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A JAPANESE PRIEST IN TIBET.

Three Years in Tibet. By The Shramana Ekai Kawaguchi. Pp. xv+719. (Adyar [Madras], Benares and London: Theosophical Publishing Society, 1909.) Price 16*s.* net.

A NEW book on Tibet, offered to "the English-knowing public" by a Japanese priest who acted for a time as physician to the Grand Lama, raises our expectations of finding therein some fresh and interesting views of Tibetan life as seen from the inside. For the author enjoyed the advantage of moving freely behind the scenes, in the palace and in the monastic temples, in intimate relations with the "Living Buddha," and with many of the notabilities of this Old-World State, at a time when it was pursuing the even tenour of its existence, undisturbed by war's alarms.

A perusal of the volume, however, even in this respect, is somewhat disappointing to a European reader. It is a shallow, rambling, and whimsical narrative, from the standpoint of an emotional oriental monk, upon his wanderings on a pilgrimage from shrine to shrine in a land which he knew little about, and over ground mostly described in detail by European writers. Of geographical or scientific data there is positively nothing of any value, and little that is new even in regard to the religion of the country. Nevertheless, the reader who patiently perseveres through much that is trivial and tiresome may pick up some grains of information respecting the life in the great lamaseries.

The personality of the writer himself is quaintly romantic at times. On starting from Japan for Tibet in 1897, on what he tells us was a search for Sanskrit Buddhist books—a search in which he proved wholly unsuccessful—Mr. Kawaguchi, in his Buddhistic zeal, extracted from his friends, as farewell presents, their pledges to abstain from stimulants or tobacco-smoking and from "the brutal business" of catching fish. "About forty persons willingly granted (this) my appeal."

His æsthetic Japanese instinct leads him to break out frequently into a rhapsody or "*uta*" at the sight of some picturesque scene or aspect of nature; though at times he regretfully tells us that "I wished to embody my sentiments in a few verses, but the inspiration would not come." In "the *Dalai* jungle," which is the nearest he can get to the Himalayan "Tarai," where he halted on the way through Nepal to the Tibetan frontier, he heard a tiger roar, on which "an *uta* came to me:—

"The night sleeps still and calm, the moon shines bright,
What ho!—so loud a roar the stillness breaks,
Vibrating—ah! it is a tiger fierce! In ripples rough his roar terrific throws
The surface even of the mountain stream."

The cuckoo's cry for him, instead of being a pleasure, was "awful."

"My sense of loneliness was heightened by the note of the cuckoo, who now and then broke the oppressive silence and an *uta* then came to me thus:—

"In tortuous paths my lonely way now lies
Among rough mountain tracks and scenes all
The rocks and giant trees in silence stood wild
With naught to break the silent depths around
Except the solitary cuckoo's notes
That make the awful silence more profound."

A flock of cranes leads him to fire off the following:—

"Like feathers white the snows fall down and lie
There on the mountain-river's sandy banks;
Ko-Kow, Ko-wow! sounds strange, a melody
I hear—I search around for this strange cry.
In majesty these mountain cranes
I find are proudly strutting—singing thus."

His visionary temperament, indeed, fired by a generous credulity, causes him often to fail in distinguishing fancies from facts. At Sna he heard the voice of a supernatural being calling to him, and again at Sera monastery; and he elsewhere tells us "I was still in an extatic (*sic*) mood." This must have been his mood also when he saw Lhasa and Potala from the track over the "Genpa" (properly Khampa) pass of the Yamdok, the one followed by the Mission, and whence both Lhasa and Potala were certainly invisible. Facts, indeed, are weak points with him throughout. To begin with, even his very first word in the title of his book, "*Three* Years in Tibet" (on the strength of which he absurdly claims for himself a position of greater authority on Tibetan matters than Csoma and Jaeschke, whereas his book shows him to be utterly lacking in scholarship, and even in ordinary knowledge of the language), is falsified by his own proof. On p. 76 he tells us that he crossed the Tibetan frontier for the first time on July 4, 1900; and on pp. 641 and 650 that he finally re-crossed it on emerging from Chumbi on June 14, 1902, thus giving the duration of his entire stay in Tibet as only *one year and* 345 *days* instead of the "*three* years" to which he gratuitously lays claim! This sort of thing is typical of his matter throughout, so that he is not to be taken too seriously. Nor does he allow his ignorance of details to stand in the way of providing precise fictitious ones. He carried no map or any instruments with him, save a small compass registering the cardinal points, yet he devotes a chapter with the heading "22,650 feet above the sea-level" to a description of his sensations in a snow-storm, when he was somewhere on the plateau, he did not know where. It will be news to the Mission force and to the hundreds of men of the convoys who drank the water of the Yamdok Lake at Nagartse, &c., for several months to be told that the water "is poisonous."

He travelled in the guise of a Chinese Buddhist priest, which his Mongoloid face and acquaintance with the Chinese language rendered not difficult for him. What was more important, he posed as a physician, and, endowed with unbounded assurance and luck, acquired such fame by his "cures" that this brought him to the favourable notice of the Grand Lama. "I came to be regarded as a god of

medicine," he says, though he naïvely confesses in excuse for his charlatanism that, not having had any regular medical training, "*I know I made a very dangerous doctor, but I was obliged to go on as a pedant domineering over a society of ignoramuses*"—this is very fine, and worthy of being preserved! Fortunately for Mr. Kawaguchi, the Dalai Lama himself became one of those ignoramuses, and conferred on the "doctor" his intimacy and confidence. But Mr. Kawaguchi is strangely silent as to the subjects of those interesting conversations, beyond the bold general statement that

"I heard and saw much of him (the Grand Lama) and had frequent interviews with him. I judge that he is richer in thoughts political than religious. He seems to fear the British most, and is always thinking how to keep them from Tibet."

Living in constant terror of being robbed explains, perhaps, the low opinion our traveller has formed of his Tibetan co-religionists—so widely different from the experience of sympathetic Western travellers like Rockhill and others. He says:—

"It is impossible to trust oneself entirely to Tibetans, for honesty is observed only among people who are known to one another, and only so long as actions are done before the public gaze. Social restraints are no sooner removed than the Tibetan is ready for any crime or enormity" (!).

Our pious priest, therefore, was perpetually inventing falsehoods to deceive his interlocutors, and to "lay false scents," as he terms it.

When the secret of his disguise leaked out, that he was not a Chinaman, but a Japanese, he tells us that he made a "bolt" from Lhasa to India, assisted by an "ex-Minister and his nun-wife (*sic*)." As there was no pursuit, however, his excitement on the way was perhaps more imaginary than warranted. Certainly we cannot say that he has brought back to us any information which is new or important.

The get-up of the book is not at all creditable. It is in the poorest Indian style—it was printed in Madras, and looks it. Misprints also abound, and there is no index. The illustrations have been roughly drawn by a draughtsman in Japan in conventional Japanese style, and exhibit little that is characteristic of Tibet.

We leave the book with the feeling that the really interesting things have been left out.

L. A. WADDELL.

CRITICISM IN GEOLOGY.

La Géologie générale. By Prof. Stanislas Meunier. Pp. xii+344. Second edition. (Paris: Félix Alcan, 1909.) Price 6 francs.

Evolution géologique de la Terre et ancienneté de l'Homme. By Alphonse Cels. Pp. viii+248. (Brussels: Lebègue et Cie., 1909.) Price 5 francs.

THE one point common to these two treatises is that both authors look with a certain enthusiasm on the earth as an active living whole. Prof. Meunier claims that his originality consists in this. For forty years he has worked towards the expression of a theory of the earth, in which the guiding idea is that

"Le globe est un véritable organisme, où des appareils harmonieusement associés poursuivent la réalisation de fonctions dont l'ensemble se traduit par les progrès d'une évolution planétaire sans arrêt."

The rocks of the earth's crust are in a state of continuous transformation; the characters of a stratum belong to all the ages that have passed since the time of its deposition.

To the mind of the geologist in these islands there is nothing very new in the propositions so clearly set forth in the author's "avertissement," and developed in the work. Some of them, such as the mode of production of flint in limestone (p. 104), and the part played by rain in the excavation of valleys (p. 162), deserve emphasising in lecture-rooms where other views may have prevailed. But they seem rather home-truths nowadays, and are, unfortunately, associated in the book with much that has been discarded in the face of cumulative evidence, and with much that must be characterised as exaggeration of a special point of view. Prof. Meunier, for instance, seems to regard oolitic structure as essentially of secondary origin in the rocks in which it occurs (p. 120); he denies, somewhat late in the day, the glacial origin of the Dwyka conglomerate and similar contemporaneous deposits (p. 277); and, while urging that springs and waterfalls tend inevitably to recede, he minimises the excavating action of a river throughout its ordinary course. Even where we are all prepared to follow him, his triumphal progress is accompanied by too much slaying of the slain. Yet here, as in his previous works, his comments on current explanations of phenomena are always well worth reading. The appearance of a river in a valley as the result of the excavation of the floor down to the surface of the permanent water-table is not new to students of English "bournes"; but it gives one food for thought when applied to larger and permanent cases.

The production of a volcano (p. 74) by the faulting up of a hot region over one saturated with water is distinctly fascinating. The essay (pp. 96–103) on "alluvions verticales," including the South African diamond pipes, has novelty, at any rate, in its treatment of the subject. The essay by Montlosier on the erosion of volcanic relics in Auvergne, published in 1788, was well worthy of resuscitation (p. 158), and forms an interesting feature of a chapter in which full justice is also done to Poulett Scrope. Prof. Meunier has always maintained the community of origin of volcanic and plutonic igneous rocks of various ages; but we doubt if the diagram on p. 82 will gratify students of differentiation. Mr. R. A. Daly, to whom igneous rocks are all basic to begin with, will regard it almost with dismay.

Prof. Meunier's remarks on the relics of the latest—and to him the only—ice-age have a Lyellian ring, but will not satisfy the growing school of glacial investigators. While he rightly urges that considerable areas remained free from ice, though others became for a time concealed, he can hardly convince us nowadays that the glacial epoch was a local phenomenon,

shifting from place to place under changes of geographical conditions. Twenty years ago many of us may have said the same, particularly if we lived where glacial relics were not abundant. Travel and conference with others have wrought a great change in this respect, and we may venture to think that Prof. Meunier still prefers to remain a critic rather than a field-observer. His volume is a pleasure to read, for he has the happy manner of an essayist; but it is full of pitfalls for the beginner. It contains, moreover, too many misprints, and is not provided with an index.

M. Cels, fortified in his geology by long and numerous quotations from De Launay's "La Science géologique," rejoices as a giant to run his course. He reminds us at all points of the sailor who, hearing for the first time of an essential fact of sacred history, left the meeting-house and knocked down an unoffending Jew. M. Cels has discovered the Huttonian doctrine; for him, as for Prof. Meunier, the world lives and is subject to evolution (p. 29); but he looks in vain (p. 247) for the traces of a beginning or of an end. Consequently, in the light of this great truth, all geologists, and notably the late M. de Lapparent, seem to him but as blind guides. Lamarck and Darwin (p. 39) have deceived enthusiastic men of science by presuming a beginning of life, from which our existing organic structures spread.

The author's devotion to causes now in action (p. 46) is that of a convert won by faith. With the earlier and not the later Lyell, he would lay enormous stress on the imperfection of the record, and would trace man back beyond the "eoliths" of early Eocene times (pp. 202 and 219). With the early Huxley, he would urge that strata containing the same fossil types in different parts of the globe may be separated by great intervals, even of geological time; and he further believes that the similarity of faunas is due to similarity of conditions of environment rather than to any contemporaneity in time. Prof. Meunier dislikes the idea of a general glacial epoch, on the ground that the earth's climates have got steadily colder; how then, he asks, shall we account for the disappearance of an epoch colder than that in which we now live? M. Cels dislikes it because he believes in the shifting of our polar axis (p. 107) and in the sufficiency of this vital earth to manage all its own affairs. Yet it is interesting to find Prof. Meunier employing the same arguments for demolishing the glacial epoch (p. 274 of his work) as M. Cels employs against the idea of successive geological periods marked by faunas in course of evolution.

M. Cels, during his recent reading, has discovered many valuable things, such as the occurrence of true sediments among archæan masses, and the difficulty of finding any relics of the primordial crust—facts pointed out long ago by Sir A. Geikie, but which are here dated back only to 1905. His studies among the modernists throw him, however, more and more towards Hutton, and even towards Pythagoras (p. 232), and his hope is to reform geology altogether. Both these books are out of the common; but neither is quite so stimulating as Reyer's "Prinzipienfragen," which was reviewed in these columns in 1908.

GRENVILLE A. J. COLE.

CHEMICAL PHILOSOPHY.

The Fundamental Principles of Chemistry. An Introduction to all Text-books of Chemistry. By Prof. W. Ostwald. Authorised translation by Harry W. Morse. Pp. xii+349. (London: Longmans, Green and Co., 1909.) Price 7*s.* 6*d.* net.

SINCE the retirement of Prof. Ostwald from the directorship of the Institute of Physical Chemistry in Leipzig, his literary activity appears to have increased, although for many years his output has been phenomenally great. With his departure from the atmosphere of the laboratory, from the sphere of attraction of experimental problems, the philosophic, pedagogic and historical aspects of chemical science have claimed his attention more closely than was possible heretofore.

The present work is essentially philosophical in character. In a sense it is an attempt to work out a system of chemistry without reference to the properties of individual substances, and its chief characteristic consists in a minute analysis of various chemical conceptions, and of the facts of experience from which they are derived.

The range of analysis is indicated by the titles of the separate sections:—Bodies, substances and properties; the three states; mixtures, solutions, and pure substances; change of state and equilibrium; solutions; elements and compounds; the law of combining weights; colligative properties; reaction velocity and equilibrium; isomerism; and, finally, the ions.

At the outset the author takes the view that the conception of matter is unnecessary, and this term is not made use of in the text. The idea that matter is something originally existing, something which is at the basis of all phenomena, and in a sense independent of them, is very widely spread, and any attempt to get rid of the conception will have to show a clear gain in simplicity, so far as derived concepts are concerned, before chemists agree to discard this particular conception. Such gain is not demonstrated, and the author's assertion that matter can be shown to be made up of the simpler concepts weight, mass and volume will doubtless be objected to on the ground that weight is not a conception of a simpler order than matter.

About half the book is taken up by the chapters on solutions and elements and compounds. A good deal seems to be made of the fact that pure substances can be regarded as limiting cases of solutions. Two component systems are subjected to a somewhat laborious analysis, and numerous diagrams are given to illustrate the various types of possible phase combinations. Chief interest attaches, however, to the demonstration that there are two component mixtures and solutions—viz. those which admit of hylotropic transformation—which behave exactly like pure substances in respect of such change. These solutions can, however, be readily differentiated from pure substances, for the hylotropy of the former is limited to certain definite temperatures and pressures, whereas that of the latter extends over considerable ranges of these variables.

The relationships involved in hylotropy are made

the basis of the author's conception of the elements, an element being a substance which cannot be transformed into another non-hylotropic substance within the entire range of attainable energy influences. By energy influences are understood any processes carried out without the actual addition of other substances. This statement is, however, scarcely adequate for the sifting out of the chemical elements. It may have been the case before the discovery of the radio-active substances, but the spontaneous disintegration of these obviously represents a non-hylotropic change, and as a consequence these elements do not fall into line.

The discussion of the laws of chemical combination, of colligative properties, and of catalysers is clear and lucid, but does not present any striking novelty.

In the chapter on ions the nature of a salt is examined. To the many definitions of this particular type of chemical individual which have been given, the author adds a new one. According to Ostwald, a salt is a substance which has the properties of a pure substance in the undissolved condition, whilst it exhibits the properties of two different substances when in solution. If in all solvents all salts are ionised or dissociated, this definition is probably sufficient to describe this group of bodies. It is, however, doubtful whether any practical test, based on the definition, could be actually applied to determine whether any particular substance is a salt or not.

In spite of the fact that we may not agree with the author's choice of fundamental concepts, and that certain results to which he is led are not in accordance with actual facts, it cannot be denied that the general treatment of the subject is profoundly interesting, and that the analysis of facts and ideas is conducted with great ingenuity. The subtitle cannot be taken very seriously, for it is too much to expect that the contents of the book can be digested by the future chemist prior to his study of the orthodox text-book. It should, however, appeal to the more mature student, to whom it is confidently recommended.

H. M. D.

OCEANOGRAPHY IN THE NORTH ATLANTIC. Scientific and Biological Researches in the North Atlantic, conducted by the Author on his Yachts "The Walwin" and "The Silver Belle." By Dr. R. Norris Wolfenden. Pp. vii+234. (London: Rebman, Ltd., 1909.) Price 7*s.* 6*d.* net.

In this work Dr. Wolfenden gives an account of the hydrographic and biological researches carried out on board his yachts, the *Walwin* and *Silver Belle*, from 1899 to 1907. The investigations, begun in the Færöe Channel with the *Walwin* (36 tons), which was replaced in 1902 by the *Silver Belle* (130 tons), were afterwards extended to the Azores and Gibraltar.

Apart from the observations actually recorded, this account is valuable as showing what a large amount of useful scientific work may be carried out on board a sailing yacht of moderate size, the cost of the additional gear necessary being only a small proportion of the original outlay. It will probably be a surprise to many to learn that from a sailing yacht of 130 tons soundings, physical observations, and tow-nettings may be taken at a depth of 1500 fathoms with comparative ease and certainty.

The first sixty pages are occupied by a summary of the various cruises, and give some idea of the inclement weather which may be expected in the North Atlantic even in summer. The work was carried on in spite of considerable difficulties and hardships, and the amount accomplished is very much to the credit of the *Silver Belle* and her crew of Shetlanders. An accompanying chart shows the positions of the stations on each cruise, and also the contour lines of depth of 100 and 2000 fathoms. The 100-fathom line is, however, erroneously drawn outside the Porcupine Bank, off the west coast of Ireland, instead of passing between it and the mainland.

Following the narrative of the cruises, Dr. Wolfenden gives the benefit of his lengthy and somewhat costly experience in the choice and manipulation of fishing engines and physical apparatus. It appears that the taking of water samples and temperatures in deep water can be worked for the most part without mishap even in rough weather, but that a heavy sea prevents the satisfactory use of closing plankton nets. The chief source of danger is the rolling of the ship, which, by slackening the wire, causes it to "kink," and thus prevents the descent of the opening and closing messengers, if it does not result in the loss of both wire and net.

The greater part of the book is occupied by an account, by Dr. H. N. Dickson, of the hydrography of the various cruises. Except in the case of the Færöe Channel, which is dealt with in considerable detail, Dr. Dickson contents himself with pointing out the general conditions of salinity and temperature prevailing over the regions investigated, deferring the further discussion of the results until a longer series of observations has been accumulated. He directs attention, however, to the effect of the highly saline water of the Mediterranean flowing outwards through the Straits of Gibraltar. The section plotted on p. 161 shows clearly how the denser water, pouring over the sill as if over the edge of a waterfall, sinks to a depth of about 600 fathoms, and at that level streams out horizontally in a layer more saline than that above or below it. The influence of this water was noticeable in the high salinities at intermediate depths found off the coast of Portugal in 1904 and 1905, and it will be interesting to learn, when the results are published, whether the plankton taken on these occasions contains any indication of a Mediterranean origin. Dr. Dickson alludes to the probability of this water reaching the English Channel, and emphasises the importance of continued observation. Other points of interest dealt with are the differences of salinity and temperature on the north and south sides of the Porcupine bank, and the accumulation of evidence to show the existence of a cold bottom current flowing southwards over the Wyville-Thomson ridge. A complete series of sections and full tables of the salinities, temperatures, and meteorological observations on each station are given, but a serious omission is the absence from the tables of a column for the depth of water, which can

only be ascertained by reference to the narrative of the cruises.

The last forty pages contain an instalment of the biological work accomplished on the cruises. The subjects treated are:—Fishes, by Mr. E. W. L. Holt and Mr. L. W. Byrne; Amphipods and Isopods, with descriptions of two new species, by Mr. W. M. Tattersall; and *Pyrosoma spinosum*, by Mr. G. P. Farran.

The printing, illustrations, and get-up of the book are excellent, and a few misprints and obscurities, chiefly in the earlier pages, do not seriously detract from the value of Dr. Wolfenden's contribution to oceanography. It is to be hoped that we soon may have a second volume dealing further with the large amount of biological material which must have been amassed.

THE CASE FOR EUGENICS.

The Family and the Nation: a Study in Natural Inheritance and Social Responsibility. By W. C. Dampier Whetham, F.R.S., and Catherine Durning Whetham. Pp. viii+233. (London: Longmans, Green and Co., 1909.) Price 7*s.* 6*d.* net.

"THE power of heredity," writes Mr. Whetham, "is an old story; 'family likeness,' 'family characteristics,' 'family temper,' are expressions which convey ideas well known to all men. Yet with amazing inconsistency we have taken little if any account of such knowledge in our conduct, little if any in our theories of social and political life. We have talked and acted as though it were of no account how men were bred, or what classes of the community were reproducing themselves fastest and what declining in number, as long as each individual was enabled by improved conditions to pass his brief lifetime in increased comfort and security."

It is the duty of preachers of eugenics, a duty conscientiously undertaken by the author, to end this state of affairs; to teach our future statesmen what biological factors govern the rise and fall of nations, and to educate public opinion in such a way that, aided by the legislation that will then be possible, it will insist on the more rapid multiplication of the desirable components in our society, and aim at the elimination of the rotten parts which now permeate it. Mr. Whetham's book cannot fail to influence all who read it. He writes with the clearness and vigour which flow from conviction based on clear thinking; and thus, having the facts with him, presents a strong case strongly.

The line of argument adopted is as follows. First, the importance of heredity is insisted on, and the methods by which it is being studied scientifically are described, namely, the analytical method initiated by Mendel and developed by Prof. Bateson and others, and the statistical method originated by Sir Francis Galton and extended by Prof. Karl Pearson.

Many pedigrees are given as instances of inheritance in man, and are illustrated by diagrams like those published in the "Treasury of Human Inheritance," now being produced by the Galton Laboratory. The important question of the relative influence of heredity and environment is referred to, but since there is very little evidence available for discussion, it necessarily receives but scanty treatment. As the author points out, the only quantitative study of the subject yet published is the work of Barrington and Pearson on keenness of vision and defects of eyesight. They found that no measurable relation exists between powers of vision and environment, whereas the influence of heredity is well marked.

Two chapters follow, the one on the inheritance of mental defect, and the other on the inheritance of ability, the latter being based largely on Sir Francis Galton's "Hereditary Genius." The influence of heredity is further shown in an examination of the circumstances causing the rise, fall, or extinction of families, and finally the effect of heredity acting in conjunction with a differential birth-rate is treated very fully.

It is a well-known fact that the birth-rate in Great Britain fell from 36 per 1000 in 1876 to 27 per 1000 in 1907. This in itself may give cause for alarm, but the most serious feature of the fall is that it has not been the same in all classes. If the lowest stratum of society had been affected equally with the higher strata, the 27 per 1000 would have been reduced to a much lower figure. As it is, the lowest stratum is as prolific as before, therefore our birth-rate has become selective. The least valuable portions of the population are selected to contribute a disproportionately large share of the next generation, by the action of the more valuable portions in bringing about at any rate a partial self-elimination.

The author gives historical instances, in which the action of a selective birth-rate produced by various causes has influenced the rise and fall of nations. As an example we may quote the influence of the Dominican and Franciscan monks, of whom the former came to England in 1220, the latter in 1224. Through their preaching and persuasion, the majority of our men of intellect were drawn into the monasteries and thus rendered sterile. Roger Bacon, Adam Marsh, Robert Grosseteste, Dun Scotus, and Occham are but a few names from a host of others. As a result came the stagnation of the fourteenth and fifteenth centuries, which was only ended by the overthrow of the monasteries in the time of Henry VIII. Then followed the "glories of the Elizabethan age," and "a period of scientific and literary activity, which carried England on through the seventeenth century."

In conclusion, we may heartily recommend this book to those who are interested in the study of heredity as affecting human societies. It is no disparagement to say that the arguments used have many points in common with the teaching of Prof. Karl Pearson. To him, as well as to Sir Francis Galton, all those who write on eugenics must owe a debt. E. H. J. S.

INDIAN WOODS AND THEIR USES.

Indian Woods and their Uses. By R. S. Troup. Pp. 273+ccxviii. (Calcutta: Government Printing Office, 1909.) Price 4*s.*

THIS work is the outcome of a gradual development of research on the part of the Indian Forest Department. The foundation of the system now instituted was laid in 1883, when Dr. (now

Sir Wm.) Schlich was Inspector General of Forests. He succeeded in obtaining the sanction of the Government of India and of the Secretary of State for India to the establishment of the working-plan branch of the department. Under the regulations then issued, all working plans had to be submitted to the Inspector General, who examined them and communicated his views on them to local governments. The Imperial Superintendent of Working Plans kept a record of the progress of the work by means of annual returns submitted to him by local authorities. In this way, a great store of statistics was collected, which, according to Sir Wm. Schlich's intentions, were to be made available as the work proceeded. Unfortunately, after his departure from India in 1885, little or nothing was done in this respect for about fifteen years.

A fresh move was commenced about the year 1901, when Mr. R. C. Wroughton, then Inspector General of Forests, conceived the idea of the present Forest Research Institute, which was approved by the Government of India. The installation of the institute was, however, carried out by his successor, Mr. J. Eardley Wilmot. It is stationed at Dehra Dun, and consists of six members, namely :—(1) a president, (2) an imperial superintendent of forest working plans, and sylviculturist, (3) a forest zoologist, (4) a forest botanist, (5) a forest economist, and (6) a forest chemist.

Arrangements were made for the publication of (1) Indian forest records, and (2) Indian forest memoirs. The latter are published as quarto volumes measuring 12¼ inches by 10 inches, this being the size used by the Royal Asiatic Society and the Geological Survey of India.

The volume under review is the first number of the economic product series. It is a stately but very unwieldy volume, of 273 pages text, and 218 pages of appendices. It is divided into part i., the various uses of Indian woods according to the different purposes for which wood is used; and part ii., descriptive list of the chief Indian woods.

The indices are two in number, giving (1) the English and trade names, and (2) vernacular names.

As part i. is divided into thirty-four sections, such as agricultural implements, boat and ship building, coopers' work, furniture, mining timber, ordnance work, railway carriages, sleepers, telegraph poles, tools, toys, wood pulp, &c., it follows that many woods are mentioned under a considerable number of sections.

Part ii. deals with each species under a number of heads, such as natural order, synonyms, English name, vernacular names, habitat, description of tree and wood, weight per cubic foot, strength, and chief uses. Under the last head, all that has been said in part i. is here repeated. The list of woods is arranged alphabetically to facilitate reference. The number of species dealt with is 554, or about 10 per cent. of some 5000 woody species, about half of which are trees. The descriptions are based mainly on those in Gamble's "Manual of Indian Timbers," supplemented by the results of a further examination of many species. To ascertain what proportion the latter bear to the former would require a detailed comparison of the two works.

The appendices are no doubt very useful, but they are contained in Gamble's book in far more concise shape, while they are spread over 218 pages in the work under review. Indeed, there is in the latter quite an inexcusable waste of space, which reduces the usefulness of the index of vernacular names considerably; it might have been condensed to one-quarter the space. We believe the work was compiled for the use of firms. If this is so, why was the information, if wanted at all, not brought out in a handy little booklet instead of in this big quarto volume, which requires a table of its own to spread it out upon? For the shape, however, Mr. Troup is not responsible; that was laid down by official orders, which the author would have done well to resist.

The present is the second work published by Mr. Troup, the first being a volume on Indian forest utilisation. Both are, to a considerable extent, compilations. We admire Mr. Troup's remarkable activity, but we hope that his transfer to the post of imperial working-plans officer and sylviculturist will enable him to devote his energy to more fruitful work. The most urgent need is the study of the sylvicultural bearing of the more important Indian timber trees. Gamble's "Manual of Indian Timbers" gives all that is required regarding timbers and their uses, until other branches of forestry have been brought up to the same level.

OUR BOOK SHELF.

A Survey and Record of Woolwich and West Kent. General editors, C. H. Grinling, T. A. Ingram, and the late B. C. Polkinghorne. Pp. viii+526. (Woolwich: Labour Representation Printing Co., Ltd., 1909.) Price 10*s.* 6*d.*

THE publication of this work, originally intended for the Woolwich Congress (1907) of the South-eastern Union of Scientific Societies, has been delayed owing to alterations found desirable in the original scheme, and to the regretted death of one of the editors and the prolonged ill-health of another. As it now appears, it is a valuable contribution to our knowledge of that portion of Kent bounded by the Thames, the Ravensbourne, the Cray, and the outcrop of the chalk between the two last-named rivers. It is, moreover, an excellent example of the beneficial result of cooperation in scientific work, for here we have brought together, in readily accessible form, records of the work of local scientific societies and isolated naturalists. The result, so far as numerical records are concerned, will doubtless be astonishing to many. From a small corner of Kent, only some fifty to sixty square miles in area, a considerable portion within the London postal district, none beyond what might be regarded as the outer suburban zone, a rich flora and fauna are recorded. Of plants there is a list of more than 2000. The number of animal forms is not summarised, but the records, with citations of localities, occupy just over 200 pages; of Coleoptera or beetles no less than 3264 species are enumerated.

The publication of these records will doubtless, as the authors hope, induce others to contribute additions either to the lists of species or of localities, and thus to secure fuller knowledge of the distribution of the organisms. Rapid changes, due to the incursions of man, are taking place within the area, and in a few years' time the records will have an added value in enabling us to trace actual changes, and also, perhaps, some of the causes determining those changes. Almost everyone interested in natural history makes

from time to time observations, of minor importance, perhaps, regarded as isolated facts, but valuable if brought together and studied in relation to those of other observers in the neighbourhood. Not the least service rendered by a volume such as this is that it offers a definite place of record for many a fact which would otherwise probably be lost. We have discussed at some length the biological matters, which occupy about four-fifths of the book. In addition, there is a brief general sketch of the geology, in which, as an instance of interrelation between geology and industry, it may be noted that Woolwich Arsenal is said to owe its establishment to the suitability of the local Thanet sands for iron-moulding. Scientific industries and archæology are other interesting chapters, and there is a concluding note on Woolwich as a centre for photography. The geological section has a very useful bibliography, arranged chronologically. The book is well indexed. W. G. F.

The Flora of the Dutch West Indian Islands. Vol. I., *St. Eustatius, Saba, and St. Martin.* By J. Boldingh. Pp. xii+321. (Leyden: late E. J. Brill, Ltd., 1909.) Price 10*s.*

CONSIDERING the comparative proximity of the West Indies and the number of nationalities in possession, there is a lack of systematic botanical information in the shape of local floras, so that Mr. Boldingh renders good service by the publication of his work relating to three of the Dutch possessions. It is based primarily on his own observations and collections, together with the collections of his countrymen, Dr. Suringar, Mrs. van Grol-Meyer, and Dr. Lionarons, totalling in all about 5000 numbers. The systematic enumeration comprises 806 species, of which 674 are regarded as indigenous and 166 are confined to the West Indies. The Leguminosæ is the best represented family, with sixty species; the Gramineæ, Compositæ, Polypodiaceæ, and Euphorbiaceæ follow in the order named. Panicum, Polypodium, and Peperomia are the larger genera. Ipomœa supplies nine species, of which two are limited to the West Indies, and another is recorded only for St. Eustatius. Two other endemic species, *Galactia nummularia* and *Calyptranthes Boldinghii*, have only been collected on St. Martin.

The author follows Eggers in the ecological divisions, and distinguishes littoral, cultivated, dry shrubby or Croton, and tree or Eriodendron types of vegetation. The dry shrubby and tree vegetations are well developed on St. Eustatius; on Saba the cultivated regions and certain ferns are notable; St. Martin is characterised by the extent of the littoral and shrubby vegetations, while forests are scanty. Generally speaking, the flora of St. Martin differs from that of the other two islands, and contains a number of plants represented on islands lying to the north, while the proportion stands the other way with regard to certain plants recorded only from islands lying to the south. The author has rounded off his information with geological and meteorological notes, a list of vernacular names, chiefly English, and maps. The flora bears out the general view that there is no striking difference between the plants of neighbouring islands in the group.

Weather Forecasting by Simple Methods. By F. S. Granger. Pp. xii+121. (Nottingham: Henry B. Saxton, 1909.) Price 2*s.* 6*d.* net.

THE aim of the author is to provide the means for a single observer "to answer the question 'When will it rain?' in a simple and intelligible manner" without the aid of instruments except a barometer, this, however, being regarded as optional, and not necessary. The methods recommended are based mainly on observations of the size, thickness, extent, height, colours, and forms of clouds. Different aspects of cumulus, cirrus, and stratus cloud are discussed in relation to the weather to be subsequently expected, and isolated examples taken from the author's observations at Nottingham are quoted.

As the result of a long series of observations by an observer who is evidently interested in the subject, the work may prove useful to local observers, but it is doubtful to what extent some of the conclusions arrived at can be considered general. Thus "visibility" is regarded as a sign of good weather, because this phenomenon occurs at Nottingham only during light easterly breezes. In some districts, however, visibility is frequently associated with winds from some westerly point, and is commonly supposed to be a prognostic of rain.

Although Mr. Granger again tells us that meteorology is not an exact but an observational *science*, he says in the same breath that his book is not written on exact and *scientific* lines. He has described it well. His cloud classification is incomplete, and is not that approved by international agreement. He ascribes the formation of cumulus to an electrical cause, and states that lurid red skies in the morning or evening are due to refraction of light. After using the word "gradient" several times he at length defines it as "the slope between two isobars when on one the barometer is one-tenth of an inch higher than the other," and speaks of a gradient of 300 miles, a gradient of 29·9, a shallow gradient, and a form of gradients. There are many other statements which ought to be modified in the light of recent researches. For example, our knowledge of the conditions in the free atmosphere is not as limited as the author suggests, and surely calculation already enters into the science of forecasting, and must continue to do so to an increasing extent.

The arrangement of the work, especially with regard to marshalling the descriptions under some definite plan and arranging them in chapters with appropriate headings, leaves much to be desired. The present arrangement is almost fortuitous.

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 Invention of the Slide Rule.

I HAVE read with great interest the abstract of the paper on the invention of the slide rule, by Prof. F. Cajori, which appeared in NATURE of December 30, 1909. I agree with the author in thinking that the Rev. William Oughtred was the first to suggest that calculations could be made more accurately and rapidly by sliding the edges of logarithmic scales together than by using compasses—the method adopted by Gunter; but Oughtred had a poor opinion of this device, and rightly considered that his circular scale was a great improvement on it. A few years before 1671, Seth Partridge [1] re-discovered the sliding principle, perfected it, and gave an almost complete specification for the slide rule which is used to-day by engineers.

I was fortunate enough recently to come across, in the library of the British Museum, a pamphlet written by Oughtred in reply to an attack make on him by an instrument maker called Delamain. The pamphlet is entitled "To the English Gentrie and all other studious of the Mathematicks, which shall be readers hereof. The just apologie of Wil: Oughtred against the slanderous insimulations of Richard Delamain, in a pamphlet called Grammelogia, or the Mathematicall Ring." The author very forcibly and very successfully rebuts the charges that were made against him. The following gives his opinion on the question of the priority of the discovery of the circles of proportion:—

1 "The Description and Use of an Instrument called the Double Scale of Proportion." (London, 1671.)

"The honour of the invention, next to the Lord of Merchiston,[1] and our Master Briggs, belongeth (if I have not been wrongly informed) to Master Gunter who exposed their numbers upon a straight line." He then describes the advantages gained by sliding two Gunter's scales together, but points out the defects of this primitive method, and so finally leads up to his circular slide rule.

In the "Epistle Dedicatorie" to Forster's "Circles of Proportion" an answer, said to have been given by Oughtred to a question asking him the reason why he had concealed his inventions so long, is quoted:—

"That the true way of art is not by instruments but by Demonstration; and that it is a preposterous course of vulgar Teachers, to begin with instruments and not with sciences, and so instead of Artists to make their Scholers only doers of tricks, and as it were Juglers; to the despite of Art, losse of precious time, and betraying of willing and industrious wits into ignorance and idlenesse."

Possibly another reason was the fear that his parishioners and others might think that he might have been better employed than inventing slide rules. Supporting this latter view is the fact that he published (1633) his "Mathematicall Recreations" under the pseudonym of Henry Van Etten. In this volume occurs the world-famous arithmetical trick, "Think on a number, double it, &c." It is highly probable that he invented it.

I see no reason for doubting Oughtred's word that he used sliding scales in 1618. The date of Wingate's reputed[2] discovery was thus anticipated by six years. A perusal of Partridge's book published in 1671 shows that the method of using compasses with Gunter's scales was the one that was then generally employed in London. In that year Partridge's slide rules were for sale at the shop of Walter Hayes, at the Cross-Daggers in More-Fields, next door to the Popes-Head-Tavern, London.

Personally, I consider that Seth Partridge is the real inventor of the modern 10-inch slide rule.

ALEXANDER RUSSELL.

Faraday House, London, January 5.

The Tercentenary of the Telescope.

THE article on the tercentenary of the telescope, published in NATURE of December 16, 1909, is extremely welcome, not only because of its appositeness in point of date, but because Dr. Dreyer sets in true light the nature of Galileo's claims in connection with the discovery of the telescope. I do not think that it can be denied that Galileo himself makes the claim, for he puts into the title of the "Sidereus Nuncius" the words "nuper a se reperti." Nor can this be brushed aside as merely an elliptical phrase, because it is pretty clear that he left on the minds of the Doge and Senate of Venice the impression that he had invented the instrument with which he showed them the shipping. I deduce this from the decree as given in a footnote by Mr. Fahie on p. 78 of his admirable "Life of Galileo."

Galileo seems to have known nothing about "the secrets of perspective" as suggested in that decree; he describes quite clearly that he did not reason from optics, but from common sense; and his optics were, in point of fact, wrong when he asserted that one lens could not alone act telescopically. It seems clear that he knew nothing about the formation of an image by a lens. I confess that I cannot see that he is entitled in this matter to so much credit as Prof. Turner ascribes to him in a recent article in the *New Quarterly*.

In the matter of the satellites of Jupiter we tread on much more certain ground, since it is now, I believe, generally conceded that Marius, in his "Mundus Jovialis," gives us a genuine account of his own observations. The charge of plagiarism formulated by Galileo, and repeated by nearly all his biographers, is now exploded. (Mr. Fahie does not explicitly charge Marius with plagiarism, but clearly he disbelieves the general truthfulness of the "Mundus Jovialis," a position that, I feel sure, he would abandon if he read what Messrs. Oudemans and Bosscha have written.) Dr. Dreyer says that Marius found the satellites one day later than Galileo, but when the actual records are compared it becomes clear that Galileo was, on the contrary, at least two days behind Marius. From Galileo's account in his Italian MS. notes, reproduced by Prof. Favaro in his national edition, we see that it was on January 11 that he first suspected the three "stars" to be satellites. (The "Sidereus Nuncius" suggests January 10 for the first suspicions.) Thus Galileo saw them as stars on January 7, and as satellites on January 10 or 11. Now Marius saw them as stars some month or so earlier, and on January 8 he discovered their true nature. Thus it is hardly fair to compare the discovery as satellites made by Marius on January 8 with the mere detection as "stars" made by Galileo on January 7. For the fourth satellite Galileo is entitled to the priority.

I dislike as much as anyone all quarrels about priority, and only direct attention to these facts because of Galileo's hostile attitude. His genius and his intuitive perception of the ways of nature will gain for him for ever the admiration of all men, but his arrogance and jealousy in these two matters make it incumbent on us to be much more critical than in ordinary cases, and particularly so because such fair-minded biographers as Mr. Fahie speak of "his right to the first discovery" of the satellites, and everyone uses the phrase "Galilean telescope."

J. A. HARDCASTLE.

The Dial House, Crowthorne.

Cross-fertilisation of Sweet-peas.

UNDER the above heading a writer in NATURE of January 6 (p. 280) refers to "the statement that the sweet-pea is invariably self-fertilised," a statement which he thinks is "often based on an opinion of Charles Darwin's." In refutation of this opinion your correspondent describes the visits of the hive-bee and of Megachile to the flower in question. These same species were seen by Mr. Darwin to visit sweet-pea flowers ("Cross and Self-fertilisation," 1876, p. 156). He goes on to ask how it is that the varieties are not habitually mongrelised, and sums up his discussion in the following words:—"Whatever the cause may be, we may conclude that in England the varieties never or very rarely intercross. But it does not follow from this that they would not be crossed by the aid of other and larger insects in their native country, which in botanical works is said to be the south of Europe and the East Indies. Accordingly I wrote to Prof. Delpino, in Florence, and he informs me 'that it is the fixed opinion of gardeners there that the varieties do intercross, and that they cannot be preserved pure unless they are sown separately.'"

January 10. FRANCIS DARWIN.

MAY it be allowable to point out that "π," who has contributed an interesting note (NATURE, January 6, p. 280) on the "Cross-fertilisation of Sweet-peas," is not the same who (vol. lxxii., p. 631) is responsible for the "Rhymes on the Value of π"?

THE ORIGINAL "π."

A Hardy Goldfish.

CAN one of your readers please explain the following incident?

I keep some goldfish in a glass bowl. On December 31 last one of them was seen lying motionless upon its side on the surface of the water. After about an hour, as it was thought to be dead, it was removed to a shelf, remaining there for three hours. My sister then picked it up to throw it away, but was surprised to find it opening its mouth and breathing. She placed it in fresh water, when at first it lay on its side, occasionally moving its head and fins. The water presently appeared to be slightly tinged with the golden colour of the fish, which suddenly turned over on to its back, the ventral surface being upwards, and remained thus for some time. On being transferred to another vessel, the fish, assuming the normal position, swam about leisurely for a little while, and gradually recovered its usual energy, being now equal to any of its old companions.

Was this a case of paralysis, cramp, or other temporary ailment, and what enabled the fish to remain so long alive out of its natural element?

G. C. CONSTABLE.

50 Clonmel Road, South Tottenham, January 4.

[1] Rather a grandiloquent method of referring to Jhone Neper, 'Fear' of Merchiston.

[2] "Le Calcul Simplifié." By M. d'Ocagne. (1905.)

RECENT WORK IN THE TELEGRAPHIC TRANSMISSION OF PICTURES.

COMMERCIAL photo-telegraphy may be said to have started in November, 1907, when Prof. Arthur Korn installed three of his selenium instruments at the offices of the *Lokal Anzeiger*, in Berlin, *L'Illustration*, in Paris, and the *Daily Mirror*, in London; towards the end of 1908 a further selenium apparatus was installed at Manchester. These early machines depend on the sensitiveness to light of one modification of the element selenium—selenium of the slate-grey form distributed over two platinum coils wound one between the other over a flat rectangular plate of steatite, being termed a selenium cell. Current was passed from a battery through the cell, on which was cast illumination from a Nernst lamp, the rays of which had first to pass through a revolving transparent photographic film, so that the intensity varied each instant according to the density of the photograph. A second cell was illuminated simultaneously by suitable means, the two being connected up on opposite sides of a Wheatstone bridge, so that the current sent to the receiving machine varied as the difference of the reciprocals of the resistance of the two cells. By combining suitable cells the inertia was largely overcome, and a photographic portrait could be transmitted in twelve minutes. The current at the receiving station passed into a string galvanometer, and laterally displaced a small shutter attached to the "strings," this movement cutting off more or less of the light projected from a second Nernst lamp on to a sensitive photographic film revolving synchronously with the transmitting cylinder, and one-quarter its size.

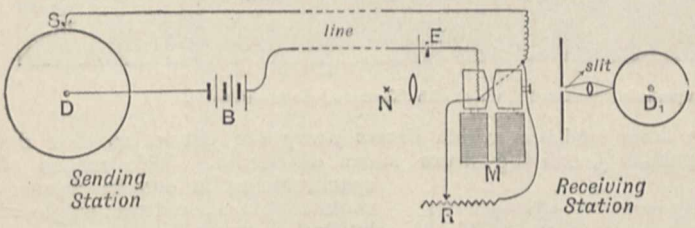
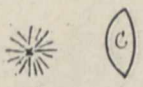


FIG. 1.

The disadvantage of this system is that the current transmitted is so small that when there is much leakage on the line it is difficult to get sufficient movement in the shutter of the galvanometer to give a useable result. The maximum current obtainable at the receiving station is about one milliampere. Prof. Korn's telautograph, which he completed in 1908, was therefore a great advance, as, the resistance of the line and the galvanometer being R and r respectively, the current C is proportional to $E/R+r$; hence by increasing the electromotive force, more current—up to 20 milliampères—can be obtained, and the induction effects from neighbouring lines are very much less pronounced.



The principle of the telautograph of Prof. Korn is seen in diagram form in Fig. 1. Here D is a cylindrical drum about 10 cm. diameter and 12·5 cm. in length, which is revolved at the rate of 30 r.p.m. by a high-speed motor suitably geared down; S is a steel stylus which is mechanically moved laterally at the rate of about 1 cm. in 40 seconds, and thus S traces a spiral path over the drum D. To D is attached a piece of copper foil, on which has been drawn a sketch or copy of a photograph in some insulating ink; more recently a single line half-tone reproduction of a photograph in fish-glue on metal foil has been transmitted with considerable success. B is a battery of thirty to sixty volts, and the telephone line is represented by dotted lines. A condenser is usually shunted across SD to prevent sparking, about one microfarad being necessary. At the receiving station we have a drum D, of ebonite, on which is wrapped a piece of sensitive photographic film or paper, this revolving in a light-tight box, and also moving laterally in corresponding manner to the transmitter. In the front of the box is a lens and small diaphragm, concentrating as a small spot on the film whatever light passes through a fine slit; this slit lies on the optic axis of a condensing lens fixed in front of the Nernst lamp N, the rays of which pass through a hole bored in the pole pieces of a strong electromagnet M, absorbing about 100 watts. A fine flat silver wire is stretched across the magnetic field, as shown in the figure, through which the current received passes; the shadow of this wire, when *no current passes, i.e.* when the stylus S is separated from the metal on D by an insulating line of the picture, just covers the slit, but when the stylus is in contact with the metal, and current flows through the circuit, the wire is displaced, and light therefore falls upon the sensitive film.

If the period of swing of the galvanometer wire nearly coincides with the period n/t of the currents sent from the transmitter—n being the number of lines per centimetre and t the time taken for a point on the circumference of the cylinder to travel 1 centimetre—there is a great tendency for the wire to vibrate intensely and so not respond exactly to the widths of the lines, which widths constitute in effect the tones in the photograph. Also in transmitting a half-tone photograph with n lines per centimetre, there is always a tendency for the wire to swing with a frequency n/t. A very dead-beat effect is, however, obtained by inserting a cell in the line circuit, and shunting a regulating resistance on the galvanometer, as indicated in Fig. 1, and by keeping the moment of inertia of the string to a minimum value.

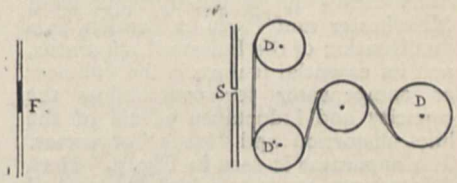


FIG. 2.

I have obtained useful photographic records of the movements of a string galvanometer of very small inertia, in the manner shown in Fig. 2. Here the light from a Nernst lamp N is projected through the hole in a string galvanometer, where it is intercepted by the magnesium shutter F attached to the strings; the shadow of the foil covers a slit S (perpendicular to the surface of the paper), and as F moves aside (when current passes through the wires), the effective width of the slit is increased; a revolving sensitive film is actuated by the drums DD, worked by clockwork. The result of transmitting a half-tone photograph, and receiving the same by optical

photographic means, is seen in Figs. 3 and 4; an artificial line was used. By means of this apparatus much valuable information has been obtained relative to the effects of capacity and inductance in long cables, some particulars of which I hope to publish shortly; the effect of capacity is to widen the "teeth" and make one run into the next.

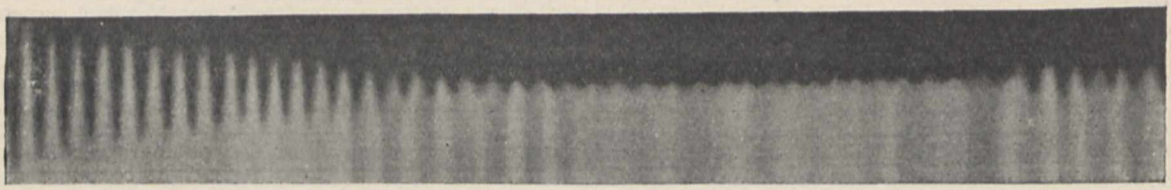


FIG. 3.—A graduating tint in a half-tone photograph represented as a series of waves of diminishing intensity.

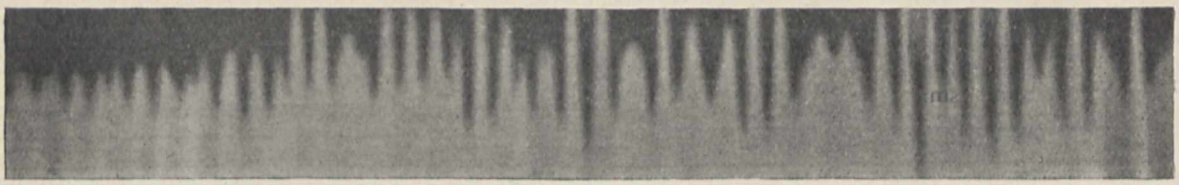


FIG. 4.—Dots of varying size in face of a portrait represented as waves with different maximum ordinates.

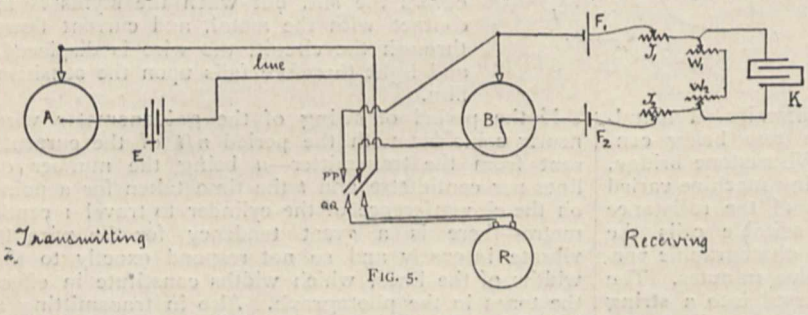


FIG. 5.

The telectrograph, which is at present being extensively used for transmitting news photographs from Manchester and Paris to London, is a modification of the Bakewell apparatus, and its essential feature is the balancer or compensator for overcoming the capacity and inductance effects of the line—distortion and "leads" of waves. The apparatus is seen in Fig. 5. Here A is a brass drum to which is attached the half-tone photograph—printed upon lead sheet, and pressed therein so that an even surface is offered to the stylus, which is provided with an iridium point E is the sending battery. The current received flows into two tongues, which are ordinarily in contact with the platinum pins PP, which lead the current to the drum and stylus of the receiver, on the former of which is placed moist absorbent paper containing the necessary chemical matter to give, by electrolysis, a coloured mark when current passes through it. At the end of the revolution, which is finished *before* that of the transmitting cylinder, a metal check arrests further movement, and the motor merely revolves a friction clutch. When the transmitting cylinder has now completed *its* revolution, the tongues being now in contact with the pins QQ, a contrary current is transmitted by means of a reverser, and this passes into the polarised relay R. The relay actuates, through a local battery, a magnetic release which draws away the check, so that the receiving drum starts off again. This means of synchronising is one in frequent commercial use, and was employed by Prof. Korn in his telautograph, and (with slight modification) in his selenium machines.

Now if a photograph transmitted as above be received direct on the chemically prepared paper, it would be blurred beyond recognition, owing to the distortion and the secondary discharges due to the line, A small dot would appear elongated as follows:—Where a succession of dots should be received, each one would run into the next, and if at a certain moment the action, after such a series of dots, should cease abruptly—corresponding to a "white" or "high-light" in the photograph—it would, on the

FIG. 6.—Telectrographed from Manchester to London.

FIG. 7. Telegraphed over artificial line of 2000 Ω by Thorne-Baker telectrograph.

contrary, not cease for perhaps a quarter of a second, a tapering chemical line trailing after the last correct mark. The balance as shown in Fig. 5 effectually stops this; two secondary cells, F_1 and F_2, are shunted on to the line through variable inductances, J_1 and J_2, and send a reverse current into the line and variable resistances, W_1 and W_2, while from the sliding contacts of the latter a variable capacity K is fitted. By carefully observing the character of the image on B during the first two or three revolutions, one can at once counteract the line effects by regulation. In the Thorne-Baker telectrograph there are seventy-five turns of the cylinder per inch travel of the stylus, and the cylinder revolves once in two seconds. A result obtained with it over an artificial line (resistance of 2000 Ω) is shown alongside one transmitted from Manchester to London (Figs. 6 and 7). Fig. 8 shows a photograph transmitted by Korn's telautograph from Berlin to Paris, and Fig. 9 a line drawing transmitted by that system over an artificial line of resistance 1000 Ω.

Experiments are at present being made to transmit pictures and photographs by wireless telegraphy, but considerable modification of the ordinary arrangements is necessary, as the number of signals to be sent per second is very much greater than in the case of word telegraphy. The problem is, in fact, comparable with that of wireless telephony, whilst synchronisation has also to be arranged. The later results I have obtained with purely experimental apparatus are sufficiently good technically to show that the problem is one within the limits of commercial practicability.

T. THORNE-BAKER.

FIG. 8.—Telegraphed from Berlin to Paris by Korn telautograph.

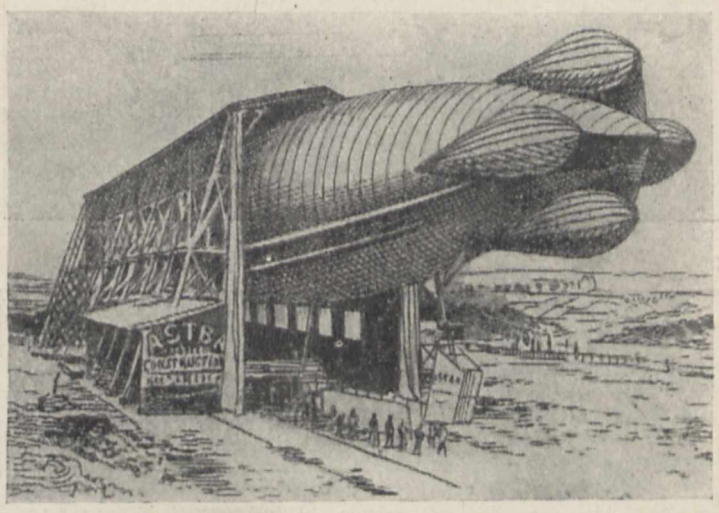


FIG. 9.—Telegraphed over an artificial line of 1000 Ω by Korn telautograph.

SIR CHARLES WILSON.[1]

THE life of Sir Charles Wilson, by his friend Colonel Sir Charles Watson, belongs emphatically to that class of biography which, as Carlyle held, ought to be written. Whether it is destined to be read by any large circle is another question. We might occupy much space in a discussion as to the exact degree of distinction in the subject that justifies a published biography were it not a question that settles itself automatically. We may, at any rate, congratulate the future historians of the Victorian and post-Victorian epochs in that they will have to look for their raw material, not among dusty and almost illegible manuscripts, but plainly set out in fair print and duly classified and catalogued by the librarians. Of such materials as this "Life" will future history be made.

Wilson's career was one of those which are still common in this country, but tend to get rarer and rarer with the advance of democratic ideals, a career devoted to the public service, and of the highest usefulness, unrecognised by, and almost unknown to, the ordinary world of newspaper readers. We might, if inclined to a satirical vein, say that its very obscurity is the best evidence of the value of such a career, seeing that it is often only on some shortcoming, either actual or supposed, that the outside world becomes conscious of the existence of the man in question. Thus in Wilson's case, were it not for the accusations, long since withdrawn as totally unfounded, of a failure on his part to do all that was humanly possibly to relieve Khartum before its capture by the Mahdi, his name would possibly be little known.

Passing over the period of childhood and adolescence and his entry into the Royal Engineers, the first important post that Wilson filled was that of secretary to the British Commission for delimiting the boundary between the United States and Canada from the Lake of the Woods to the Pacific along the 49th parallel of latitude. This line was marked out by astronomical methods, a procedure now known to be liable to the defect that the observations at each station are subject to an unknown error due to the force of local attraction or the deflection of the level. At the present day such a line would be delimited by means of a triangulation. In 1858, however, survey methods had not developed enough for this to be practicable, at all events within any reasonable limit of time, and the only possible course was taken. That the line as then marked out, and as it remains to this day, was not a true parallel of latitude, but a wavy line departing from the truth to distances of some hundreds of feet on either side, was of secondary importance. The urgent point was to get some acceptable boundary laid out upon the ground, and so marked that nobody could have any doubt as to which side of the line they were on at any given moment.

With the technical work of the Commission in the field, Wilson had, however, little to do; his duties were of a more arduous character. The

[1] "The Life of Major-General Sir Charles William Wilson, Royal Engineers, K.C.B., K.C.M.G., F.R.S." By Colonel Sir Charles M. Watson, K.C.M.G. Pp. xv+419. (London: John Murray, 1909.) Price 15s. net.

country traversed by the line was in parts almost unknown, and, as regards all the western section, of an extremely wild and mountainous character. The winters were very severe, and the difficulties of travel formidable. In such circumstances it may well be understood that the responsibilities of Wilson's position, he being then little more than a boy, entrusted with the duties of commissariat, store and transport officer, were great.

Jebel Musa.

Jebel Serbal.

The Problem of Mount Sinai. From "The Life of Major-General Sir Charles William Wilson."

Not long after the termination of this commission, he had an opportunity of taking up a work of a somewhat different character, a work which at intervals occupied his energies for a large part of his life—the survey of Palestine and the surrounding regions. It is not the place here to recapitulate, even in briefest summary, the services rendered by him and other officers in this great undertaking; those curious may consult the maps and records of the Palestine Exploration Fund, or may read the account of Wilson's share of it in the work before us.

After his return to England in 1866, and his marriage in 1867, he again went to the East to carry out a special task for the same body, the survey of the Sinaitic Peninsula, with the object of illustrating and elucidating the events of Bible history. Pre-eminent among the points to be investigated was that of the identification of Mount Sinai, then a disputed question, some authorities contending for a mountain called Jebel Musa, and others for Jebel Serbal. Wilson's party, including, it should be remembered, the late Prof. E. H. Palmer, afterwards murdered by Bedouins in the same country, unanimously came to the conclusion that Jebel Musa was the true Sinai of the Exodus. This view is now generally accepted, and it is this mountain which is pointed out to passengers in mail steamers proceeding southward from Suez. The late Sir Richard Burton, however, always refused to accept it, and maintained that the honour belonged to one of the minor peaks to be found along the pilgrim road from Suez to Akaba.

Wilson's share in the Nile expedition of 1884, and in the attempt to relieve Khartum and rescue Gordon, is dealt with at length. We have already alluded to the abortive attack upon him for a failure in no wise his fault, and it may be fairly conjectured that the author, himself a life-long friend of Gordon, welcomed this opportunity of putting on record his version of the history of that troubled time, especially so in view of the opinion strongly held by him that Lord Cromer, in his "Modern Egypt," was less than fair to Gordon, and gave evidence of a certain want of understanding of his character.

The other work that filled Wilson's busy life we must pass by with slight notice. In 1878 he was appointed to delimit the Turco-Servian frontier, and he afterwards served as Consul-General in Servia. He was for seven years, 1886–94, Director-General of the Ordnance Surveys, a post that he filled with efficiency, though his rule was not marked by any striking advances. From 1895 to 1898, the date of his retirement from the army, he held the office of Director of Military Education. After his retirement he twice again visited Palestine, and in 1901 was elected to the chairmanship of the executive committee of the Palestine Exploration Fund, a position which he held until his death in 1905. He was the recipient of numerous honours, being elected a Fellow of the Royal Society in 1874. The present biography is written in a simple and unpretentious style. It may be cordially recommended to all those to whom the history of the events of which it treats is of interest. The general reader may also find a certain attraction

in this account of a man who possessed a personality of rare charm, and, without any commanding intellectual equipment, lived a life of high accomplishment.

E. H. H.

TECHNOLOGICAL SCIENCE IN GERMANY.

WHAT are the chief causes to which the remarkable industrial progress made by Germany in recent years is attributable? This is the question M. E. Leduc sets himself to answer in a paper[1] which, though written primarily for his compatriots, is also of much interest to others.

On the morrow of Jena the outlook in Prussia was sorry indeed. The country was poor, the population sparse; there were no manufactures, and not much commerce. Few roads, and those bad; an ill-equipped postal service; little money, and the kingdom ringed around with tax-offices: such is the picture drawn of the land which lay there bleeding after Napoleon's victory in 1806. Yet now, little more than a century after, the vanquished of Jena have not only ousted their conquerors from the position of military predominance, but are steadily forcing them, and others, from their coigns of vantage on the fields of industry and commerce.

M. Leduc first outlines the earlier steps which led to this industrial advance—the revival of national sentiment, the removal of class barriers and other mediæval restrictions upon freedom—and then deals at length with the two causes which he holds to be the principal factors in the great modern expansion of German commerce, namely, education and cooperation.

By "education" here is meant education in applied science. First, as regards the teacher; the ideal is a man possessing a thorough knowledge of his subject, a teaching aptitude, and a certain quality of industrial practicality. This last is the touchstone. In technological training the aim should be to impart the scientific spirit rather than to let the student lose himself in "pure" science. Otherwise his intellect is apt to become somewhat mummified; and so far as industrial fertility is concerned he presently, college days being over, comes to resemble the fig-tree of scripture, which bore nothing but leaves.

This leaven of practicality is traceable in all the German technical science training. The professors at Charlottenburg are not merely college dons; some, for example, are chiefs of factories, others are the proprietors of commercial laboratories. The students in the technical institutes brew beer, distil spirits, and bake bread, all on a manufacturing scale, and all for sale in the ordinary way of trade.

From the description given it appears that the German instruction in technological science may be broadly classified into four divisions. First, there is the comprehensive training which is to turn out the future captains and leaders of industry. Next, provision is made for putting trustworthy information on technological matters at the disposal of the trading community. Thirdly, central institutions are established where certain industries—*e.g.* brewing, sugar-production—are studied scientifically and practically. Fourthly, there are local technical schools adapted to the special needs of particular localities.

Under the first category comes the famous High School of Technology at Charlottenburg. Here a complete course of instruction in any of the leading branches of technology is obtainable. The scale upon which the institution is equipped may be best shown, perhaps, by the following summary of the professorial staff:—

Section	Professors	Privats-docent
Architecture	21	12
Civil Engineering	13	8
Mechanical Engineering	20	14
Maritime Engineering and Naval Construction	6	1
Chemistry and Metallurgy	15	20
Mathematics and Natural Science	18	15
Foreign Languages	4	—
	97	70

In M. Leduc's opinion, specialisation and the more definitely practical character of the instruction are the points on which the German system shows itself superior to the French. It was all very well a century ago to say "Technical science is one subject; every manufacturer must know it in all its branches or be dubbed incompetent"; but this, like other formulas, has become antiquated, and the world has outgrown it.

Supplementing the tuition in technological science indicated above comes the work of the laboratory at Gross-Lichterfeld. This is a large establishment, covering an area of 10,360 square metres. Its duties are (*a*) to carry out researches, and to make examinations and analyses of materials both for public departments and for the trading community, issuing certificates and valuations based upon the results obtained; and (*b*) to arbitrate, on request of both parties, in matters of litigation concerning the composition and properties of commercial products. In addition, practical instruction in the testing of materials is given to certain students from Charlottenburg; and, as far as circumstances permit, assistance is rendered to persons pursuing special researches. Fixed fees are payable for the services of the laboratory; and the certificates issued are commonly used in commercial transactions as proof of the composition and properties of the articles described upon them. There are six sections, dealing respectively with metals, building materials, paper and textile fabrics, oils, general analytical chemistry, and metallography.

In the third class come the special institutes devoted to various agricultural industries; for example, sugar production, brewing, distilling, milling, and baking. Each of these has its institute, splendidly—nay, lavishly—equipped, not only for the training of students, but for research into any special problem of the industry. One feels, says M. Leduc, speaking of the sugar institute, that money without stint has been given to assemble here everything required for the study of beet-sugar production, and everything is the most perfect of its kind.

Now, in its origin and development this industry is notably a French one, yet Germany has outstripped France in its exploitation, and produces nearly three times as much sugar. Why? Because in Germany the production is organised and unified. "Germany is the land of cartels; jealousy of one's neighbour is unknown. The sugar factories all accept one and the same guidance, namely, that given them by the Institute at Berlin, which is richly endowed by the manufacturers. Prof. Herzfeld, to whom neither money nor help is begrudged, studies for all, and everybody profits thereby."

Similarly in the milling and baking industry,

[1] "L'Organisation syndicale et technique en Allemagne." By M. E. Leduc. (Bulletin de la Société d'Encouragement pour l'Industrie nationale, Octobre, 1909.)

important problems have arisen which could not be authoritatively solved by practical experience only. It was recognised that, as in other industries, the one condition of progress was the founding of an institution devoted solely to the study of cereals, and in which every detail of the questions at issue could be submitted to rigid experimental investigation. Accordingly the required institute was established. It was erected at the expense of the State, but receives subventions from the Chamber of Agriculture, the Society of Millers, and others.

Finally, for the specific assistance of certain local industries, technical schools exist, the particular instances quoted being the professional college of ceramics at Buntzlau and a similar but more restricted institution at Lauban. The instruction here is less generalised than at Charlottenburg, the aim being to impart an artistic and technical education suited to the special requirements of the locality.

As regards cooperation, a good deal is said, but we are only concerned here with its bearing upon technological progress, not with its purely trade aspects. Associations of manufacturers are formed, and if, for example, it is required to carry out some special research, they may give subventions for the purpose to technical colleges or to individual experts; or a commission may be nominated to make experiments; or chemists and engineers may be dispatched abroad to study new processes and new apparatus. Thus even a small manufacturer can keep himself abreast of progress in his department, and researches altogether too costly for single firms can be carried out by spreading the cost over the whole association. As concrete examples may be mentioned (1) the makers of explosives, who maintain an experimental laboratory with firing ground and testing station at an annual cost of 200,000 marks; and (2) the association of Portland cement manufacturers, who, for the reputation of German cement, make stipulations as to quality, and support a laboratory where each member's product is examined to ensure that it conforms to the requirements.

Lack of space forbids us to follow M. Leduc further in his study of this most interesting question, but the keynote of the whole matter is organisation. There is first an intelligent appreciation of the benefits which science can render to industry; next a liberal but carefully-bestowed provision for instruction of her sons in the applications of science; and then, by her organised system of trade syndicates, Germany pushes home the advantage gained through her equally well-organised system of technological education.

C. SIMMONDS.

PLAGUES OF LOCUSTS IN SOUTH AFRICA.

FOR the past three years an organised effort has been made by the Governments of the South African colonies to destroy the swarms of locusts that from time to time invade the cultivated districts and ravage the crops. The third annual report of the Central Locust Bureau has lately been issued under the editorship of Mr. C. P. Lounsbury, the entomologist for the Cape.[1] Together with the two previous reports it furnishes a very instructive demonstration of what can be done by enlightened executives working harmoniously on scientific principles. The Central Bureau comprises representatives of the Cape, Natal, Transvaal, Orange River Colony, Southern Rhodesia, Bechuanaland, Basutoland, Swaziland, Mozambique, and German South-west Africa, its influence thus overstepping political boundaries. It acts by collecting and spreading information about locusts and their migrations throughout the district of its operations, the actual work of repression or extermination being undertaken by the local governments separately.

Two species of locust periodically become serious plagues in South Africa. The red-winged locust (*Cyrtocanthacris septemfasciata*) infests, in various seasons, the east coast districts, migrating in spring and summer, and retiring to the forests in winter. The young locusts are active and most destructive during January and February. No serious invasion of this species was observed in Natal and the neighbouring districts between 1846 and 1893. Whence the migrating swarms come has not been certainly determined, but the Zambezi region is regarded as their probable home. Since 1893 there have been several plagues of this locust in the British colonies, notably in 1907–8, when more than 33,000 swarms were destroyed in Natal. During 1908–9 the insects were by far less numerous; nevertheless, it is computed that a loss of 250,000*l.* from damage to crops was prevented by the exertions of the locust officers.

The brown locust (*Pachytylus sulcicollis*) has its headquarters in the Kalahari Desert, whence swarms migrate into the settled central regions of the South African colonies. The eggs of this species are laid in winter, and are incited to hatch by the influence of the summer rains. Dry conditions lead to postponement of hatching, possibly for a term of more than three years, and such "suspension of animation" is obviously of advantage to a desert-haunting species. Like the red-winged, the brown locust was less numerous and destructive in 1908–9 than in 1907–8, which seems to have been a year of exceptionally severe attack. In March of last year, however, enormous swarms of this species invaded Cape Colony from the north, overspreading an area of 125,000 square miles, so that during the summer of 1909–10 great care and energy will be needed to keep the pests in check.

According to Mr. Lounsbury, no preventive measures can be taken in the "uninhabited and practically waterless wastes" whence the great swarms migrate into the colonies. Attention must be directed to the destruction of the young locusts hatched from the eggs laid by these winged swarms. The young insects during their preparatory stages, while the wings are still undeveloped, are known as "hoppers" or "voetgangers" by the English or Dutch farmers. It is these young locusts that ravage the crops to so terrible an extent, and if the insects be left alone, successive generations may follow each other in the settled districts that are invaded. The farmers, therefore, assisted by the Government, are urged to make war on the "hoppers." Burning grass lands, and poisoning with a sweetened solution of soda arsenite, are the means of combat now in general use. During the locust-campaign of 1907–8, forty-three tons of soda arsenite, ninety-eight tons of sugar, forty tons of treacle, 150 water-tanks, and 5000 pumps were provided, and nearly 12,000*l.* was expended.

In his warfare against the locusts, man finds valuable allies in several species of birds, which pursue the locust swarms, and sometimes well-nigh exterminate them. Kestrels, the "locust bird" (*Glareola melanoptera*), and the white stork are especially active as locust-eaters. It is of great interest to find that two white storks observed devouring locusts in Basutoland in January, 1909, bore leg-rings with inscriptions showing that the birds had migrated from northern Germany in the preceding autumn.

G. H. C.

[1] Third Annual Report of the Committee of Control of the South African Central Locust Bureau. Edited by Charles P. Lounsbury, Government Entomologist, Cape of Good Hope. (Cape Town, 1909.)

NOTES.

THREE British expeditions are likely to be engaged in the exploration of the Antarctic before long. In April last Dr. W. S. Bruce described his plans for a Scottish Antarctic expedition; in September Captain R. F. Scott appealed for support for an expedition which will leave London in July next; and Sir Ernest Shackleton, who has been presented with the Nachtigall gold medal of the Berlin Geographical Society, announced in a speech at Berlin on January 9 that he proposes to begin the preparations for a new expedition when he has completed his work and lectures relating to the achievements of the last expedition. Captain Scott has just received a letter from the Treasury informing him that Parliament will be asked next session to vote a sum of 20,000*l.* towards the cost of his expedition to the South Pole. The sum he asked for in appealing for funds was 40,000*l.*, and the total amount now subscribed and promised is 31,000*l.*, so there should be no difficulty in raising the additional 9000*l.* before the expedition starts. In all probability the amount originally asked for will be considerably exceeded. The expedition will sail in the *Terra Nova*, and the money already subscribed is sufficient to equip the vessel for her voyage. After departing from London the ship will call at Cardiff for coal, and will then proceed south *via* the Cape and Australia and New Zealand, and will leave the last-named place for Antarctic regions early in December. Though the undertaking is described by Captain Scott as "an all-British expedition," it is unfortunate that the announcement of the proposed Government grant of 20,000*l.* has been received with mixed feelings by geographers in Scotland. A circular letter which has reached us from Mr. J. G. Ferrier, secretary of the Scottish Oceanographical Laboratory, Edinburgh, deplores the fact that last November Dr. Bruce was refused a Government grant toward the equipment of an Antarctic expedition then being organised in Scotland, though in the words of Prof. James Geikie, president of the Royal Scottish Geographical Society, "no one is better fitted to carry such an enterprise to a successful conclusion, and the scientific results he has obtained have not been surpassed in interest or importance by the work of any living explorer in high latitudes." While we gladly acknowledge that Dr. Bruce has done splendid work in Antarctic regions with limited means, and regret that Government support for the proposed Scottish expedition has not been forthcoming, we think that in a matter of this kind it is undesirable to appeal to the Scottish public "to stand up for this and other Scottish rights." The claims of an expedition to support from the State for Antarctic exploration must surely be scientific and not political. Because we have confidence in Dr. Bruce's scientific ability and experience we trust that the funds will be provided for the expedition he is organising. Three British expeditions approaching the highest southern latitude from different bases would make for national credit and scientific progress.

THE annual general meeting of the Iron and Steel Institute is to be held at the Institution of Civil Engineers, London, on May 4 and 5, and the autumn meeting at Buxton on September 27–29 next. The council of the institute will proceed shortly to award Carnegie research scholarships, and application must be made before February 28. The awards will be announced at the autumn meeting.

A COMPANY is being formed in America by Dr. Aaron Aaronsohn, a Turkish agronomist, to investigate the agriculture of Palestine with the view of finding plants that will resist drought in the United States. The inquiries will be carried on through an experiment station at Haifa, which will exchange information with the Department of Agriculture at Washington.

THE death is announced at Bayonne, New Jersey, of Mr. William Abner Eddy, in his sixtieth year. In 1890, while engaged as an accountant, he began the aërial experiments which made his name widely known. These included some of the earliest attempts at photography from kites and at measuring by the same means the temperature at various heights. In 1903 he experimented with model aëroplanes dismissed from the lines of kites in mid-air. Mr. Eddy also invented various devices for measuring the tremors of the earth.

THE Civil Service Commissioners announce that an open competitive examination for not fewer than three situations as cartographer in the Hydrographic Department of the Admiralty will be held in July next, and that copies of the regulations and syllabus may be obtained at once from the secretary, Civil Service Commission, Burlington Gardens, London, W. Forms of application for admission to the examination will be ready for issue towards the end of January, and will then be obtainable on request, by letter, addressed to the Secretary of the Civil Service Commission.

THE opening lecture on January 6 of a course on parasitology, which Prof. R. Blanchard is delivering at the Paris Medical School, was made, the Paris correspondent of the *Times* reports, the occasion of a demonstration of the cordial relations existing between French and British men of science. Prof. Blanchard devoted the lecture to an account of the progress made by British men of science, and especially by the Liverpool School of Medicine, in parasitology and in the treatment of tropical diseases. Since the foundation of the Paris Institute of Colonial Medicine in 1902 through the initiative of Prof. Blanchard, friendly relations have been maintained between it and similar institutions in England and in Brussels, Hamburg, Lisbon, Naples, and Philadelphia. In 1903 pupils of the Paris institute visited the London school under the guidance of Prof. Blanchard, who has been to London and Liverpool several times. Sir Rubert Boyce, professor of pathology in the University of Liverpool, was present, and met with a flattering reception. In expressing his thanks, he dwelt on the importance of the work of Prof. Blanchard and his pupils in furthering the advance of parasitology.

BY the death of Colonel George Earl Church, on January 4, science has lost one of the most striking representatives of geographical studies in this country. He was born in Massachusetts, U.S.A., in 1835, and was educated as a civil engineer. In his twenty-third year he took part in a scientific expedition to South America, and was in later life closely associated with that continent. After distinguished service in the American Civil War and the Mexican campaign of 1866–7, he devoted himself to the problem of opening up communication between Bolivia and the Atlantic, and reached the Bolivian plateau by way of the Madeira and Mamore. Having satisfied himself that by the construction of a short line of railway round the cataracts of the Madeira a large area of Brazil and Bolivia would be opened to commerce, he obtained a concession, funds were raised, and work commenced. Unfortunately, as a result of malaria, financial and political intrigues and litigation, it was found impossible to carry

out the undertaking, and the ruins of the abandoned railway remained an object of melancholy interest to travellers until in recent years the construction of the line was once more put in hand. After a successful career, during which he was engaged in advising on or carrying into execution important operations in different parts of the world, he took up his residence in this country. He contributed some suggestive papers to the *Geographical Journal*, including one on the physical geography of South America, and as president of the Geographical Section of the British Association delivered an address on the ancient Pampean Sea of the Argentine. He will best be remembered for his contributions to the discussions of the Royal Geographical Society, in which he entertained his audience from his inexhaustible stores of personal reminiscences and historical reading. He served on the council of the society, and held at one time the position of vice-president.

THE first part of the fortieth volume of Gegenbaur's *Morphologisches Jahrbuch* contains an exhaustive treatise, by G. P. Frets, on the lumbo-sacral plexus of monotremes, which will be indispensable to all future students of this extremely variable part of the nervous system. By way of comparison, the author also deals with certain other forms, notably Sphenodon, giving a detailed account of the myology of the hinder extremity in this important type.

THE sixth part of the *Sammlung anatomischer und physiologischer Vorträge und Aufsätze*, edited by Profs. Gaupp and Nagel, consists of an interesting memoir, by Dr. H. Schridde, on "Die ortsfremden Epithelgewebe des Menschen." The author deals with epithelial abnormalities of various kinds, and endeavours to interpret them in a philosophical spirit from the points of view of phylogeny and ontogeny. His observations have thus more than a merely medical interest, although no doubt they will be appreciated mainly by the student of cellular pathology.

THE *Quarterly Journal of Microscopical Science* for December, 1909 (vol. liv., part iii.), contains the third part of Dr. Gordon Hewitt's important memoir on the structure, development, and bionomics of the house-fly. A short account is given of the part played by flies in the dissemination of disease, which we could wish to see republished in a popular form and distributed broadcast. It is difficult to exaggerate the danger to which human beings expose themselves by uncleanly habits in relation to filth, food, and flies, and it is equally difficult to comprehend the indifference which even "educated" people show on this subject—except as the result of gross ignorance and want of observation. The information which Dr. Hewitt has collected with regard to the mutual relations of flies and soldiers in camp, and flies and typhoid patients in hospitals, ought to be sufficient to convince anybody who does not at once set it aside as too nasty for consideration. Unfortunately, the study of nastiness is a necessary preliminary to its removal.

IN view of the renewed interest which has lately been manifested in the difficult problem of the origin of vertebrates, zoologists will welcome Prof. MacBride's contribution to the subject in the *Quarterly Journal of Microscopical Science* (vol. liv., part iii.). Though dealing primarily with the formation of the layers in Amphioxus, this paper includes a discussion of the corresponding processes in the higher vertebrates, with special reference to the views recently expressed by Prof. Hubrecht, with which Dr. MacBride by no means agrees. We must note the addition of two new inmates to the zoological Noah's Ark of imaginary animals, viz. the "Pleuronectid" ancestor of Amphioxus, which, with a number of enormous round holes on its flattened back to represent gill-slits, appears none too well adapted to its environment, and "the common ancestor of Vertebrata, Enteropneusta and Echinodermata," which looks like a mixture between several well-known larval forms. Whatever reception they may accord to these imaginary ancestors, however, most zoologists will probably be grateful to Dr. MacBride for his expressed opinion that, "in starting with Mammalia, and reading their complicated processes into the development of lower Vertebrata, Prof. Hubrecht has read the book of vertebrate development upside down."

A COPY of the Johns Hopkins University Circular, Medical Department, has been sent to us. It corresponds to our calendars or prospectuses, and contains full details of the courses of instruction given, with fees and time-table, and a list of graduates, endowments, publications by graduates, &c. It is published by the University, and can be obtained on application to the registrar.

BULLETINS Nos. 11 and 12 of the Sleeping Sickness Bureau have been issued, and contain full and useful summaries of various papers on trypanosomes and trypanosome diseases, and their agents of transmission. We would suggest that it would be a convenience to readers if the bulletins were issued with cut edges. The director will be glad to receive early copies of authors' papers for notice and for the library of the bureau.

WE have received a reprint of an article by Arthur Macdonald from the *Journal of Inebriety*, Boston, 1909, on the statistics of alcoholism and inebriety, which gives a useful summary for various countries. We are surprised to see it stated that drunkenness in London has risen from 537 to 566 in 1890–5 to 898 in 1904 and 859 in 1905 per 100,000 of population. Certainly the police-court records show the reverse, viz. a decline in drunkenness.

THE Johns Hopkins Hospital Bulletin for December, 1909 (xx., No. 225), contains another contribution on the subject of the ancient medical writers, essays on which have appeared in that journal from time to time. Prof. Eugene Cordell writes on Aretæus, the Cappadocian who lived probably in the second century of the Christian era, about the time of Galen. Many of his works are now lost, but such as remain portray very exactly the symptoms of disease, *e.g.* tetanus, epilepsy, and hysteria. He recognised the "murmur" of heart disease, and treated phthisis by life at sea.

IN a leaflet entitled "A Plan for the Study of Man," by Mr. Arthur Macdonald (from the Proceedings of the Imperial Academy of Sciences, St. Petersburg), an apparatus for the measurement of pain is described. This "temporal algometer" consists of a brass cylinder with a steel rod running through it. The rod is supported by a spring, so that varying pressures from 0 to 4000 grams may be applied, the amount being indicated by an attached scale. The rod has a disc 15 mm. in diameter, and covered with flannel at the end. It is applied over the temporal muscle; as soon as the subject feels the pressure to be in the least disagreeable, the amount of pressure applied is read on the scale.

WE have pleasure in directing attention to the artistically designed "Nature Calendar" published by Messrs. George Philip and Son, Fleet Street, E.C., at the modest price of sixpence. Horticultural notes, observations on the movements of birds, and hints for the collection of Lepidoptera are the features of this year's issue. Special notes

for the months refer to varying aspects of the weather in relation to outdoor phenomena and animate nature. The calendar is very suitable for the study and class-rooms where natural science is taught, both for the information supplied and as a suggestion for children to draw up a calendar for themselves.

OWING to the want of agreement between recent investigators of species of Isoetes, any additional information derived from the examination of different species, as the account by Miss A. G. Stokey in the *Botanical Gazette* (April, 1909), is of direct interest to botanists. The anatomy of four American species was investigated. The chief point of originality lies in the interpretation of the so-called "prismatic layers" formed centripetally by the cambium; the author dissents from the explanation, first offered by Russow, that certain of these cells are phlœm elements, but regards the whole of the prismatic layers as secondary xylem. With respect to the phylogenetic position of the genus, the author favours affinity with the Lepidodendreæ, on the ground of morphological characters.

THE identification of the lichens collected during the second Norwegian Arctic Expedition in the *Fram*, 1898 to 1902, chiefly by Mr. H. G. Simmons, was entrusted to Dr. O. V. Darbishire; the results are embodied in Report No. 21 of that expedition, together with a systematic enumeration of all the species—about 500—recorded from the Arctic regions exclusive of Alaska. The material brought on this journey from Ellesmere Land and King Oscar Land yielded more than a thousand specimens, from which 161 different species have been obtained, including the types of eight new to science. The fruticulose lichens play an important part in the vegetation; the various species of Cetraria occur in large quantities over wide areas. It is noted that no specimen of the reindeer moss was collected. The author institutes a comparison between the lichen flora of the Arctic regions, Germany, and the Tyrol to point out that nearly three-fourths of the species are found in the Tyrol and two-thirds in Germany.

THE *Kew Bulletin* (No. 9) opens with an article by Mr. W. J. Bean providing garden notes on some of the newly introduced trees and shrubs collected by Mr. E. H. Wilson in western and central China at elevations ranging from 2500 feet to 10,000 feet. A primary object of Wilson's expeditions was to introduce ornamental horticultural novelties in the shape of arborescent plants that would be hardy in the British Isles. Many of the plants raised from seed have already survived the rigours of more than one English winter. The plants selected for description are almost entirely monotypical genera. Another article by Mr. Bean refers to the Canadian wild rice, *Zizania aquatica*, recommending it for trial as an ornamental plant in ponds and backwaters. It is an annual requiring plenty of sunshine, and it is especially necessary to keep the seeds moist between collection and sowing. Dr. O. Stapf contributes an article on the perennial species, *Zizania latifolia*, which is cultivated in China for use as a vegetable, but cannot be recommended as an ornamental plant.

THE annual report from the Experiment Station, Tortola, Virgin Islands, records a year of steady progress. In the cotton industry the export of lint amounted to 52,528 lb., an increase of 2500 lb. over the preceding year. A lime industry on similar lines to the cotton industry has also been successfully started, the fruit being purchased from peasants at the experimental station. The Agricultural Department not only gives advice and assistance, but forms a direct market for much of the produce raised in the islands.

LUCERNE-GROWING in South Africa has, according to the *Agricultural Journal of the Cape of Good Hope*, recently suffered from a stem-infesting nematode, viz. *Tylenchus dipsaci* (*devestatrix*), which has hitherto not appeared in South Africa, although well known in Europe. The adult worm is a fifteenth of an inch long, and produces characteristic distortions and discolorations in the plant. Infested shoots only grow out a few inches; the whole plant languishes and dies in the course of about a year. The infection spreads in a variety of ways, and in time the entire crop is so badly attacked as to be not worth cutting or feeding off. Up to the present no successful means of combating the pest is known.

THE *Agricultural Journal of India*, issued from the Research Institute, Pusa, differs from most of its kind in that it is intended for the intelligent non-technical reader and therefore appeals to a wider class than the more technical memoirs issued from the same institute. One of its most interesting features is the description of native methods of cultivation, management of crops and of stock. In the current issue the Kachin cultivation of tea is dealt with. In other articles an extension of the area under fibre plants is urged, and methods of growing lucerne are described. Mr. Maxwell-Lefroy has a suggestive paper on the cultivation of shellac. The scale-insects of the genus Tachardia, which form shellac as a resinous covering, live on a variety of trees and suck out the sap; they occur to a very great extent in Indian forests, and are, indeed, already cultivated to some extent.

THE reports on the Botanic Station Experiment Plots and Agricultural Education, Antigua, are to hand. There has been a shrinkage in the number of acres planted in cotton in the island to one-third what it was last year, chiefly because of bad seasons and insect pests. Details are given of experiments with sweet potatoes, yams, and other crops. The sugar-cane experiments are carried out on an extensive scale, there being more than 1100 plots of varieties of canes and 256 plots of manurial experiments. Some interesting results are expected from the work on limes and broom-cotton. A new industry, the production of cocoa-nuts, has been started and promises success in certain districts where the conditions are favourable. The report from St. Kitts-Nevis also shows a great amount of activity; the principal industry being sugar production, much attention is given to experiments with the sugar-cane. A good deal of work is being done in cotton, now an established industry in the presidency, and likely to be of considerable economic importance. The report from Grenada deals with cacao, rubber, Sea Island cotton, and other crops. Some interesting experiments are recorded on mulching cacao, but the problem is not yet solved, because of the difficulty of getting plants to grow in the shade of a cacao plantation.

ATTENTION is directed in a recent number of the *Agricultural News* to the fact that about 20 per cent. of the bananas grown in banana-producing countries are unfit for export, and are often completely wasted. Attempts to make a saleable product by drying the fruit and producing banana flour have been only partially successful. Experiments made at the Central Laboratory, Guatemala, described at length in the *Journal d'Agriculture Tropicale*, have shown how to obtain from this waste material a spirit resembling whisky in flavour. The yield of spirit from each bunch of bananas is estimated at 4½ litres, and the cost of manufacture is said to be much less than that of whisky. Over a period of two years the process has proved to be a commercial success. A very similar

problem is discussed in the *Journal of Agriculture of South Australia*. The production of raisins has exceeded the local consumption, and as there is no prospect of a successful export trade, some new outlet has to be found. Experiments have therefore been made to ascertain whether raisins could be utilised in satisfying the local demand for strong spirit. Prof. Perkins's results led him to conclude that 150 to 154 gallons of proof spirit might be obtained from a ton of first-grade raisins, and 130 to 134 gallons from a ton of second-grade raisins, and he adds that on this basis raisins should be worth to the grower not much less than 20*l*. a ton.

BULLETIN No. 399 issued by the United States Geological Survey contains results of spirit-levelling carried out by the Survey in western Virginia during the years 1896 to 1908, with the cooperation of the West Virginia Geological Survey after 1901. The results have been compiled by Messrs, S. S. Gannett and D. H. Baldwin, and include all previously published data along with the newer observations, re-adjusted and re-arranged by quadrangles. Descriptions and elevations of bench-marks are given for forty-eight counties, furnishing vertical control for nearly half the State.

IN a paper published by the Department of Agriculture and Technical Instruction for Ireland (Fisheries, No. 7) Mr. C. M. Cunningham discusses the results of investigations on the drift of the Irish Sea made with floats of various kinds. The floats were distributed by making use of the many steamship lines radiating from Belfast and crossing different parts of the area under examination, and the experiments extend from June, 1903, to May, 1906; the total number of floats distributed was about 1200, and almost exactly half these have been found and the cards returned. The general result suggested is that there is a northward drift throughout the year, modified by a southward tendency during certain states of the weather, especially during the months of March, April, May, and June, when northerly winds are most apt to assert themselves. No instrument distributed north of a line joining Cork Harbour and the Land's End has been found to the south of it.

MR. D. W. JOHNSON contributes an interesting study of hanging valleys to the Bulletin of the American Geographical Society. Excluding the types of hanging valleys which are not definitely related to a main stream and its tributaries, as, for example, the valleys left hanging by the encroachment of the sea on south-east England and north-western France, and valleys raised above the level of adjacent plains by up-faulting, the author discusses the questions:—(1) are hanging valleys a trustworthy indication of glacial erosion of the main valley? and (2) may not hanging tributary valleys result from glacial widening of the main valley, instead of from glacial deepening? The investigation goes to show that hanging tributary valleys may be produced independently of glacial erosion, but valleys of this type are of rare occurrence, and that wherever the mouth of a hanging valley has been materially altered to the typical glacial trough form we must infer a greater or less amount of glacial deepening.

FROM the Survey Department of Egypt we have received a copy of "An Almanac for 1910," compiled at the Offices of that department, and published by the National Printing Department, Cairo, at the price of 25 millièmes (6*d*.). For anyone at all interested in Egyptian affairs this almanac is full of interesting information concerning the various Government departments and services, the railways, telegraphs and population, the meteorological elements and the rise of the Nile at various places, the geographical coordinates of the principal towns, &c. General and scientific matters are also well represented by conversion tables, ephemerides, &c. The ephemeris for Halley's comet is accompanied by figures showing its brightness on different dates and its times of rising and setting. A comprehensive index concludes this cheap and useful work.

AN interesting article, by Mr. R. H. Curtis, on the development and standardisation of sunshine recorders appears in *Symons's Meteorological Magazine* for November and December, 1909. The instrument first in use consisted of a hemispherical wooden bowl with hollow glass ball filled with water, invented by Mr. J. F. Campbell about fifty-six years ago, in which the charred wood gave a six-months' record, from solstice to solstice. A regular daily record was first obtained at Greenwich Observatory in 1876 by using a metal bowl, presented by Sir W. Armstrong, and a narrow strip of blackened card. So far as ordinary observers were concerned, there was some difficulty in the adjustment of the card, but this was overcome by Sir G. G. Stokes in 1879, who developed the Campbell-Stokes recorder and cards now in general use; only some trivial additions for adjustment have been made since, one of which is due to Mr. Curtis. Owing to the cost of this instrument, Mr. J. B. Jordan introduced a very ingenious photographic recorder in 1885, but the two forms of instrument do not register precisely the same thing, and after careful comparisons had been made of the results, the Meteorological Office decided to publish only the records of the burning instrument. A report upon the instruments is contained in the Quarterly Journal of the Royal Meteorological Society (vol. xxiv., p. 1), and the specification for the standard instrument has, with slight variation, been printed in the "Observer's Handbook," published by the Meteorological Committee. For obtaining uniformity of results, Mr. Curtis lays great stress upon the necessity of using cards of colour and texture similar to patterns preserved in the Meteorological Office. Other recorders, not in such general use, are not referred to in this article.

BULLETIN No. 395 of the U.S. Geological Survey contains an elaborate investigation, by Profs. Schlundt and Moore, of the radio-activity of the thermal waters of Yellowstone National Park. One of the most interesting points brought out is that the travertine of the old terraces contains very little radium as compared with that of more recent formation. The authors interpret this to mean that the hot water has effected a chemical separation between radium and its parent uranium, carrying off and depositing the former only. In course of time the radium in the travertine decays, and is not replaced by a fresh growth, as in normal radio-active minerals. Since some of the travertine is overlain by glacial boulders, this obviously gives a method of dating the Ice age in this district if the accepted rate of decay of radium be assumed and if we suppose that the material discharged by the spring has been of uniform quality throughout the interval. The figure at which the authors arrive is 20,000 years.

THE *Physikalische Zeitschrift* for December 15, 1909, contains a paper by Dr. J. J. Kossonogow, of the University of Kiev, on the application of the ultramicroscope to the study of the phenomena of electrolysis. He finds that when an electrolyte is examined under the ultramicroscope, at the moment the current is switched on there appear in the field of view a number of bright points of light which travel towards the electrodes with velocities of the same order of magnitude as have been found for

the ions. The path may be deviated by means of a magnet. When a point reaches an electrode it appears to attach itself and take a crystalline form. None of these appearances is observed in the case of a non-electrolyte, and the author considers he has proved beyond the possibility of doubt that the ultramicroscope provides a powerful means of studying directly the motions of the ions in electrolysis.

A SEPARATE copy has reached us of Prof. Zeeman's paper on the degree of completeness of the circular polarisation of magnetically divided lines, which was communicated to the Academy of Science of Amsterdam on October 30, 1909. It will be remembered that a luminous gas in a strong magnetic field gives a spectrum which, when viewed along the lines of the field, consists in the simplest case of two lines, which according to Lorentz's elementary theory of their production should be circularly polarised, one right-, the other left-handed. On examination of lines which normal to the field become triplets, quartets, sextets, and nonets, Prof. Zeeman finds that in each case, whether along the field a line becomes a doublet or a quartet, the lines so produced are circularly polarised, and the degree of circular polarisation found approaches more and more to completeness as the intensity of the light transmitted by the instrument increases. The orbits of the electrons in planes perpendicular to the magnetic field are therefore almost exactly circular.

IN an article in *Engineering* for December 31, 1909, on the command of the air and its effect on land warfare, some interesting points are dealt with. We may probably quite disregard the idea of balloons being used to drop bombs into towns for the sake of wantonly destroying private property. There are other and more legitimate ways in which the command of the air may probably be the deciding factor in a war. There is the facility it gives for ascertaining an enemy's disposition and movements, and flying machines may be of great use in war by acting on an enemy's communications. There is no reason why such machines should not start from a ship as well as on land, and, if capable of flying 300 miles, would have a striking distance of 150 miles inland from an enemy's coast. At present it looks as if the aëroplane rather than the navigable balloon would become universal, owing to its being faster, quicker at turning, harder to hit, and very much cheaper.

IN an article on latter-day developments of the American locomotive in the *Engineering Magazine* for December, 1909, Mr. H. Keith Trask deplores the fact that American locomotive practice has followed rather than led European practice in matters of design relating to increased efficiency from the standpoint of economy. Thus European designers had long considered the advantages offered by superheated steam before the question was seriously taken up in America. Cheap American fuel was responsible for this neglect, but the recent developments of the compound locomotive have rendered the American designers alive to the benefits resulting from the use of superheated steam. As developed for use on American railroads, the superheater is of two types, the smoke-box and the fire-tube. While both types were originally introduced several years ago, it is only within the past twelve or eighteen months that the American railroad world in general has awakened to their possibilities, and they are being applied to many new engines now building for various roads. The Canadian Pacific was the first road to adopt the fire-tube superheater exclusively, and the Santa Fe, although not the first road to test the smoke-box design, was the pioneer in adopting this device as a standard.

ONE of the chapters in the recent report of the U.S. Commissioner of Education deals with education in Central Europe. Among much other information of interest in this chapter is a reference to the attempt of Prof. Du Bois-Reymond, in his work on inventions and inventors, to prove that inventive productivity in different countries depends on social factors. General education, density of population, transportation facilities, social organisation, and so on, he maintains, determine this productivity, and despite the participation of working men in State affairs comparatively few patent applications come from them. The result of an inquiry made in 1900 shows that in England 15,300 applications for patents were made, or 37 to every 100,000 of inhabitants, and that the percentage of illiteracy was 3·7. In the United States the corresponding numbers were 22,900, 30, and 6·2, the percentage of illiteracy in this case being of the white population above ten years of age. In Germany the numbers were 14,800, 26, and 0·05. In France, however, only 7020 patents were applied for, or 18 per 100,000 inhabitants, the percentage of illiteracy being 4·6. The numbers in Italy, again, were 1030, 3, and 33·8 per cent. of illiteracy. Race characteristics, in other words, do not predetermine the inventive productivity of a country, nor does the high proportion of literates, but social factors, especially the high status of industry, do determine it. England, the United States, and Germany, the countries having the best developed systems of industry, are the most productive in inventions. Germany alone had, in 1900, 1500 patent applications concerning technical contrivances relating to electricity.

OWING to the death of the late Colonel Bingham, editor of the "Fauna of British India," no volume of the series has been issued for some time. This month, however, Mr. Malcolm Burr's half-volume on the earwigs of British India will appear, which is the first monograph on the Dermaptera which has been published since De Borman's monograph in "Das Tierreich." It will contain a description of a number of new and recently established genera, and will be well illustrated.

OUR ASTRONOMICAL COLUMN.

HALLEY'S COMET, 1909*c*.—Some interesting measures of Halley's comet, made with the micrometer of the Yerkes 40-inch refractor, are published by Prof. Barnard in No. 605 of the *Astronomical Journal*. With this large telescope the comet was quite an easy object, and the measures should be good; but, as Prof. Barnard suggests, the edges of such a nebulous body are not easy to set on.

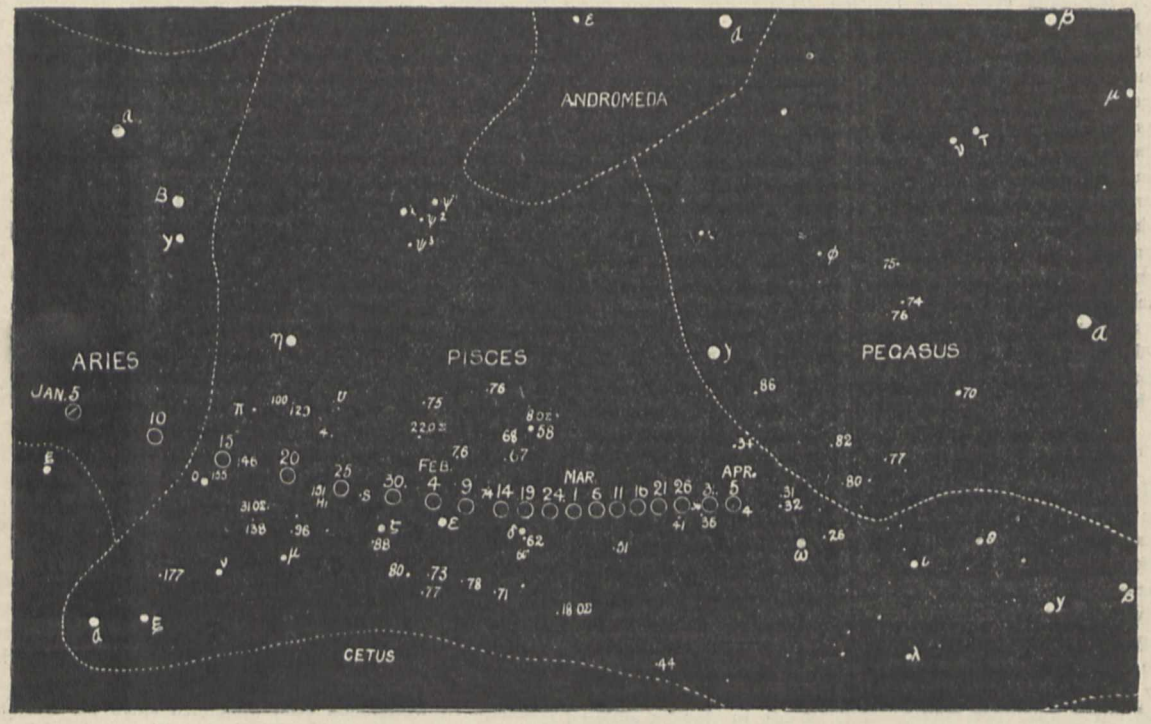
The measures extend up to November 30, 1909, when the estimated magnitude was about 11·0, and the comet showed a condensation of some 7″ diameter. The diameter of the whole object was 41″, and possibly an ill-defined nucleus was seen, but this feature was very doubtful. From September 17 to November 14 the measured diameters, reduced to miles, ranged from 16,400 to 9200 miles, the mean being 12,600 miles, or about 1½ times the earth's diameter.

At the December (1909) meeting of the Royal Astronomical Society, reported in No. 418 of the *Observatory*, the Astronomer Royal announced that a photograph secured with the Reynolds reflector at Helwan, on August 24, shows the comet's image; its position agrees within 0·12s. in R.A. and 1·7″ in declination with the position calculated from the Cowell-Crommelin orbit corrected by the Greenwich observations. Messrs. Keeling and Knox-Shaw are to be congratulated heartily upon securing the first known photograph of the comet.

In No. 25 of the *Gazette astronomique*, Signor Pio Emanuelli discusses the probable encounter between the earth and the comet's tail in May next. At 10 a.m. (G.M.T.) on May 18 the comet will pass the descending

node of its orbit, whilst the earth will pass the same point eighteen hours later. For an encounter between the tail and the earth to take place, it is shown to be necessary that the latter should be 22,100,000 km. (13,812,500 miles) long, and that its breadth should be such that it extends, from its axis earthwards, 400,000 km. (250,000 miles).

The accompanying chart shows approximately the apparent path of the comet, according to Mr. Crommelin's ephemeris, up to April 5.



Apparent Path of Halley's Comet, 1910, January 5–April 5.

THE TOTAL SOLAR ECLIPSE OF MAY 8.—From the *Times* of January 5 we learn that Australian observers are already well advanced in their preparations for the observation of the total eclipse of the sun, in Tasmania, on May 8. The conditions of the eclipse—the sun's altitude will be only about 8°—are not sufficiently favourable for the sending of a Government expedition from this country, but the Australian Eclipse Committee is being assisted, by the loan of instruments, &c., by the Joint Eclipse Committee of the Royal, and Royal Astronomical, Societies.

The observations will probably be made from the locality of Port Davey, fourteen hours' journey from Hobart, in difficult country, and a reconnaissance of the district is being arranged for by the Surveyor-General of Tasmania. Messrs. Baracchi, Baldwin, and Merfield are to form the expedition from the Melbourne Observatory, and contingents are expected from the Perth, Sydney, and Adelaide institutions.

Mr. Frank McClean, of Tunbridge Wells, who was so successful at the 1908 eclipse on Flint Island, is about to start for Tasmania, privately, equipped with instruments for photographing the corona and the chromospheric spectrum, &c.

COMETS DUE TO RETURN THIS YEAR.—In addition to Halley's, two other comets are due to pass through perihelion this year. The first is known as Tempel's second periodical comet, discovered in 1873 July 3 at Milan. Its period is about 5¼ years, and it was re-observed in 1878, 1894, 1899, and 1904, making its perihelion passage, on the last occasion, in November; it should therefore return this coming spring. D'Arrest's comet, discovered in 1851, is the second object, and is due to return during the summer of this year. Its period is about 6½ years, and it was re-observed at its returns in 1857, 1870, 1877, 1890, and 1897, but it escaped observation, being unfavourably placed, in 1903.

Mr. Lynn, who gives these particulars in No. 418 of the *Observatory*, also recalls some of the historic occurrences which have coincided with the returns of Halley's comet.

OPPOSITIONS OF MARS, AND SIMULTANEOUS DISAPPEARANCES OF JUPITER'S SATELLITES, 1800–1999.—Two useful long-date ephemerides are given by M. Enzo Mora in No. 4379 of the *Astronomische Nachrichten*. The first gives all the dates of the oppositions of Mars between the years 1800 and 1999, the dates of, and the distances and apparent diameters at, perigee, and the relative maximum brilliancy of the planet at each opposition. In the second table are given full particulars of the thirty-six occasions, during the nineteenth and twentieth centuries, on which the four Galilean satellites of Jupiter were, or will be, simultaneously invisible; the next occasion is not until October 21, 1913.

A BRILLIANT FIREBALL.—In No. 418 of the *Observatory* Mr. Denning describes the path of a brilliant fireball which was observed at Harrow and at Bournemouth on November 7, 1909. The true path of this meteor was over Tours and Angers, in France, at a height of from fifty-nine to forty-five miles, and, on the assumption that its radiant was near *e* Tauri, at 58°, +9°, the motion was due east to west. Observations from France, where the meteor must have appeared very bright, are desirable.

ANCIENT IDEAS OF THE PHYSICAL WORLD.—In an article which appears in No. 72 of *La Revue des Idées* (December 15, 1909), M. Leon Jaloustre gives an account of the ideas held by the ancients, at different epochs, anent the physical constitution of the universe. Most of these ideas were, of course, connected with astronomy, and the hypotheses of philosophers from Plato onwards are discussed in a very interesting manner.

MINOR PLANETS.—In *Astronomische Nachrichten*, No. 4380, Dr. Neugebauer continues the list giving the adopted numbers and the orbital elements of minor planets. The present table includes Nos. (661) to (673) inclusive, which were discovered in 1908.

MARINE BIOLOGY AT PORT ERIN.

THE annual report of the Marine Biological Station at Port Erin, Isle of Man, being the twenty-third annual report of the Liverpool Marine Biology Committee, has just been published, and it may be of interest to refer briefly to some of the features of a successful year's work. The station appears to have been more active than ever this last year, and the record of work indicates that researches of a most varied nature have been carried out.

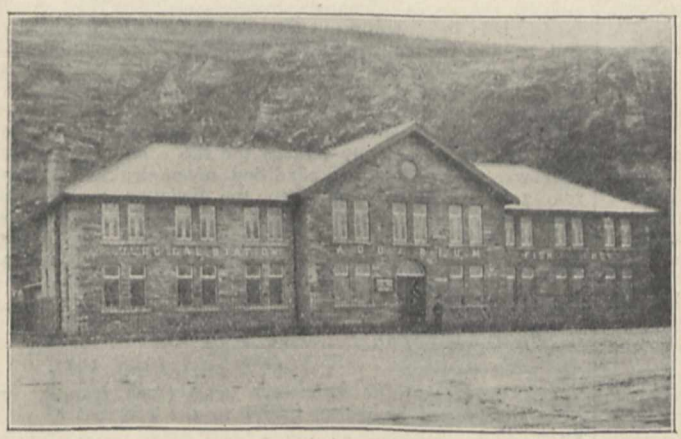


FIG. 1.—The Biological Station at Port Erin

The adjoining fish hatchery (the expenses of which are met by the Isle of Man Fishery Board) has been employed, as usual, in the hatching of plaice eggs, and a total of 7,124,500 larvæ were liberated in the open sea. Some of the eggs have been used for experimental purposes, and a series of extremely good photographs, taken by Dr. F. Ward, and illustrating various stages of the larvæ from the time of hatching until metamorphosis had begun, are included in the report. The number of workers who occupied tables in the laboratory is forty, of whom twenty were senior students of the Liverpool University attending an Easter class in marine biology, which has now become an annual fixture. As a matter of fact, the station is usually crowded during the Easter vacation, and a visitor would be struck immediately by the number of people taking advantage of the laboratory, and by the economical way in which the work is carried out. More than one foreign professor of zoology has been surprised, on learning the finances of the Biological Station, that the place could be kept going with active workers there at all, for it must be remembered that this is not a laboratory subsidised by Government or county council, but depending for the main part of its income upon the voluntary contributions of those interested in the work.

In addition to the report of the curator (Mr. Chadwick) are minor reports on some of the research work, including statements of Mr. W. J. Dakin's work on the sense organs of Mollusca, Mr. F. H. Gravely's studies on the polychæte larvæ, and Dr. Roaf's researches on the digestive processes in marine Invertebrata—histological, biochemical, and faunistic work being thus represented. An article by Prof. W. A. Herdman on "Our Food from the Sea" completes the report, and alludes to the scope of the quantitative plankton investigation, which has been one of the features of Port Erin work. The article is illustrated by some photographs of practically pure plankton catches, of which two are reproduced here (Figs. 2 and 3).

No doubt many scientific workers in other branches of zoology who have not considered this quantitative plankton work in detail still hold more or less to Haeckel's view—that time is being lost by using methods which are inaccurate, based upon principles which are impossible. It may be useful, therefore, to consider some of these points here, for a report of this kind brings one up against the question of the practicability and value of quantitative plankton research. During the last few years the number of workers studying the plankton of fresh and salt water has greatly increased, and some of the most remarkable problems in marine biology have been shown to be bound up in plankton questions. I might refer, in the first place, to Pütter, who but a short time ago propounded certain startling theories concerning the food of marine organisms. According to this author the planktonic organisms are insufficient to provide for the wants of many marine animals which can only obtain their food from filtered sea water, and he asserts that the latter is in itself a nutrient fluid.

Many facts, both biological and chemical, have been brought forward against these theories, but, whether correct or not, Pütter has shown the need of further research and the importance of the problem of animal metabolism in the sea. The actual food requirements of the animals must be determined by physiological and biochemical methods, and quantitative plankton methods alone will show whether the plankton can supply the demands made by the physiologist. The total plankton present at any time is the result of a series of processes—productive and destructive—and it is important to know how the volume or quantity varies.

No qualitative work will show the seasonal, or even daily, variation in the volume of the plankton, though it may indicate the specific change. The interest in such problems is immediately aroused when catches with a certain net, after averaging a few cubic centimetres in volume, suddenly rise to 40 cubic centimetres, remain there for a period, and then as suddenly fall to about 1 c.c. or 2 c.c. for the summer season, and this is a characteristic annual change observed in the Irish and Baltic Seas. What determines these changes in volume? When do they

FIG. 2.—Plankton consisting mainly of *Ceratium tripos*.

FIG. 3.—Plankton catch consisting almost entirely of *Balanus nauplii*.

occur? Is there a relation between the times of maxima of different groups of plants or animals? We can hardly look to qualitative plankton work for the answers, and it has been the quantitative methods that have mapped out the spring maxima of diatoms and dino-flagellates, and, in opposition to qualitative results, have shown how in temperate and arctic regions the plankton is greater in volume than in the tropics.

Again, in order to show whether the changes in the plankton are due to inherent qualities in the organisms, to external influential hydrographical conditions, or to both, a combination of hydrographic and planktonic work is required. It is, I think, obvious that there are many problems awaiting solution, and our choice is limited to the alternative of either leaving them alone or adopting quantitative methods.

It has been said that the latter are inaccurate. Of course they are, to a certain extent, but unfortunately we have no better at our disposal, and have considered it better to use the most accurate methods possible, and to remember the error when drawing our conclusions, than to leave the whole question alone. It is significant that all the objections, backed by scientific evidence, which have been brought against the quantitative methods have

FIG. 4.—The Closing Petersen-Hensen Net going down open.

come from investigators using these methods. It is obvious, therefore, that their eyes are open to the defects of the methods and the limits of the apparatus used. In this respect may be mentioned the work of Lohmann and Kofoid on the catching power of the nets (Fig. 4), and of Herdman in regard to the variations in uniformity in the distribution of the plankton, which question was the first to be considered in the Port Erin work. I cannot do better than quote certain lines from the article in the report referred to:—"With the object of formulating such views as to the nature of the Plankton at any particular time, and as to the changes, both diurnal and seasonal, and the determining factors of such changes, we must endeavour to make quantitative catches as accurately and as frequently as possible, so that our samples may be as nearly representative and as nearly comparable one with another as the difficult conditions will admit. These catches should be made with standard nets, should be preserved and measured according to a uniform system, and may then be compared in bulk; but, in addition, the more important organisms should be counted approximately, and the results in round numbers may be used in comparing catches or tracing changes; but such figures should not be made the basis of calculations as to the total numbers of such organisms in the oceans." The last sentence cannot be too strongly emphasised; the quantitative method is *not* used with the object of determining the number of diatoms in the Irish Sea, and *comparisons* of figures obtained in a uniform way should be the feature of the system.

It would be of great value if some system could be arranged so that plankton catches made in a uniform manner could be taken in different parts of the Irish Sea and St. George's Channel simultaneously. This would greatly help in mapping out the distribution of the plankton and tracing the course of the maxima. For example, in July last, after weeks' of catches containing a normal and small number of various copepoda, echinoderm larvæ, &c., the nets one day were found to contain large masses of *Calanus helgolandicus*. The catches were almost pure, and, in fact, practically useless for the echinoderm larvæ that were wanted. This condition of affairs lasted from two to three days, and then the Calanus swarm disappeared as mysteriously as it came. Systematic and simultaneous catches in the Irish Sea would have shown over what area this Calanus swarm extended, and perhaps whence it came.

W. J. DAKIN.

PRIZES PROPOSED BY THE PARIS ACADEMY OF SCIENCES FOR 1911.

GEOMETRY.—The Francœur prize (1000 francs), for discoveries or works useful to the progress of pure or applied mathematics; the Bordin prize (3000 francs), for improving at an important point the theory of triple systems of orthogonal surfaces; the Poncelet prize (2000 francs), for work in applied mathematics.

Mechanics.—A Montyon prize (700 francs), for the invention or improvement of instruments useful to the progress of agriculture, the mechanical arts or sciences; the Vaillant prize (4000 francs); the subject for 1909, postponed to 1911, is to improve the application of the principles of the dynamics of fluids to the theory of the helix, and the question proposed for 1911 is to perfect at some point the study of the motion of an ellipsoid in an indefinite liquid, having regard to the viscosity of the liquid.

Navigation.—The extraordinary prize of 6000 francs, for work tending to increase the efficiency of the French naval forces; the Plumey prize (4000 francs), for improvements in steam engines or for any other invention which would contribute to the progress of steam navigation.

Astronomy.—The Lalande prize (540 francs), for the most interesting observation, memoir, or work useful to the progress of astronomy; the Valz prize (460 francs), for the most interesting astronomical observation made during the current year; the G. de Pontécoulant prize (700 francs); the Damoiseau prize (2000 francs), subject postponed from 1909, the theory of the planet Eros based on known observations, and for 1911, to perfect the "Tables de Jupiter" of Le Verrier.

Geography.—The Tchihatchef prize (3000 francs), for a recompense or encouragement for exploration of the unexplored or partially explored portions of Asia; the Gay prize (1500 francs), for the study of a French African colony from the geological point of view (Algeria and Tunis excepted).

Physics.—The Hébert prize (1000 francs), for a discovery in applied electricity; the Hughes prize (2500 francs), for a discovery or work contributing to the progress of physics; the Gaston Planté prize (3000 francs), for an important invention, discovery, or work in the field of electricity.

Chemistry.—The Jecker prize (10,000 francs), for work in organic chemistry; the Cahours prize (3000 francs), for the assistance of young chemists already known by their original chemical researches; Montyon prizes (unhealthy trades) (2500 francs and a mention of 1500 francs), for a discovery of a means of rendering an art or trade less unhealthy.

Mineralogy and Geology.—The Delesse prize (1400 francs); the Joseph Labbé prize (1000 francs), for geological works or researches leading to effective development of the mining wealth of France, its colonies or protectorates; Fontannes prize (2000 francs), to the author of the best palæontological publication.

Botany.—The Desmazières prize (1600 francs), for a publication on cryptogams; the Montagne prize (1500 francs), for important works bearing on the anatomy, physiology, development, or description of the lower cryptogams; the de Coincy prize (900 francs), for a work on phanerogams; the Thoré prize (200 francs), for the best work on the cellular cryptogams of Europe.

Anatomy and Zoology.—The Savigny prize (1500 francs), for the assistance of young travelling zoologists, not in receipt of Government assistance, who occupy themselves more especially with the invertebrates of Egypt and Syria; Grand prize of the physical sciences (3000 francs), for the morphogenic study of the characters of adaptation to free life in the vertebrates; the Cuvier prize (1500 francs), for a work on zoological palæontology, comparative anatomy, or zoology.

Medicine and Surgery.—Montyon prize (2500 francs, mention of 1500 francs); the Barbier prize (2000 francs), for a valuable discovery in surgical, medical, or pharmaceutical science, or in botany in its relation to medicine; the Bréant prize (100,000 francs), for discovering a cure for Asiatic cholera, or by discovering and removing its cause; the Godard prize (1000 francs), for the best memoir on the anatomy, physiology, and pathology of the genito-urinary organs; the Baron Larrey prize (750 francs), for an army or navy surgeon or physician for the best work dealing with the subject of military medicine, surgery, or hygiene; the Bellion prize (1400 francs); the Mège prize (10,000 francs); the Chaussier prize (10,000 francs), for the best book or memoir on practical or forensic medicine.

Physiology.—A Montyon prize (750 francs), for experimental physiology; the Philipeaux prize (900 francs); the Lallemand prize (1800 francs), for the encouragement of work on the nervous system; the Pourat prize (1000 francs), for a memoir on the origin of the antiferments (postponed from 1909), and (1911) for a memoir on the influence of the mineral elements, especially of calcium, on the activity of the digestive diastases.

Statistics.—A Montyon prize (1000 francs, a mention of 500 francs).

History of Science.—The Binoux prize (2000 francs).

General Prizes.—The Arago, Lavoisier, and Berthelot medals; the Gegner prize (3800 francs); the Lannelongue prize (2000 francs); the Trémont prize (1100 francs); the Wilde prize (one of 4000 francs or two of 2000 francs), for discoveries in astronomy, physics, chemistry, mineralogy, geology, or experimental mechanics; the Lonchampt prize (4000 francs); the Saintour prize (3000 francs), for work in mathematics; the Victor Raulin prize (1500 francs), for assisting the publication of works in geology and palæontology; the prize founded by Mme. la Marquise de Laplace; the Félix Rivot prize (2500 francs); the Pierson-Perrin prize (5000 francs), for a discovery in mechanics or physics; the Serres prize (7500 francs), for works on general embryology applied to physiology and medicine; the Jean Reynaud prize (10,000 francs), for an original scientific work; the Petit d'Ormoy prize (two prizes of 10,000 francs), one for work in pure and applied mathematics, and one for natural science; the Baron de Joest prize (2000 francs).

LONDON COUNTY COUNCIL CONFERENCE OF TEACHERS.

SIX addresses were given from the chair and twenty papers were read at the meetings held on January 6, 7, and 8 at the Birkbeck College. As a rule, the gatherings were large, and the papers read were of considerable importance. We understand that the London County Council will publish and distribute a complete report with the same liberality as in former years.

The subjects of the papers were classed under the headings:—(1) organisation of higher schools; (2) training of engineers; (3) teaching of number; (4) teaching of domestic economy; (5) methods of teaching in schools for the mentally defective; (6) educational experiments in schools. With so varied a programme it is not easy to point to any single idea as dominant in the papers or in the discussions which followed. Nevertheless, it is safe to say that there was a continued endeavour, consciously in some cases and unconsciously in the remainder, to bring the work within the school walls into closer relation with the present and future activities of the pupils in their daily lives.

The main impression produced by the conference as a whole—an impression which could hardly escape the notice of any reflective observer—was that the London education authority is acting with wise foresight in encouraging initiative and individuality among its teachers. One cannot, of course, assume that such encouragement is given in every school simply on the evidence of these meetings, but there is no doubt that men of originality and proved competence are encouraged and helped to put into practice new ideas and new methods, and that this is true for the older as well as the newer subjects of the curriculum. It is not easy to overrate the importance of the attitude of the London Education Committee and its official advisers with regard to this treatment of the teacher. Whether we approve or not, for good or for ill, the growing municipalisation of education in this country is an irresistible fact.

That the administration should be municipalised is probably a benefit; we may agree with Mr. Cyril Cobb (who opened the conference) in his view that the union of education with other municipal work was good, both for education and the other municipal departments which were brought into touch with it. The danger—and it is a grave one—is that the teachers may become bureaucratised—that they may sacrifice the finer elements of professional spirit to the attainment of smooth and trustworthy working as components of the municipal machine. If English schools are to continue to deserve their reputation for training character it can only be by retaining the requisite spirit in the teachers. From these considerations we may regard the tone of these conferences as promising well for the future of London education. With thankfulness we recognise that the London County Council is anticipating the dangers which are liable to accrue from the very efficiency of its system, and is inhibiting their growth by promoting the development of initiative and of independent professional criticism among the teachers in the London service.

Organisation of Higher Schools.

Turning to the headings given above, under (1) Mrs. Millington discussed the aims of the new Central Schools for Girls, for which the age of entry is eleven to twelve and of leaving fifteen to sixteen. Girls needed both fitness to take charge of a home and fitness for commercial or industrial employment. Training for home-making should be given to all girls alike; for this purpose a small house, a day-nursery, and a small garden should be attached to the schools. Poetry, music, and one foreign language were among the essentials. Mr. H. J. Spenser, headmaster of University College School, read a paper on the organisation of a large secondary school, in the course of which he said that, as compared with other nations, we suffered from lack of expert knowledge in our rulers. Abroad, the men who controlled national systems were men who had spent most of their lives in teaching. We pay a heavy price for amateur government. The greatest national need to-day is the need for efficiency in the secondary schools.

Training of Engineers.

The discussion on the training of engineers took place under the presidency of Sir William White, who advocated a preliminary practical training interposed between the secondary school and the technical college. It was during that period that the boy learned most from the workman, and in Germany they had gone back to that system. After Dr. Walmsley had described the "sandwich" system of training as practised by engineering students of the Northampton Polytechnic Institute at Clerkenwell, a paper was read by Prof. D. S. Capper, in which the author reviewed the whole subject. He divided an engineer's training into (1) school training; (2) scientific training; (3) technical training; (4) subsequent training. As regards (1), he deprecated specialisation, advocated freehand and mechanical drawing, and limited the usefulness of school workshops to teaching a boy to use his tools, to think in the solid and to realise methods of simple construction.

Study of literature and history should balance the work in mathematics, physics, and chemistry. Modern methods of teaching mathematics in schools had produced a great improvement. After school, the factory or office training should extend over two or three years. Should a year of it be interposed between school and college, and the remainder be completed after college? Or should the summer of each year be spent in the factory and the winter in college? Twenty years' experience had shown him that the answer depended on the individual temperament of the student. The college course should lead to a science degree, and the technical diploma should be granted, not by the university, but by a professional body qualified to judge technical training. This training must be carried out on its "clinical" side on a commercial scale and amid commercial surroundings. With reference to the London matriculation, he pleaded for a simplification of the "English" paper and for the introduction of trigonometry in the syllabus for elementary mathematics. At whatever branch of engineering the students were aiming, they should acquire some knowledge of machinery and machine processes, and also some familiarity with the applications of electricity—for engineering practice, not for passing an examination. Specialised professional subjects, *e.g.* bridge building, should be treated at the post-graduate stage.

Domestic Economy.

Mr. J. Wilson (Battersea Polytechnic) delivered an address on the correlation between the teaching of domestic economy and experimental science. The practical problems are how to link the chemistry and physics to the domestic subjects, and how to teach the latter, so far as possible, as applied science. Should the experimental science and the domestic subjects be fused together into one subject? After an experience of ten years at Battersea, the lecturer gave it as his opinion that they should remain two distinct but correlated branches of study. At present the proper teaching of the science subjects on the one hand, and the domestic subjects on the other, demands a specialist mistress for each group. There must be frequent consultation between the two teachers to ensure proper coordination. The principles to be followed were illustrated by detailed discussion of the following typical course for a girls' secondary school (some nature-study should precede the course):—

	Science	Household Work
First year.	Physical measurements. Heat. Chemistry of air.	Needlework.
Second year.	Water and Solution. Acids, alkalis, &c.	Cleaning materials.
	Chalk, lime. Derivatives of common acids.	Elementary principles of cookery.
Third year.	Chemical change; outlines of theory.	More advanced cookery and needlework.
	Flame, washing soda, borax, sugar, alcohol, vinegar, oils and fats, soap.	
Fourth year.	Classification of food-stuffs. Starch, flour and cereals.	Cookery; potatoes, rice, bread, cakes, puddings.
	Milk, butter, cheese, eggs. Meat, meat extracts.	Soup; cooking meat.
	Vegetables. Tea, coffee, cocoa.	
Fifth year.	Digestion: dietetics, dietary scales. Heat values.	Experimental cookery (an adaptation of "research in household processes.")
	Elementary bacteriology (air, water, milk, dust). Preservation of foods.	
	Laundry; textile fibres; bleaching; examination of soaps; dry cleaning.	Laundry work.

Generally speaking, the girls feel that the work is of direct value to them, and the course proves to be as truly educational as the older courses of systematic chemistry and physics, although the problems studied are much more complex. With the present regulations for matriculation, girls who enter for this examination cannot take the fourth or fifth year's course. Mr. Wilson suggested that the London University and the Joint Scholarships Board should add a suitable syllabus which would allow candidates to follow such a course as the one outlined.

Sir Lauder Brunton, who presided, and the Hon. Mrs. Bertrand Russell, dealt with the social aspect of the subject, and it was pointed out that the comfort, health, and sobriety of the nation depended to a great extent on efficient and widespread teaching of domestic economy.

Other Subjects.

The initiated are aware that the teaching of number is of far greater importance than is generally supposed, and will learn without surprise that a whole session was devoted to that topic. Mr. T. Raymont (Goldsmiths' College) opened with an exposition of fundamental principles. The fifth meeting was devoted to problems connected with mentally defective children, and there was a small exhibition of work accomplished, which served to illustrate the methods of teaching in some of the council's special schools.

The final meeting was in many respects the most important and encouraging of the series organised by Dr. Kimmins. Under the title "Educational Experiments in Schools" was given the clearest evidence of the abilities of the teachers and of the opportunities afforded them to develop their ideas. Mr. E. White, handicraft instructor at Essendine Road, gave a lucid account of the manner in which the work of his handicraft centre had been coordinated with that of the schools connected therewith. A sound start was made by bringing the class-teachers into closer relation with the instructor. The council's inspectors and H.M. inspectors gave help, with the result that arithmetic, nature-study, science, and in a lesser degree composition, geography, and history, were all benefited by the connection established between these subjects and the manual work. Mr. J. S. Fowler showed how to treat "weather study" so that its real importance and interest were grasped by boys, and Mr. A. Beaver dealt in a practical way with local history. Miss C. von Wyss gave much-needed advice upon the care of animals in schools. Teachers who wish to keep their furred, feathered, or finned pets in good health should read this paper in the coming report. Incidentally, they will, it is to be hoped, both imbibe themselves and infuse into their pupils that spirit which prompts "courtesy to tadpoles."

G. F. D.

ELECTRIC VALVES.

NOW that the use of higher voltages for bulk supply is becoming more general in this country, the question of protection of electrical plant against damage due to resonance surges in underground lines and atmospheric disturbances as well as in overhead lines—which for commercial reasons are likely to become more common in the near future—is one that electrical engineers should turn their attention to at the present time.

Where trouble has already occurred in central stations it has generally been put down to faulty design or bad insulation of the machines. There is no doubt, however, that the damage is caused very often by the setting up—owing to a short circuit or the sudden action of the automatic fuse—of a serious rise of potential, which is stored in the windings of the alternator, and can only flow off through the capacity of the transformer or by perforating the insulation. Such voltages rapidly deteriorate the insulation of sunk windings, and so it becomes necessary to find some means of overcoming this difficulty. Two such pieces of apparatus are now available, and may be used in conjunction with each other or separately, according to the conditions controlling the line, area of distribution, capacity of plant, &c., and are known as the "electric valve" and "Moscicki condenser."

The electric valve consists of a number of spark-gaps arranged as follows. The first spark-gap is placed in series with a sufficiently high resistance, so as to avoid high-frequency oscillations, and the remaining spark-gaps are indirectly connected to earth through small condensers, the last spark electrode being connected direct to earth. The spark-gaps are formed between the edges of sharp round discs of non-arcing metal insulated from each other and from the earth connection. The capacity required is obtained by these discs and a central rod which is connected to earth, and also acts as a support for the discs

which are insulated from it. The resistance in series with these discs is a metallic one, and obviates the trouble usually due to high resistances of graphite or carborundum.

The first spark-gap is adjustable, and is enclosed in a glass cylinder. Six or more sets of spark-gaps are connected in parallel—each through a high-tension fuse—to a common disc, which acts as one pole, while the cast-iron base to which the columns are bolted acts as the other pole. The columns are protected from dust and damage by a glass cylinder, which rests on rubber pads on the cast-iron base, and is protected on top by an insulated cover.

The characteristics of the electric valve may be summed up as follows:—(1) absolute prevention of high-frequency currents; (2) unlimited capacity for dealing with any energy; (3) the adjustable spark-gaps being enclosed in glass cylinders, there is no likelihood of dust getting between the knobs and causing premature action of the apparatus; (4) the automatic extinction of the arc; (5) erection or dismounting very rapid.

The Moscicki condenser resembles an extremely long Leyden jar, with the difference that the neck of the jar—where the coatings end—is considerably thickened. The coatings are produced by a chemical silvering process, and a heavy deposit on both the inside and outside of the jar is obtained, which is further strengthened and protected by a copper deposit. The jars are then mounted in a tin or brass tube, on the top of which a high-tension insulator is arranged, and carries the contact connected to the inner coating. The outer coating is connected to the metal tube, and the intermediate space is filled with a mixture of glycerin and water. It is then hermetically sealed, and consequently the condenser can be used in any position. Glass is used for the dielectric, owing to its great dielectric capacity and uniformity.

The usual type of condenser as used for line protection consists of a number of tubes, as described above, mounted on a wrought-iron frame, and the inner coatings are connected in parallel through high-tension fuses to a common terminal, to which the line is connected. The outer coatings are connected to the tin or brass tubes, and connected to earth by means of the framework, which is so arranged that each tube can be easily replaced or removed when it is necessary.

The design and action of both the electric valve and the Moscicki condensers are clearly explained in a pamphlet issued by Messrs. Isenthal and Co., of 85 Mortimer Street, W., who have acquired the patent rights for both these forms of apparatus for this country and the colonies.

EDUCATION DURING ADOLESCENCE.[1]

FOR the vast majority of English boys and girls, our system of national education is a torso. It ends too soon. It is a trunk without a head. How to remedy this defect with practical wisdom, without expenditure so immense as to provoke reaction, and with the convinced cooperation of enlightened employers of labour, and of all parents who unselfishly desire to further the best interests of their children, is becoming one of the pressing questions of the day.

Out of some 1,300,000 boys and girls in England and Wales who are between twelve and fourteen years of age there are (to the best of our knowledge) about 211,000 (in addition to partial exemption scholars) who have already obtained exemption from attendance at school, and are receiving no further systematic education. Out of the two million young people in England and Wales who have passed their fourteenth birthday, but are still under seventeen years of age, only one in four (so far as our knowledge goes) receives on week days any continued education. "The result" (I quote the finding of the Consultative Committee) "is a tragic waste of early promise. Through lack of technical training, hundreds of thousands of young people fail to acquire the self-adaptiveness and dexterity in handicraft which would enable them to rise to the higher levels of skilled employment. Through lack of suitable physical training, their bodily powers are insufficiently developed, and their self-control impaired. Through lack of general training, their mental outlook remains narrow, their sympathies uncultivated, their capacity for cooperation in civic welfare stunted and untrained. In the meantime, modern industry, in some of its developments, is exploiting boy and girl labour during the years of adolescence. An increasing number of 'blind-alley' employments tempt boys and girls, at the close of their day-school course, by relatively high rates of wages which furnish opportunities of too early independence, but give no promise of permanent occupation and weaken the ties of parental control."

The present state of things is not only intellectually and economically wasteful, but often morally mischievous. City life enhances the danger. Unskilled, or relatively unskilled, employment at thirteen, with good money, tempts a boy (and an increasing number of girls) like a baited trap. A lad is drawn into a way of life which leaves him at sixteen or seventeen without a trade to his fingers, and with the habit of steady learning clean gone out of his head. The years between thirteen and sixteen or seventeen are the years of educational leakage. We are like people who have laid down a costly system of water supply, but have left a badly leaking pipe just behind the tap. In order that our system of national education for the masses of the people may bear better fruit in personal skill and in civic value, the time has come for us to secure a better foundation in the elementary day schools and the continuance of wise educational attendance during the years of adolescence.

Differ as we may in judgment as to the legislative treatment of the problem, we find, I think, but little disagreement among ourselves in educational aim. Do we not virtually concur in thinking that all boys and girls ought to receive, during the years of adolescence, some form of continued education which will develop their physique, widen their mental outlook, cultivate their sympathies, prepare them for the responsibilities of parenthood, equip them for trustworthy efficiency in the occupation by which they will earn their livelihood, and fit them for the duties of citizenship? If this is to be done, it will be necessary to mortise the work of the day and evening technical classes into the work of the elementary day schools. We need in the latter more training of the hand and of the constructive powers, not with any prematurely technical purpose, but as a necessary factor in brain development and in a liberal education. This will not be possible unless we have smaller classes in the elementary day schools and unless the course of training for teachers can be so prolonged as to permit training in educational handwork to be included in their course of professional preparation without congestion of studies, without overpressure of mind, without encroachment upon the indispensable liberal education, and without undue curtailment of that mental leisure which is needed for all healthy growth of interest, originality, and purpose. Nor do we conceive of the technical class, whether day or evening, as purely utilitarian or technological. Direct bearing upon subsequent employment or occupation it must have. But inseparable from its true educational influence is careful regard for the training of the body, for the cultivation of the sympathies and of the imagination by the love of literature, by music and by art, for an opening of the mind to the significance of civic responsibility, and also for those influences (often most powerful when least expressed in words) which help in forming a purposeful, steadfast, and disinterested character.

It is because the people's high schools in Denmark have not only aspired to these aims, but have largely achieved them, that they have raised the level of culture in the whole nation and have indirectly, and, as it were, in by-product, enhanced the economic welfare of the people. Nor should it be forgotten that the Danish high schools do not receive children during the years immediately following the day-school course, but are confined to pupils above sixteen years of age. For this reason, the Danish high schools are not at present fully grappling with the problem of how best to continue the education of urban children; but the record and success of these schools may well make us hesitate before embracing the conclusion that, for children in the agricultural districts, attendance

[1] From a paper on "The Relation of Elementary Schools to Technical Schools—Day and Evening," read at the North of England Education Conference, Leeds, on January 7, by Prof. M. E. Sadler.

at a continuation class between fourteen and sixteen is the only, or indeed the best, way of securing the kind of further education most fitted to their needs.

Many of the statements now current as to the universality of compulsory attendance at continuation schools in different parts of Germany seem to me unintentionally misleading. After persistent efforts, and with the help of some of the best informed of German educators, I have failed to obtain any comprehensive statistical statement showing the number of boys and girls between fourteen and seventeen years of age in different parts of the German Empire who are actually attending continuation schools. Where I have been able to test such figures as are published, I have been drawn to the conclusion that the enforcement of compulsion, even in those parts of Germany where compulsion is statutory, is less general than the wording of the statutes would lead us to expect. The whole subject calls for closer investigation. There is some reason to think that, even in the progressive parts of Germany (and there are large regions in which education is the reverse of progressive), the problem of securing continued education for the majority of girls, and also for those boys who are not intending to enter a skilled trade, is still far from having been effectively solved. We in England have indeed much to learn from Germany and from some of the cantons of Switzerland, but it is right to remember that, for historical reasons which are far from discreditable to us, we have approached the problem from the point of view of the individual rather than from the point of view of the State. I can find no country in which the voluntary attendance at evening classes is so large in proportion to the adult population as it is in England and Wales. I would venture to urge that our task is so to use the collective power of the State as to stimulate, but not to supersede, the energy and forethought of the individual. Bureaucratic collectivism in education seems to me as false an ideal as, at the opposite extreme, is chaotic and plunging individualism. We need a synthesis between the individual energy of the pupil, the responsibility of the parent, the responsibility of the employer, and the watchful supervision, the financial aid, and the uplifting public purpose of the local authority and of the State. Nor, in this matter of continued education, should we allow ourselves to attach too much importance to academic standards of attainment or of theoretical knowledge. Much of the best education in the world is remote from the class-room.

In England, the difficulties which we find in the way of bringing the elementary schools into closer and more fruitful relation to a stimulating kind of further and largely technical education are partly psychological, partly administrative, partly economic.

A great number of English employers and foremen are lacking in insight into the true meaning and value of education, and also often fail to discharge their moral responsibilities for the further education of the young people in their employment or under their care. Nothing strikes me so much in comparing a German industrial city with an English as the keener interest on the part of the mass of German employers in educational questions, and especially in the educational aspect of the daily duties of the workshop. We in England are apt to forget that education is really an aspect of life, and that every skilled adult may find one of his keenest pleasures in imparting a right attitude of mind and a sense of skill and finish to the young people growing up under his care. These things are partly traditional in a nation, and the unbroken tradition of skilled workmanship which has survived from the Middle Ages to the present day in many of the older German cities is one cause of the German attitude of mind towards industrial and technical training. With us the industrial revolution, which introduced the factory system (great as that achievement was from many points of view), snapped an ancient tradition (which already was half dead) and purposely re-started industry in new places where the old tradition had never grown. The first step towards the diffusion of a deeper insight into the value of education is the extension of a liberal, non-pedantic, non-examination-ridden, secondary education accessible, not only to the employing class, but to those who will rise to be foremen and thus hold responsible, though subordinate, posts in industry and commerce. When a man has himself had at school an education which has affected his whole life, he is more ready to understand the importance of securing a similarly suitable education for other people.

It is idle to deny that a comprehensive system of continued education during adolescence (the kind of system which the country really needs and without which much of its present expenditure runs wastefully into the sand) will be a very costly thing to provide and maintain. On the Consultative Committee we tried to form an honest estimate of the cost. We came to the conclusion that a system of compulsory attendance at continuation schools of all young persons between fourteen and seventeen years of age would, if universally applied in a satisfactory manner, involve for maintenance alone an additional annual expenditure of two and a half million pounds. For my own part, I believe that if the work in continuation schools were made (as it should be made) thoroughly practical, the cost would be considerably greater.

Every month given to the further study of the subject which we are met to discuss impresses upon us more deeply the range and social complexity of the issues which necessarily arise, in this country and elsewhere, whenever the problem of continuation schools is seriously approached. The better adaptation of technical schools, day and evening, to the public elementary-school system involves something far beyond skilful administration on the part of the local authorities, and is on a quite different plane of difficulty from that of previous proposals for the raising of the school age. It would be misleading to discuss the subject with our attention confined to narrow technicalities or administrative details, necessary as those are to the right solution of our difficulties. On the whole, as it seems to me, we have just reason for encouragement as to the future. There are many signs that the nation is approaching the problem in the right attitude of mind and with willingness fairly to consider temperately stated arguments for reform. The growth of this right attitude of mind is much more important than hurried legislation, which, indeed, if precipitately forced on to the Statute Book, would retard rather than hasten our advance. English opinion ripens slowly, but I believe that ultimately it will regard as a social necessity the continued education of young people during adolescence under conditions which will protect them from overwork of body and mind. In the meantime, the Scottish experiment is full of significance for us. The foundations of an effective continuation-school system must be laid through a change in the conditions of attendance and study in the elementary schools. Our primary need is a raising of the normal age for exemption from day-school attendance to the limit adopted in Scotland since 1901. Further, is not the time ripe for imposing on every local authority the statutory duty of making suitable provision of continuation classes for the further education of young persons resident in their district from the time they leave the day school up to their seventeenth birthday, and of keeping a register of all such young persons with a record of their occupations? In order that this duty may be rightly discharged, it appears to me indispensable that the Parliamentary grant in aid of continuation schools should be materially enlarged. Without such aid the poorer districts in town and country will not be able to support the expense of providing instruction sufficiently practical or teachers adequate to the task of imparting it. In this particular grade of education the schools must necessarily compete with industry and with commerce for the services of those who are really competent to teach what the pupils will most require to learn.

With the growth of public confidence in their fair-mindedness and educational insight, the local authorities will acquire that moral authority which will alone enable them to exercise the power, almost certain in the end to be entrusted to them by statute, of prescribing the limit of hours of work which no young person under the age of seventeen may exceed in any day or week in employment and systematic education combined; but in order to secure in an effective way physical, technical, and civic training for all young people during the years immediately following the close of the day-school course, two other

statutory changes seem to me to be necessary. First, it should be lawful for the education authority of any county or county borough to make bye-laws (subject to confirmation by the Board of Education) for requiring the attendance at continuation classes up to any age not exceeding seventeen years of any young persons resident or working in their district and not otherwise receiving a suitable education. Secondly, Parliament should make it the statutory duty of every employer of any young person under seventeen years of age (*a*) to enable him or her to attend continuation classes for such period of time and at such hours as may be required by the bye-laws of the local education authority of the district in which such young person either works or resides, and (*b*) to supply the names of all such young persons to the local authority on its demand; and, in order to secure the regular attendance of pupils at technical and other continuation classes in areas where such attendance is made compulsory by bye-law, all employers in such trades or parts of the district as the bye-law may specify should be forbidden, under penalty, to employ any young person under seventeen years of age who fails periodically to produce a card attesting his or her attendance at continuation classes in conformity with the terms of the local bye-law.

These are the central and fundamental recommendations unanimously made by the Consultative Committee of the Board of Education. They are so designed as to stimulate individual energy within the necessary framework of administrative unity.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

A POST-GRADUATE course of seven lectures on "Photo-electricity" will be given at King's College (University of London) during the Lent term, by Dr. H. Stanley Allen, on Wednesdays, at 5 p.m., beginning on January 19. These lectures are open without fee to internal students of the University on production of a card of admission from their college.

IT is stated in *Science* that Mr. Henry Phipps, of New York, founder of the Phipps Institute in Philadelphia, has presented to the University of Pennsylvania the sum of 100,000*l.*, to be used in the campaign against tuberculosis. Six years ago Mr. Phipps founded the Phipps Institute for Tuberculosis Research in Philadelphia, with a large endowment. In 1908 he gave 100,000*l.* to the Johns Hopkins University for the founding of a psychiatric clinic. From the same source we learn that the eleventh industrial fellowship at the University of Kansas has been established by the Pacific Coast Borax Company, of Oakland, California, and will be known as the Borax fellowship. The amount which this company will pay to support the work of its fellow is 150*l.*

WE learn from the *Pioneer Mail* that the Government of Bombay, in a letter to the University Senate, says the offers of contributions which have been made by the leading citizens render it possible to begin the establishment of a central institute in Bombay for the teaching of science. Such an institute is needed urgently in order that the Presidency may have advantages essential to progress which are now reaped by other countries. Before practical steps can be taken in this direction it is necessary to consider what classes of students should be provided for and how the teaching of science can be blended with the system of higher education under the direction of the University. The Governor in Council, after considering the existing curriculum, concludes that radical changes are necessary if the teaching of science and higher education generally are to be brought into harmony with modern requirements.

THE current issue (No. 29) of the *Transvaal Agricultural Journal* contains an article on the desirability of founding a national college of agriculture for the Transvaal. A million pounds is asked for as an endowment, and it is suggested that the college should be thrown open to all students from the British Empire. Mr. F. B. Smith, the Director of Agriculture, has repeatedly urged the necessity for a well-organised scheme of agricultural education in South Africa, and has, indeed, already opened a college at Potchefstroom, under Mr. Holm's principalship. A number of letters from distinguished Americans are printed setting forth the great advantages that have accrued in the United States from the elaborate system of agricultural colleges and experiment stations established there. As the Transvaal already possesses one of the best agricultural departments in the British Empire, it seems fitting that it should also possess the greatest agricultural college.

MUCH educational information of interest and importance is to be found in the latest report of the U.S. Commissioner of Education. We notice that attention is directed to the 1908 report of the Prussian Minister of Public Instruction, which gives a list of twenty-six States comprising the German Empire and their relative university attendances. The list makes it clear that south Germany supplies a relatively greater number of students than Prussia and Saxony. This is noteworthy, because the south has many more small shop industries and smaller farms than the north. The proportion of Prussia would be smaller still if Berlin were excluded. Of the thirteen Prussian provinces, nine remain below the Prussian average. Those districts of the north which are chiefly agricultural furnish few university students, while the agricultural districts of the south furnish many more than the Prussian average, and more than the average of the Empire. Among every 10,000 male inhabitants in east and north Germany in 1905–6, 10·90 were attending universities, in middle and west Germany 12·63, and in south Germany 14·25. Whether analogous results would be noticed if the attendance at technological institutes, agricultural colleges, mining schools, and so on were considered cannot be stated with certainty. In a few years the relative attendance will be greatly changed, since Prussia has opened its universities to women.

THE inaugural address of Prof. H. J. Waters on the occasion of his formal installation as president of the Kansas State Agricultural College, Manhattan, is given in a recent number of *Science* (December 3, 1909). Prof. Waters dealt with the development of the agricultural college in America, and pointed out that, as only one out of every four hundred school children ultimately graduates at college, steps must be taken to bring the work of the colleges to the people. The farmers' institutes do splendid work in this direction, bringing no fewer than one-third of the farmers into personal touch with the college representatives, while as soon as funds are forthcoming the experimental work is to be carried into every county in the State. In justification of these proposals he says, in reference to the past methods of management:—"Ours has been a waste of the resources of soil and forest and stream that is without parallel in the history of the world. This waste has been largely due to improper systems of farming, and cannot continue another century without bringing ruin to American basic industry." The new department of public highways at the college will urge the importance of good country roads, and supervise their construction as soon as the money is forthcoming. In plant and animal improvement, also, the college must lead the way, since it alone can carry on a well-planned programme for an indefinite time. The distinct position occupied by the experiment station was well brought out. Its function was to create agricultural knowledge, not simply to benefit the farmer directly, but to make an exact science of agriculture and enable it to be taught successfully in the colleges, schools, farmers' institutes, and on demonstration farms. Lastly, the rural school problem was dealt with, and this seems to be as far from a satisfactory solution in America as it is here. Not only is there a lack of suitably trained teachers, but, so far, no satisfactory scheme of working the school has been devised. The address is highly suggestive.

THE Education Department of the London County Council has circulated particulars of the science and technology scholarships and exhibitions which are open for com-

petition. The Council is prepared to award in 1910 not more than fifteen scholarships in science and technology, consisting of free education at recognised polytechnics, technical institutes, or institutions of university rank, together with, in cases where the Council thinks fit, maintenance grant, to be fixed after consideration of the circumstances of each candidate, but not to exceed 50*l.* a year in any case, and to be tenable for a period of two years, with a possible extension for a third year. The scholarships will be open to persons engaged in industrial pursuits who have attended evening classes at polytechnics, technical institutes, or colleges of university rank. Also not more than 180 evening exhibitions in science and technology, to be open to persons engaged in or intending to engage in industry, each exhibition to consist of payment of tuition fees, together with a grant of 3*l.* a year, and to be tenable for two years, with a possible extension for a third year. Full particulars of the conditions under which the awards will be made are contained in a pamphlet to be obtained from the L.C.C. education officer. There will be two distinct compeitions, viz. Classes A and B. Candidates for the scholarships must compete under Class B; those for the exhibitions may compete under either Class A or Class B. The teachers' reports will also be taken into account. The award of exhibitions by the competition in Class A will be confined to candidates who, in the case of boys, are less than eighteen, and, in the case of girls, are less than nineteen, years of age on July 31, 1910, and have attended classes in the subjects which they offer for examination for not less than 150 registered hours during the two previous school years at one of the Council's evening schools or evening centres. These candidates will be required to take an examination to be conducted by the Council in certain subjects of general education. Candidates in Class B may compete in either of two ways, by entering for an examination in two subjects, or by submitting works and also undergoing a test examination in one subject. The principals and headmasters or headmistresses of the institutions or schools at which the candidates are in attendance will be asked to submit full reports on their work. In making the award, account will be taken of these reports as well as of the candidates' work in the examination. Fuller particulars of the Council's scholarships, &c., appear in the Council's Scholarships Handbook, published by Messrs. P. S. King and Son, 2 and 4 Great Smith Street, Westminster, S.W., price 1*d.*

SOCIETIES AND ACADEMIES.

LONDON.

Geological Society, December 15, 1909.—Prof. W. J. Sollas, F.R.S., president, in the chair.—R. H. **Rastall**: The Skiddaw granite and its metamorphism. The visible exposures of the Skiddaw granite are three in number, all very similar; part of the more northerly one is a greisen, which is not here dealt with. The normal granite is more or less porphyritic in structure, with large phenocrysts of perthite, in a coarse- or fine-textured ground-mass of orthoclase, plagioclase, biotite, and muscovite. Evidence is brought forward to indicate that the granite is intruded along the axis of an anticline, with a strike approximately E. 15° N. and W. 15° S., the normal direction for the district. The metamorphic aureole is very large, measuring about six miles from east to west, and five miles from north to south. This is out of all proportion to the size of the visible exposures of granite, and it is inferred that the intrusion underlies a large area at a small depth. Within this area three distinct rock-types can be recognised, namely:—(1) black slates; (2) grey flags; (3) grey grits. The metamorphism produced in each of these is described in detail, and it is shown that the commonly accepted zones of alteration do not hold, since the rocks concerned were originally of very different character. The phenomena displayed may be summed up as an example of a moderate degree of thermal metamorphism, due to the intrusion of a large mass of granite, at a comparatively low temperature, into a series of rocks of variable composition, which had previously undergone dynamic metamorphism.—A. M. **Finlayson**: The metallogeny of the British Isles. The ore-deposits of the British Isles (tin, copper, lead, zinc, gold) are considered synthetically in their relation to igneous rocks and to tectonics. The great bulk of the deposits of economic importance, including the veins of Cornwall and Devon, the lead, zinc, and copper veins in England, southern Scotland, Wales, and Ireland, are of Hercynian (and Armorican) age. This is shown by the age of the fissuring in many cases (post-Carboniferous to pre-Triassic), by the absence of ore-veins in Jurassic or later formations, and by other evidence. The Tertiary volcanic period was not accompanied by ore-deposition. The ore-deposits are classified according to metallogenetic epochs, and are divided into metallogenetic provinces, as has been done by Prof. L. de Launay with the ore-deposits of Italy, Africa, and Siberia. The essential features of the different groups are summed up. The evidence, collected and sifted, indicates the following zones of ore-deposition:—(1) Pneumatolytic zone: tin, passing up into copper. (2) Deeper vein-zone: copper with gold. Lead and zinc subordinate. (3) Middle and upper vein-zones: lead and zinc. Copper subordinate. The conclusions drawn from the investigation are:—(i) The importance of the physical conditions of the Permo-Trias in favouring ore-deposition in upper zones. (ii) The close connection between metallogenetic and petrographical provinces, and the essential dependence of ore-formation throughout geological time on the differentiation of igneous rocks accompanying great crustal movements. Differences in ore-deposits in different localities and regions appear to be due to primary differentiation of ores accompanying the differentiation of igneous magmas at successive epochs.—F. P. **Mennell**: The geological structure of southern Rhodesia. The author describes in some detail a portion of what may be termed "the Laurentian area" of Africa. The oldest rocks include all lithological varieties, and exhibit most of the known types of alteration. They comprise a great development of hornblendic rocks (epidiorites and amphibolites); on the other hand, mica-schists, and sheared rocks generally, are conspicuously absent. They include (1) "basement schists" on which the altered sediments were laid down, and (2) altered basic igneous intrusions, simulating rocks of any previous age. All these are older than the granites by which they, and the metamorphic series, are invaded. The vertically bedded "ironstone series" is described, and is compared with similar rocks of the Lake Superior region. They are shown to be especially developed along the eastern border of Matabeleland. The conglomerate beds (or Rhodesian "banket") are 10,000 feet thick, and rest unconformably upon the ironstone series in the west, both these formations being gold-bearing. The thick crystalline limestones overlying the conglomerate series contain chert and dolomite, the latter rock occurring also as an alteration product from serpentine. Graphite also is found, and is attributed to the insolubility of carbonaceous matter in a highly siliceous magma. The granites occupy the greater part of the area dealt with, and their intrusive character as regards the metamorphic rocks is shown. No fossils are recorded, other than silicified wood, except in the coal-bearing beds, in which occurs *Palaeomutela keyserlingi* of the Russian Permian, as also plants. The paper concludes with a description of the diamond-bearing beds of Rhodesia, which resemble those of Kimberley, and also contain fragments of eclogite.

Royal Microscopical Society, December 15, 1909.—Mr. E. J. Spitta, vice-president, in the chair.—A. A. C. E. **Merlin**: The measurement of Grayson's 10 band plate.—Dr. M. **Ewell**: A convenient form of stand for use as a micro-colorimeter and with micro-spectroscope.—Dr. J. F. **Gemmell**: An automatic aërating apparatus for aquaria.—F. **Enock**: The life-history of the Hessian fly, with notes on the Tenby wheat midge. Although known in America so far back as 1776, and believed to have been introduced there in the straw mattresses of some Hessian troops, it was not until 1886 that public attention was directed to the Hessian fly in this country. The fallacies then circulated were described and corrected, and

the true life-history, as traced by the author, was given. Some notes on observations on the Tenby wheat midge, *Clinodiplosis equestris*, followed.

PARIS.

Academy of Sciences, January 5.—M. Émile Picard in the chair.—Address by the president.—A. **Lacroix**: The existence on the Ivory Coast of a petrographic series comparable with that of charnockite. All these rocks constitute a continuous and comprehensive series passing from granite to a hypersthene almost solely formed of quartz and felspars. The series is interesting as being very rare, and forms a parallel with that of the alkaline and alkalino-calcic rocks.—G. **Koenigs**: Conjugate curves in the most general relative displacement of two bodies.—A. **Demoulin**: The transformation of Ribaucour.—G. **Teitzéica**: A problem on triple orthogonal systems.—Arnaud **Denjoy**: Uniform analytical functions with discontinuous non-isolated singularities.—Camille **Hautier**: The adiabatic compression of air applied to a vehicle moved by an explosion motor in order to replace mechanical transmission.—A. **de Gramont**: The re-partition of the ultimate rays in the spectrum of different regions in the sun.—E. **Voisenet**: The production of small quantities of formaldehyde in the oxidation of ethyl alcohol by chemical, physical, or biological means. Formaldehyde is constantly formed in the oxidation of ethyl alcohol, free from all trace of methyl alcohol.—E. **de Stoecklin**: A new method allowing of the liberation of traces of alcohols.—L. **Margaillan**: The separation of saccharose and lactose by the "bulgare" ferment.—Pierre **Berthault**: The wild types among cultivated potatoes.—Th. **Mamelle**: The use of potassium cyanide as a subterranean insecticide. This salt injected in aqueous solution in the soil is decomposed by the acidity of the latter, the hydrocyanic acid gas thus permeating the whole.—Mdlle. P. **Cernovodeanu** and Victor **Henri**: A study of the action of ultra-violet rays upon microbes.—C. **Levaditi** and R. **Landsteiner**: Experimental infantile paralysis.—Jean **Boussac**: The nummulites of the zone of the flysch at the west and south-west of the Mercantour.—Héribaud **Joseph**: Investigations on the diatoms of the travertines deposited by the mineral waters of Sainte Marguerite (Puy de Dôme).—E. **Péroux**: The boring of the artesian well of the Maisons-Laffitte.

NEW SOUTH WALES.

Linnean Society, November 24, 1909.—Mr. C. Hedley, president, in the chair.—Dr. H. I. **Jensen**: The variable character of the vegetation on basalt soils. The different types of basaltic country in eastern Australia, and the factors which control the vegetation thereof, may be briefly summarised as:—(1) The tropical or subtropical, coastal basalt scrubs (jungle), with a high rainfall; the soil is very rich, and has a high water-retaining power but low porosity. (2) The extra-tropical, coastal basaltic ranges of southern New South Wales, with a colder climate and a lower rainfall; rapid corrosion and erosion, unhindered by dense vegetation, have given rise to steep slopes, and these have an excellent natural drainage and a stony soil. (3) The almost treeless basaltic plains west of the Great Dividing Range, the dearth of vegetation being due to a low and uncertain rainfall, and sometimes to a cold climate as well. (4) The isolated basaltic knolls of the western interior, usually stony and bare of soil, their barrenness being due to two causes; the basalt is such a compact, homogeneous, and even-grained rock, and the climate so arid, that decomposition is extremely slow, and as the minerals all decompose with about equal readiness, the soil formed is very finely divided, and is removed by the wind practically as fast as it is formed. (5) The basaltic bogs of plains and tablelands, with a water-logged soil due to inefficient drainage, and a soil-water charged with deleterious salts. Hence it will be seen that the defect of basaltic soils is never want of plant-food. The most serious drawbacks are high water-capacity, which causes the asphyxiation of plants in wet weather, and low capillarity power, which impedes a renewal of soil-moisture in droughty seasons.—Dr. W. G. **Woolnough**: The geology of the Tallong-Marulan area, N.S.W. This area has already formed the subject of a communication to the society by Mr. T. G. Taylor and the author. In that paper the physiography was dealt with, and a fine case of river-capture on a large scale described. The district is very remarkable for the great variety of its geological formations. Ordovician, Silurian, Permo-Carboniferous, and Tertiary fossiliferous strata are developed, while eruptive rocks are represented by a great boss of grano-diorite, grading into granite-porphyry and dacite, intersected by complementary dykes of aplitic and lamprophyric character, and by extensive basalts and basalt tuffs. The Ordovician rocks are the nearest to Sydney at present known, and contain abundant beautifully preserved graptolites, series of which have been exhibited at the meetings of the society. The Silurian rocks include two thick belts of fossiliferous limestone in which extensive caves occur. The Permo-Carboniferous rocks are somewhat abnormal in character, lying as they do at the extreme south-western corner of the basin. The formation consists chiefly of coarse conglomerates and breccias. A seam of inferior coal is developed. The grano-diorite mass presents some very interesting problems in magmatic intrusion. It is suggested that it is a laccolitic mass only just laid bare by denudation. The very important problems of magmatic differentiation presented by this mass are not dealt with in this paper. Extensive contact-metamorphism is met with in the district, and a preliminary description of this is given.—E. J. **Goddard**: Contribution to our knowledge of Australian Hirudinea, part iv., with a note on a parasitic endoproctous polyzoon. The paper comprises a detailed account of a leech found in the Brisbane River, which is regarded as indistinguishable from the Jamaican *Pontobdella macrothela*, Schmarda, and descriptions of a species of Pontobdella from the Hawkesbury Estuary, and one of Geobdella from British New Guinea. Certain incomplete but abundant structures adherent to examples of the second of these are pronounced to be the stalks of an endoproctous polyzoon, possibly allied to Loxosoma. Similar structures were erroneously supposed to be the spermatophores of a leech by Macdonald.—L. A. **Cotton**: The tin deposits of New England, N.S.W., part i., the Elsmore-Tingha district. There are three geological units within the tinfield:—(1) a series of slates and claystones; (2) a series of granites; (3) a series of basalts; while a fourth flanks its eastern side. The slates are Palæozoic, and are probably of Silurian age. The basalts are the youngest of the formations, and their age has been determined as Tertiary. The granites are intrusive into the Palæozoic slates, and their age has been provisionally stated as Permian. There are two chief granite types:—(1) the "acid granite" of Mr. E. C. Andrews, which is chiefly a quartz-felspar rock; (2) an older and more basic rock, the Tingha granite. The tin-ore deposits have been found always closely associated with the "acid granite," though post-dating the solidification of that rock. On examining the fracture-systems of Elsmore, Emmaville, and Tingha, it was concluded that the force causing these was a thrust from the east, or a torsional stress having the axis of torsion approximately east and west. It was noted that the system of fractures corresponds closely with the general trend of the tin-bearing belt, both being best developed in a direction about N.E. by E. The tin-ore deposits are discussed under several heads, the chief among them being (*a*) the quartz-quartzose type; (*b*) the quartz-felspar type; (*c*) the pipes; (*d*) the chlorite deposits.

DIARY OF SOCIETIES.

THURSDAY, JANUARY 13.

ROYAL SOCIETY, at 4.30.—On the Atomic Weight of Strontium: Sir Edward Thorpe, C.B., F.R.S., and A. G. Francis.—On the Approximate Arithmetical Solution by Finite Differences of Physical Problems involving Differential Equations, with an Application to the Stresses in a Masonry Dam: L. F. Richardson.—On a Method of Determining the Viscosity of Gases, especially those Available only in Small Quantities: A. O. Rankine.—Recombination of Ions at Different Temperatures: Dr. P. Phillips.—On the Electricity of Rain and Snow: Dr. G. C. Simpson.—On the Polarisation of X-Rays compared with their Power of Exciting High Velocity Kathode Rays: L. Vegard.

MATHEMATICAL SOCIETY, at 5.30.—The Transformations of Coordinates which can be used to transform One Physical Problem into Another:

H. Bateman.—On Homogeneous Oscillation: Dr. W. H. Young.—On the Determination of a Semi-continuous Function from a Countable Set of Values: Dr. W. H. and Mrs. Young.—Note on a Former Paper on the Theory of Divergent Series: G. H. Hardy.—On the Expression of a Certain Function by Means of a Series of Polynomials: Dr. H. F. Baker.—On the Theory of the Cubic Surface: Dr. H. F. Baker.—The Harmonic Functions associated with the Parabolic Cylinder: G. N. Watson.—Note on the Theory of Sets in Probabilities: Dr. H. de S. Pittard.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Lord Kelvin's Work in Telegraphy and Navigation (*Second Kelvin Lecture*): Prof. J. A. Ewing, C.B., F.R.S.

FRIDAY, JANUARY 14.

MALACOLOGICAL SOCIETY, at 8.—Note on *Helix desertorum*: Mrs. G. B. Longstaff.—Description of *Thersites* (*Glyptorhagada*) *Hillieri*, n.sp., from Central South Australia: E. A. Smith.—Note on *Athoracophorus Schauinslandi*: Henry Suter.—The Ampullaridæ of the Eastern Hemisphere. Description of New Species of Donovania, Scutellina, Fissurella, and Pisania: G. B. Sowerby.—Marine Mollusca from the Kermadec Islands. Notes on Polyplacophora, chiefly Australasian: T. E. Iredale.—Helicoids from New Guinea and Description of a New Species of Papuina: G. K. Gude.

ROYAL ASTRONOMICAL SOCIETY, at 5.—The Moon in Ultra-violet Light: Spectro-selenography: R. W. Wood.—Radial Movement in Sun-spots: *Second paper*: J. Evershed.—On Mr. Fotheringham's Criticisms, *Monthly Notices*, Vol. lxix., pp. 669-73: E. Nevill.—A Last Word on the Correlation of Variable Stars: Karl Pearson.—The Principal Formulæ of Interpolation and Mechanical Differentiation and Integration: H. C. Plummer.—Note on some Sun-spots visible in September, 1909: Col. E. E. Markwick.—*Probable Papers*: Observations of Occultations of Stars by the Moon made at the Royal Observatory, Greenwich, in the year 1909: Astronomer Royal.—Observations of Minor Planets from Photographs taken with the 30-inch Reflector of the Thompson Equatorial at the Royal Observatory, Greenwich, during the year 1909: Astronomer Royal.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Some Uses of Mechanical Power in Engineering Construction: H. F. Donaldson, C.B.

MONDAY, JANUARY 17.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—The Direct Separation of Emulsions by Filtration and Ultra-Filtration: E. Hatschek.—Significance of the Abel Heat Test of Gun Cotton and Nitro-glycerine: R. Robertson and B. J. Smart.—Note on the Estimation of Iron in Ferric Solution: A. F. Joseph.

ROYAL SOCIETY OF ARTS, at 8.—Textile Ornamentation: Alan S. Cole, C.B.

TUESDAY, JANUARY 18.

ROYAL INSTITUTION, at 3.—The Cultivation of the Sea: Prof. W. A. Herdman, F.R.S.

INSTITUTE OF METALS, at 10.30 a.m.—Address by the President, Sir Gerald Muntz, Bart.

ZOOLOGICAL SOCIETY, at 8.30.—Report on Pathological Observations at the Society's Gardens during 1909: Dr. H. G. Plimmer.—Zoological Collections from Northern Rhodesia and Adjacent Territories: *Lepidoptera Rhopalocera*: S. A. Neave.—On the Marine Fishes and Invertebrates of St. Helena: J. T. Cunningham.—Notes on the Hydroids and Nudibranchs of Bermuda: W. M. Smallwood.—On New or Rare Crustacea of the Order Cumacea from the Collection of the Copenhagen Museum. Part II., The Families Nannastacidæ and Diastylidæ: Dr. W. T. Calman.

ROYAL STATISTICAL SOCIETY, at 5.

INSTITUTION OF CIVIL ENGINEERS, at 8.—*Further Discussion*: The Design of Rolling Stock for Smooth-rail Working on Heavy Gradients: F. W. Bach.—*Probable Paper*: The Reconstruction of the Tyne North Pier: I. C. Barling.

FARADAY SOCIETY, at 8.—The Conditions which Determine the Composition of Electro-deposited Alloys. Part II., Silver-copper: S. Field.—Studies in the Electro-deposition of Metals: Dr. F. Mollwo Perkin and W. E. Hughes.—The Compressibilities of Helium and Neon: F. P. Burt.—Gas-washing Bottles with very Slight Resistance to the Passage of a Gas: Dr. A. C. Cumming.

WEDNESDAY, JANUARY 19.

INSTITUTE OF METALS, at 10.30 a.m.—*Probable Papers*: The Use of Carbonaceous Filters in the Smelting of Zinc, as employed in the Hopkins Fumeless Zinc Process: C. O. Bannister.—The Properties and Constitution of Copper Arsenic Alloys: G. D. Bengough.—The Failure in Practice of Non-ferrous Metals and Alloys, with Particular Reference to Brass Loco-tubes: T. Vaughan Hughes.—A Contribution to the Study of Phosphor Bronze: O. F. Hudson and E. F. Law.—Notes on a Suggested Record of Analyses: C. A. Klein.—The Analysis of Aluminium and its Alloys: Dr. R. Seligman and F. J. Willott.—The Assay of Industrial Gold Alloys: E. A. Smith.

ROYAL SOCIETY OF ARTS, at 8.—The Japan-British Exhibition, 1910: Count Hirokichi Mutsu.

ROYAL MICROSCOPICAL SOCIETY, at 8.—President's Address: Sir E. Ray Lankester, K.C.B., F.R.S.

ENTOMOLOGICAL SOCIETY, at 8.—Annual Meeting.

ROYAL METEOROLOGICAL SOCIETY, at 7.30, Ordinary Meeting.—At 7.45, Annual General Meeting.—Presentation of the Symons' Gold Medal to Dr. W. N. Shaw, F.R.S.—Presidential Address: Some Relations of Meteorology with Agriculture: H. Mellish.

THURSDAY, JANUARY 20.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: Further Observations on the Pathology of Gastric Ulcer (Progress Report): Dr. C. Bolton.—(1) The Velocity of Reaction in the "Absorption" of Specific Agglutinins by Bacteria, and in the "Adsorption" of Agglutinins, Trypsins, and Sulphuric Acid by Animal Charcoal; (2) On the Absorption of Agglutinin by Bacteria, and the Application of Physico-chemical Laws thereto: Georges Dreyer and J. Sholto Douglas.—Observations on the Rate of Action of Drugs (Alcohol, Chloroform, Quinine, Aconitine) upon Muscle as a Function of Temperature: Dr. V. H. Veley, F.R.S., and Dr. A. D. Waller, F.R.S.—An Examination of the Physical and Physiological Properties of Tetrachlorethane and Trichlorethylene: Dr. V. H. Veley, F.R.S.—The Action of Antimony Compounds in Trypanosomiasis in Rats: J. D. Thomson and Prof. A. R. Cushny, F.R.S.—"Amakebe," a Disease of Calves in Uganda: Colonel Sir David Bruce, C.B., F.R.S., Captains A. E. Hamerton, H. R. Bateman, and F. P. Mackie.

ROYAL INSTITUTION, at 3.—Assyriology: Rev. C. H. W. Johns.

LINNEAN SOCIETY, at 8.—Discussion on the Origin of Vertebrates: Dr. Gaskell, Dr. Gadow, Mr. Goodrich, Prof. Starling, Prof. MacBride, Dr. Smith Woodward, Prof. Dendy.

INSTITUTION OF MINING AND METALLURGY, at 8.

FRIDAY, JANUARY 21.

ROYAL INSTITUTION, at 9.—Light Reactions at Low Temperatures: Sir James Dewar, F.R.S.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Ninth Report to the Alloys Research Committee: On the Properties of some Alloys of Copper, Aluminium, and Manganese (with an Appendix on the Corrosion of Alloys of Copper and Aluminium when exposed to the Sea): Dr. W. Rosenhain and F. C. A. H. Lantsberry.

PHYSICAL SOCIETY, at 5.—Saturation Specific Heats, &c., with van der Waals' and Clausius' Characteristics: R. E. Baynes.—The Polarisation of Dielectrics in a Steady Field of Force: Prof. W. M. Thornton.—On the Use of Mutual Inductometers: Albert Campbell.

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