number of students in the various departments of the College reached 5651, of whom 596 were students studying in the day technological courses. Although the evening classes were attended by 4174 men and 220 women, the governors were unable to find room for some hundreds of students, who were perforce refused admission. In view of this serious want of accommodation, we are glad to learn that contracts, amounting to about 130,000*l.*, have been entered into for the erection of the first section of the proposed new buildings. The section will comprise about seventy-two per cent. of the whole structure, and fully three years will be occupied in its erection. It is anticipated that the new buildings, as planned, exclusive of equipment, will cost about 180,000*l.*, to which amount must be added 30,000*l.* for the site. The building fund, as shown by the list of donations given in an appendix to the report, now stands at 175,000*l.*, to which the Scottish Association of Master Bakers has contributed nearly 2500*l.*, the Glasgow Building Trades' Exchange about 650*l.* and the Trades' House and Incorporations of Glasgow an amount approaching 2000*l.* Nor is this the only evidence of the keen interest taken in higher education by Scottish manufacturers and merchants, for the report contains long lists of firms who have either given facilities for parties of students to visit works or have supplied the College with gifts of apparatus, specimens or laboratory material. That the claims of pure science have not been overshadowed by the pressing needs of the technological studies is shown by the gift of 5000*l.* from Mrs. John Elder for the provision of lectures on descriptive astronomy. There is evidently a great future in store for this deserving Glasgow institution.

SCIENTIFIC SERIAL.

Journal of Botany, October.—From the collection of plants made by Mr. T. Kässner chiefly along the railway from Mombasa, in British East Africa, Mr. Spencer Moore selects for description the more interesting species of the Compositæ and Acanthaceæ, and proposes seven new species.—Mr. W. E. Nicholson refers some miniature mosses gathered near Crowborough, Sussex, to *Ephemerum stellatum*, a species first recorded by Monsieur Philibert for specimens collected at Bruailles, in France.—A note on the genus Sematophyllum signifies Mrs. E. G. Britton's approval of the revival of that genus of mosses by Dr. Braithwaite.—Mr. G. C. Druce gives a brief account of the plant establishments on the shingle near Dungeness, and a list of Kentish plants which adds a few new localities to those recorded in Hanbury and Marshall's "Flora of Kent."—Mr. S. T. Dunn, by an inductive method of argument, deduces that only one species of the British representatives of the deadnettles, *Lamium Galeobdolon*, has maintained its original habitat and may be considered naturally indigenous.—A list of West Lancashire plants, by Messrs. J. A. Wheldon and A. Wilson, provides new county records and localities.

SOCIETIES AND ACADEMIES.

LONDON.

Entomological Society, October 1.—The Rev. Canon Fowler, president, in the chair.—Mr. H. St. J. Donisthorpe exhibited specimens of *Dibolia cynoglossi*, taken by him near Pevensey on August 11 last. He said that the beetle, which was figured by Curtis, had not been recorded as British since 1866.—Mr. O. E. Janson exhibited a fine hermaphrodite specimen of *Dryas paphia*, taken in the New Forest by Mr. Herbert Charles on July 28 and recorded in the *Entomologist*, also a melanic specimen of *Papilio demoleus* from Ceylon, in which all the usual marginal and submarginal yellow markings were absent and the discal markings much obscured; on the underside the yellow markings were entirely wanting.—Mr. C. P. Pickett exhibited a ♂ *Callimorpha dominula* with the hind-wings suffused with black and an extra black spot in the centre, the white spot on the fore-wings being absent, and a very large ♀ of the same species, both bred from larvæ found at Walmer at the end of March; also three aberrant specimens of *Triphaena fimbria* bred from larvæ taken at Wood Street during the same month.—Mr. C. O. Waterhouse exhibited specimens of a wasp, *Zethus chalybeus*, and a neuropteron, *Mantispa semihyalina*, received with a collection of Hymenoptera from Rio Janeiro, suggesting a curious case of mimicry.—Mr. F. B. Jennings exhibited specimens of *Hister merdarius*, from Broxbourne, Herts, part of a large colony of this usually scarce species found with *Hister 12-striatus* and other beetles inhabiting a heap of a chemical substance, probably gas-lime, in which also many larvæ, presumably of *Hister merdarius*, and burrows were observed. The soil was warm and moist, and this, and the presence of a quantity of vegetable refuse thrown on the heap, was no doubt the attraction to the Histers to settle there.—Mr. A. J. Chitty exhibited a specimen of *Metoecus paradoxus* with a part of the cells of a nest of *Vespa vulgaris*, in which place the beetle is invariably found. The beetle in the cell tucks in his head, only displaying on the surface the thorax, which is coloured similarly to the face of the wasp. This peculiarity suggests a case of mimicry, and Prof. Poulton said that it fitted in with the case of some other bees and wasps.—Mr. H. Rowland-Brown exhibited on behalf of Mr. G. F. Leigh, of Durban, a ♀ and ♂ specimen of a rare noctuid, *Musgravia Leighi*, Hampson, discovered by him in Natal, and read remarks upon the life-history of the species, communicated by the captor.—Mr. Stanley W. Kemp exhibited two additions to the British list of Coleoptera, *Bembidium argentiolum*, from Lough Neagh, Armagh, and *Laemostenus complanatus*, from the neighbourhood of Dublin, taken in June.—Mr. W. J. Kaye exhibited examples of *Heliconius Lindigii*, *Heliconius antiochus* and *Morpho achilles* from British Guiana with notches taken out of the hind-wings, presumably by birds, to illustrate that these distasteful or warning-coloured species are subject to attack, this helping to show that experimental tasting as propounded by the Müllerian theory of mimicry does exist and go on.—Prof. L. C. Miall, F.R.S., communicated a paper by Mr. T. H. Taylor entitled "The Tracheal System of Simulium."—Prof. Auguste Forel communicated a paper entitled "Descriptions of some Ants from the Rocky Mountains of Canada (Alberta and British Columbia) collected by Edward Whymper."—Dr. T. A. Chapman read a paper entitled "On *Heterogynis paradoxa*."

Royal Microscopical Society, October 15.—Dr. H. Woodward, F.R.S., in the chair.—Prof. T. G. Bonney, F.R.S., gave a demonstration on rock changes in nature's laboratory.

PARIS.

Academy of Sciences, October 20.—M. Bouquet de Grye in the chair.—Studies on earth, by M. Th Schloesing. In a previous paper the author has shown that the distribution of the ferric oxide varies with the size of the earth particles. In the present paper a similar result is obtained for the organic matter. The earth was separated into particles of varying fineness by levigation and the amount of organic matter determined in each, the percentage varying from 0·15 in the coarsest particles to 7·8 in the finest. A hypothesis is developed to explain these results, which it is proposed to submit to experimental verification.—On the mode of action of carbonic acid in experimental parthenogenesis, by M. Yves Delage. It has been shown that the addition of carbonic acid communicates to sea water the property of developing parthenogenetically the eggs of Asterias. Its effect is now considered from the points of view of its acidity, anæsthetic action, asphyxiating power and effect on osmotic pressure, and the conclusion is drawn that parthenogenetic agents act as temporary poisons. Carbonic acid is a perfect agent because it completely poisons the eggs, but its action is absolutely temporary, and after its elimination the protoplasm is unchanged.—On some parasitic protozoa in *Damonia Reevesii*. by MM. A. Laveran and F. Mesnil.—On the problem of the brachistochrone, by M. Haton de la Goupillière.—Remarks by M. R. Zeiller on his note in *Palaeontologia Indica* entitled

"Observations on some Fossil Plants of the Lower Gondwanas."—Remarks by M. Dubail on a volcanic eruption at the island of Torishima, Japan.—On the formation of liquid drops and Tate's laws, by MM. Ph. A. Guye and F. Louis Perrot. The formation of drops of water, benzene and aniline issuing from a capillary tube has been studied photographically by means of the kinematograph. The photographs were taken under two conditions, one in which the drops were formed slowly (statical drops) and the other in which the rate of growth was increased (dynamical drops), and a plate is given showing a typical set of the forms observed in each case. The separation of the drop offers a great analogy with the rupture of metallic wires under traction; the rigidity of the liquid is consequently one of the elements of the problem. The authors conclude that the laws of Tate do not correspond to the facts observed, and hence should be abandoned.—On the elastic parameters of silk fibres, by M. F. Beaulard. In spite of the frequent use of silk fibres in bifilar suspensions, the elastic properties of this substance do not appear to have been determined. In the course of the experiments it was found that silk fibre is affected by hysteresis and undergoes permanent deformations.—Thin metallic films obtained by kathode projection, by M. L. Houllevigue. Mirrors of platinum, palladium, iron, nickel, cobalt, copper and bismuth have been prepared by this method, but no trace of deposit could be obtained from carbon. A bismuth film prepared in this way and placed normally in a strong magnetic field showed no variation in its electrical resistance; from this it would appear that bismuth obtained by kathode projection is absolutely amorphous. Transparent films of iron placed normally in an electromagnetic field showed the existence of a magnetic rotatory power without difficulty.—The action of mixed organomagnesium compounds on the esters of ketonic acids, by M. V. Grignard. The interaction of CH_3MgI with isoamyl pyruvate, ethyl phenylglyoxylate, ethyl levulate and ethyl acetosuccinate has been studied, and brief descriptions of the resulting products are given.—On the derivatives of ethyl pyruvylpyruvate, by M. L. J. Simon. A substance to which the constitution of ethyl pyruvylpyruvate has been assigned is produced by the consecutive action of aniline and strong sulphuric acid upon ethyl pyruvate. In order to demonstrate clearly the ketonic nature of this substance, its interaction with phenylhydrazine has been studied. Two isomeric hydrazones are produced, the preparation and properties of which are fully described.—The germination of the spores of *Sterigmatocystis nigra* in the trachea of some birds, by M. Pierre Lesage.—Experiments on the germination of pollen grains in the presence of stigmata, by M. Pierre Paul Richer. The pollen of a certain number of species, which do not germinate in pure water, germinate if stigmata of the same, or closely allied, species be added.

DIARY OF SOCIETIES.

FRIDAY, OCTOBER 31.

PHYSICAL SOCIETY, at 5 p.m.—On the existence of a Relationship between the Spectra of some Elements and the Squares of their Atomic Weights: Dr. W. Marshall Watts.—The Size of Atoms: H. V. Ridout.—Exhibition of "Vacuum Calorimeters." Prof. H. L. Callendar, F.R.S.

INSTITUTION OF MECHANICAL ENGINEERS, at 8 (Extra Meeting).—Discussion of the Paper on Oil Motor Cars of 1902: Captain C. C. Longridge.

MONDAY, NOVEMBER 3.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—Preliminary Investigation of the Chemical Changes produced by various Reagents on Guttapercha: Sir William Ramsay, K.C.B., F.R.S.—Also, *time permitting*, The Reduction of Ammoniacal Silver Solutions by Organic Substances: Dr. G. T. Morgan.—A simple Qualitative Test for Bromides and Iodides: Dr. F. Mollwo Perkin.—The Influence of Impurities on the Specific Gravity of Sulphuric Acid: Arthur Marshall.

SOCIETY OF ENGINEERS (Royal United Service Institution), at 7.30.—Effect of Segregation on the Strength of Steel Rails: Thomas Andrews, F.R.S.

TUESDAY, NOVEMBER 4.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Address by the President, and presentation of Medals and Prizes awarded by the Council.

ZOOLOGICAL SOCIETY, at 8.30.—An Account of Recent Palæontological Discoveries in Egypt: Dr. C. W. Andrews.—On the Classification of the Fishes of the Suborder Plectognathi, with Notes and Descriptions of New Species from Specimens in the British Museum: C. Tate Regan.—On the Transformations of *Papilio dardanus* and *Philampelus megaera* and on two new Species of South-African Heterocera: Lieut.-Colonel J. Malcolm Fawcett.

WEDNESDAY, NOVEMBER 5.

COLD STORAGE AND ICE ASSOCIATION (Institution of Mechanical Engineers), at 8.—The Technical Application of Liquid Air: Dr. Carl Linde.

SOCIETY OF PUBLIC ANALYSTS, at 8.—(1) The Reactions of the Alkaloids of Ipecacuanha; (2) The Analysis of Preparations containing Opium: Alfred H. Allen.—The Estimation of Salicylic Acid: Sidney Harvey.—Volatility of Aqueous Solutions of Acetic Acid: William Chattaway.

GEOLOGICAL SOCIETY, at 8.—The Fossil Flora of the Cumberland Coalfield, and the Palæobotanical Evidence with regard to the Age of the Beds: E. A. Newell Arber.—Notes on Mr. E. A. Newell Arber's paper on the Clarke Collection of Fossil Plants from New South Wales: Dr. F. Kurtz.—On a New Boring at Gaythorpe (Lincolnshire): Henry Preston.

ENTOMOLOGICAL SOCIETY, at 8.—New Indian Hymenoptera: Major C. G. Nurse.—Notes on *Drilus flavescens*, Rossi: L. R. Crawshay.—New Species of Indian Chrysididæ: Major C. G. Nurse.

THURSDAY, NOVEMBER 6.

LINNEAN SOCIETY, at 8.—Notes on a Natural History Journey to Chile: H. J. Elwes, F.R.S.

RÖNTGEN SOCIETY, at 8.30.—Address by the President, Mr. Herbert Jackson.

CHEMICAL SOCIETY, at 8.—Di-Indigotine: J. Moir.—Note on the Localisation of Phosphates in the Sugar Cane: C. H. G. Sprankling.—The Specific Heats of Gases: H. Crompton.—On the Non-existence of the Gaseous Sulphide of Carbon described by Deninger: E. J. Russell and N. Smith.—The Action of Nitric Acid on Bromophenolic Compounds: W. Robertson.—Hydroxyoxamides. Part II.: R. H. Pickard, C. Allen, W. A. Bowdler and W. Carter.—3:5-Dichlor-*o*-xylene and 3:5-Dichlor-*o*-phthalic Acid: A. W. Crossley and H. R. Le Sueur.—Isometric Anhydrous Sulphates of the Form $M''SO_4.R'_2SO_4$: F. R. Mallet.—The Catalytic Racemisation of Amygdaline: J. W. Walker.—The Combination of Carbon Monoxide with Chlorine under the Influence of Light: G. Dyson and A. Harden.—The Constituents of Commercial Chrysarobin: H. A. D. Jowett and C. E. Potter.

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