NATURE

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"To the solid ground
Of Nature trusts the mind which builds for aye."—WORDSWORTH.

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THURSDAY, FEBRUARY 20, 1919.

EDUCATION IN THE ARMY.

THE publication of the Second Interim Report of the Adult Education Committee of the Ministry of Reconstruction, presided over by the Master of Balliol, on "Education in the Army" (Cd. 9225, price 2*d*.), may raise hopes which a study of the report will disappoint. For the report was written several months before the Armistice, being dated July 3, 1918, and is concerned mainly with the educational problems of an Army living and working under different conditions from those which exist to-day. Some delay has occurred in the publication of the report. An appendix contains a note by Col. Lord Gorell, Deputy Director of Staff Duties (Education) at the War Office, dated November 8, 1918. The creation of this branch at the War Office was one of the chief recommendations of the Committee, which wisely suggested that the proposed new branch should be placed under the direction of a specially qualified military officer of academic distinction and with educational experience. The force of the recommendation may be understood by considering the fact that, although the War Office has charge of important educational institutions like Woolwich and Sandhurst, the examinations for admission to which directly affect the curricula of our secondary schools, it has never called to its aid the services of an officer—civil or military—with such special qualifications, although an excellent precedent was provided by the Admiralty in the appointment in 1903 of Sir Alfred Ewing as Director of Naval Education.

The education of Army officers was presumably not regarded by the Committee as coming within its terms of reference, "adult" being interpreted to mean the man in the ranks rather than the officer. But the Committee has formed a conception of the Army, Navy, and Air Force of the future as great training colleges for the nation; and for this advance the country should be grateful. Due recognition has been given in the report to the efficient educational work of the Y.M.C.A. for the British Army, and the corresponding work in the Canadian and New Zealand Armies. In view of the changed military conditions and the fact that the principal reforms advocated in the report have already been carried out by the War Office, there is not much material in the report for comment or criticism; but we may express the earnest hope that the educational work for the enlisted man, which has been started with so much energy and enthusiasm, will be wisely organised and developed.

The question of the selection, education, and training of the officers of the *post-bellum* Army, scarcely less urgent and important, has apparently not yet received official consideration. Mr. Winston Churchill's appointment as Secretary for War, following close on the happy conclusion of hostilities, suggests that the time has arrived for a frank discussion of the whole subject. The "modern eye" which he claims to possess should find useful work in exploring some of the dark places of the office over which he is now called upon to preside.

We approach the question with a deep sense of obligation to the thousands of brave men who have lost their lives through the educational and scientific deficiencies of our military machine. The Expeditionary Force of the old Regular Army was a well-organised and efficient engine of war, which achieved a magnificent record in the early months of the war by its heroism and devotion to duty, its high standard of discipline, and its excellent Staff work. Consummate skill was shown in its transportation overseas and its supply services. Nevertheless, the conclusion to be drawn from the later history of the war is irresistible. The education and training of the average Army officer were shown to be defective, through his inability to adapt himself to new conditions and to solve the difficult problems which the development of the war presented in bewildering number and variety. An officer who has spent more than three years on active service at the front has given it as his considered opinion that, of the daily problems confronting the regimental officer, more than 99 per cent. required brains rather than courage for their solution, and were solved or left unsolved according as the officer had received preliminary training and possessed the necessary natural ability.

War's arbitrament has finally destroyed the cherished idea that "brains" and "bravery" are mutually exclusive. The distinctions obtained by university-trained officers in the war are conclusive evidence on this point. In the case of one university O.T.C., four out of five V.C.'s were obtained by officers who had taken the university degree or its equivalent. The scholar-soldier is not a contradiction in terms. Mental training develops personality. "I don't like work—no man does," says Joseph Conrad, "but I like what is in work—the chance to find oneself." We must bear these facts in mind in considering the pre-war policy as regards the selection and training of officers for the Army. Whether Parliament or the War Office was mainly responsible we are not in a position to determine, but it is undoubtedly a fact that commissioned service in the Army was re-

stricted to men of means and leisure, and educational standards had to be adjusted accordingly. Sir Henry Campbell-Bannerman acknowledged in the House of Commons on March 9, 1903, that the crucial question of Army organisation was whether this system should continue. In his evidence before the Military Education Committee which was set up after the South African War, Sir Evelyn Wood said: "I am sorry to say that the officer wanted in the Army is only one who can command 150*l.* to 1500*l.* a year; there is no room at all in the Army—and that comes before me every day—for the man who has only 50*l.* a year of his own."

Such was the position when Lord Haldane became Secretary for War in 1905. Unfortunately for the nation, Lord Haldane preferred precept to practice. His *apologia* during these crucial years on high educational standards and democratic principles was intended for outside consumption. He was either unwilling or unable to overcome the *vis inertiae* of Army tradition. During his years of office educational standards for officers of the Regular Army were actually reduced, for no other result could follow the lowering of the age-limit for the Sandhurst examination from seventeen and a half to sixteen and a half—a change which had the further vicious result of interfering with the proper work of our secondary schools. The position as regards the supply of officers for the Army became so desperate that the competitive examination for Sandhurst was reduced almost to a farce as the number of candidates approximated to the number of places. Can it be doubted that a good many educational "duds" gained admission to our largest military college? Further, the immature youths who joined the college were provided with an educational course which, judged by modern standards, was too short and altogether inadequate in scope and character. Training in scientific method was entirely lacking. At one period, we believe, the whole course only lasted for about nine months. Much of the time available was necessarily taken up with drill, horsemanship, and routine military training. Those who know the facts can read Mr. Thomas Seccombe's brilliant preface to "The Loom of Youth" without surprise. The products of this system of education were pitted in the war against highly trained officers of a nation which, whatever its failings may be, has a profound respect for science and education.

As we have already indicated, the Army has now taken up with great energy the further education of "Old Bill," that lovable figure who, by his cheerful courage and self-sacrifice, has shown himself able to satisfy some of the highest tests of education. We shall refuse to show any great enthusiasm for this work until there is a complete change of heart at the War Office as regards the higher direction of the Army. The old "caste" theories have been shattered by the war. "Old Bill" asks primarily to be led by an officer who knows his job, whatever his private income or ancestry may be. The Army must be brought into the main stream of the nation's educational and scientific life. Mr. Churchill's first lesson will be to learn that an A1 Army cannot be made with C3 brains. His task at the War Office must be to set up an Army, not inferior to the old Army in discipline and devotion to duty, but immensely superior in its respect for science and education. It should be a model organisation which other great national institutions will aspire to copy in its educational standards and the application of science to all departments of its work, in its conditions of employment, its belief in equality of opportunity, its standards of health and discipline—an Army for which compulsion will be unnecessary, because every public-spirited citizen will desire to take advantage of the opportunities it offers for educational and physical training.

We may add with confidence that, in accord with the democratic conditions under which our national life will in future be lived, some system will have to be devised for selecting men from the ranks who have attained the necessary educational standard and for training them for commissioned service. For this important task and for the training of ordinary university students as Regular and Reserve officers the establishment of residential military colleges within existing universities is clearly indicated. The success of the universities in training officers for the Army through their contingents of the Officers Training Corps, and through the exiguous scheme for university commissions in the Regular Army which was in operation before the war, warrants confidence in their ability to discharge the wider functions suggested. Any such scheme would have the further effect of bringing the Army into closer touch with the educational and scientific thought of the universities and with the results of research in all departments of knowledge. If the ancient and honourable profession of arms is to be made a real profession in a modern sense, a high standard of selection and training must be demanded. Under no other conditions can the reasonable demands of Army officers for higher pay and improved prospects be granted by a grateful country.

ANCIENT PALESTINIAN FOLK-LORE.

Folk-Lore in the Old Testament: Studies in Comparative Religion, Legend, and Law. In 3 vols. By Sir James G. Frazer. Vol. i., pp. xxv + 569; vol. ii., pp. xxi + 571; vol. iii., pp. xviii + 566. (London: Macmillan and Co., Ltd., 1918.) Price, 3 vols., 37*s.* 6*d.* net.

IN certain parts of Palestine there used to dwell a savage people who were called 'Ibhrim, or Hebrews, whose customs show that they were originally slaves to the same crude and cruel semi-religious observances as may be found in any modern uncivilised tribe. If an explorer, well equipped with all that science can endow for collecting, collating, and recording primitive folk-lore, had gone among them and studied them, his labours would show that these same Hebrews, who were to have such an effect on the Western world for at least two thousand years, were scarcely different in their habits and customs from any other barbarians. As, however, this people has passed away from Palestine, the explorer cannot get into direct touch with them, and he must either dig up their records from their ancient cities, or so analyse their writings that he can trace the origins of obscure customs by comparison with those of other races.

This latter method Sir James Frazer has applied to the Old Testament, with all his usual energy and in his apt, mellifluous style. His three volumes show with a wealth of detail how little was the difference between the original Semite and the savage of to-day. It is perhaps one of the saddest phases of human adventure that this savagery, made respectable by being wedded to subsequent civilisation and veneered with an ecclesiastical gloss, should have been considered the justification for so much fanatic cruelty in the late medieval and early Victorian periods. The Palestine Exploration Fund excavations at Gezer under Macalister showed that it was the Hebrews who were the real Philistines, in the artistic sense of the word, and their crude productions which were discovered undoubtedly deserved this paradoxical epithet.

These three volumes should be the household companion of every religious teacher, nay, of everyone who cares or dares to see what that latest daughter of science, folk-lore, has to say about the cherished beliefs from the Old Testament, absorbed in infancy and rarely visualised differently in later life. There are plenty of Englishmen still who believe the conservatism of childhood's religious conceptions to be a virtue, and the danger to humanity of such immature conceptions, atrophied naturally by a complacent neglect, is obvious. Not many laymen, for instance, even now know that there are two widely different accounts in Genesis of the Creation, the Sacred Tree, and the Flood, welded into composite stories, and yet these stories are still believed to be a divine revelation.

How much exercised the theologians have been over the apparent iniquity of Jacob, and how pathetic the explanation that, although the deed was wrong, it demonstrated Jacob's cleverer nature, thus fitting him for his stupendous future! Who does not remember his juvenile disgust at the way in which Jacob usurped his brother's right by chicanery? And who would have thought that in reality he was merely laying claim to his own on the grounds of ultimogeniture? Many savage tribes recognise the rights of the last-born in inheritance, and this custom, according to Sir James Frazer, is compatible with both the agricultural and the pastoral way of life: "As the sons of a family grow up, they successively quit the parental abode and clear for themselves fresh fields in the forest or jungle, till only the youngest is left at home with his parents; he is therefore the natural support and guardian of his parents in their old age. This seems to be the simplest and most probable explanation of ultimogeniture." It would therefore appear on these grounds plausible that that unamiable Oriental Jacob, as the younger son, had a certain righteous claim to what he is said to have obtained by fraud, a defence "undertaken by a compatriot and namesake, Mr. Joseph Jacobs, who has essayed to wipe out the blot on the ancestral scutcheon." The other part of the story, how he dressed himself in skins, follows naturally from Sir James Frazer's ingenious explanation that it was a survival of the custom of re-birth. Primitive peoples, when adopting children, frequently go through a pantomime representing a new birth, and this in certain cases includes the ceremony of investing the new son with the skins of sacrificed animals.

The Brand of Cain is another problem for which a new theory is provided. Robertson Smith thought that it was a tribal mark, a badge which every member of the tribe wore on his person, which served to protect him by indicating that he belonged to a tribe which would avenge his murder. The later explanation, far more plausible, is that it was a mark laid on Cain to prevent the ghost of his murdered brother recognising him and haunting him. This is obvious from the numerous similarities collected by Sir James Frazer from savages; for instance, among the Yabim of New Guinea, when the kinsmen of a murdered man have accepted a blood-wit instead of avenging his death, they take care to be marked with chalk on the forehead by the relatives of the murderer, "lest the ghost should trouble them for failing to avenge his death." It is, in fact, closely allied to an external sign of mourning for the dead which so changes the appearance of the mourner that the ghost cannot return to annoy him.

Again, the difficult problem of the slave who, although having the right of freedom after his sixth year of service, elected to remain to serve his master continuously is discussed at length. Everyone will call to mind the curious treatment with which his new undertaking was inaugurated: his ear was to be bored through with an awl at the doorpost by his master. The parallels from savage folk-lore are sufficiently similar to show

that some form of magic underlies the ceremony. Among the Ewe negroes of Togoland, when any of the tribe desire to prevent a slave from running away, it is customary to bring him before a fetish named Nanyo, where the priest pares the nails of the slave's fingers and toes, shears some of the hair of his head, and buries all the parings and cuttings in the earth with a fetish mark. Other ceremonies are included, but those quoted are ample to show (from the common beliefs about magical powers obtained through possession of the nail-parings and hair of an enemy) that the master has now some occult control over his servant. In the case of the Hebrew slave it is the blood which represents the substance through which the control is acquired; and when the earlier form of the Hebrew law, as recorded in Exodus, is remembered ("then his master shall bring him unto God, and shall bring him to the door, or unto the door-post"), the connection with the savage story is still more striking.

The curious story of Elijah and the ravens is briefly discussed literally. It is curious to see that Sir James Frazer (who read the whole of the Old Testament in Hebrew before undertaking this great work) is apparently unaware of the ingenious but simple emendation of the word "ravens" (*'orĕbhîm*) to "Arabs" by a very slight vowel change, which, of course, renders any mythical explanation unnecessary.

There are one or two small slips noticeable. In the description of Babylon the learned author describes the mound Babil, which is the most northern of the three mounds composing the city, as the site of the ancient temple *E-temen-an-ki* (the real Tower of Babel), which actually lies a little to the north of the southern mound Amran, at least a mile from Babil. Another small slip is "Mandace" (three times, vol. ii., p. 441) for "Mandane," the mother of Cyrus. But the wonder is that, in all this varied display of erudition, the slips should be so small and trivial. It is impossible to do justice to the large number of new theories amply supported by evidence. Hebraists and anthropologists (and, incidentally, examiners for the Oriental Tripos) have at hand a wonderful storehouse, an Aladdin's cave of jewels, on which to ponder. R. C. T.

THE PAST AND FUTURE OF ORGANIC CHEMISTRY.

Recent Advances in Organic Chemistry. By Dr. A. W. Stewart. With an introduction by Prof. J. N. Collie. Third edition. Pp. xx + 350. (London: Longmans, Green, and Co., 1918.) Price 14*s*. net.

THE growing mass of research in pure and applied chemistry has created a demand for some kind of periodical summary which will afford the non-specialist an opportunity of following the varied phases of development of the science without wading through the original literature. This demand is being met by the annual reports of the Chemical Society and the Society of Chemical Industry, and to a more limited extent by *Science Progress*, by the "Smithsonian Reports," and by the Journal of the Royal Society of Arts. The volume under review stands in a somewhat different category, for it takes in its successive chapters the character of a general *résumé*, a students' text-book, a critical essay, and a speculative forecast. Such varied treatment has many advantages for both author and reader. For the latter, severe mental application is not demanded, and the matter is sufficiently varied to be stimulating without being wearisome; for the former, free play is permitted to his and other people's imagination without the controlling fetters of unbiassed fact.

The latest edition of Dr. Stewart's well-known book has attempted to sustain its character as a record of new achievements in organic chemistry by deleting some former chapters and replacing them by others of fresher interest. Thus the polymethylene group, the quinols, asymmetric synthesis, and the bibliography have been replaced by accounts of recent researches on chlorophyll, the anthocyanins, the chemistry of rubber, and new arsenic compounds, whilst the chapters on triphenylmethyl and the alkaloids have been somewhat extended.

A book which professes to record recent advances is bound to modify its contents with each succeeding edition as the subjects pass into the range of ascertained facts, and so fall into their natural positions in the scheme of classification. It is a little difficult, therefore, to perceive upon what principle the present selection is made—why certain chapters should be discarded, whilst others which appeared in the earliest edition should be retained almost intact. The opening chapter, on "Organic Chemistry in the Twentieth Century," is extremely lucid and well expressed, but much too superficial to be instructive. Here is a paragraph:—"As far as the benzene nucleus is concerned, the question which has excited most interest recently is the substitution problem; but it cannot be said that, even yet, in spite of extensive investigation, we possess the true key to the riddle," and there the matter ends, and those who do not know what the substitution problem is are referred to a solid treatise of 500 pages by Holleman. Nevertheless, to those familiar with the changes that have taken place during the century, the chapter as a whole will serve as a pleasant reminder.

It may be observed that the theory of isorrepesis is still retained, in spite of the contrary evidence adduced by Lowry, to which no mention is made. The word "ketene," which is derived from ketone, with the usual suffix "ene," denoting doubly linked carbon, is written, *à la* German, "keten," an undesirable modification from every point of view.

The succeeding chapters on the terpenes, the alkaloids, and the polypeptides have undergone little or no change, and are ordinary text-book descriptions; but those on chlorophyll and the anthocyanins are new, and introduce us

to some of the most highly complex structures found in organic Nature, the constitution of which has been elucidated in a masterly fashion by Willstätter and his associates.

One of the most interesting chapters in the book is that dealing with theories relating to the synthesis of vital products, the greater part of which, according to the author, has been elaborated by Prof. Collie. Here we enter the realm of speculation; indeed, so little is known of the laboratory methods of the living cell that free rein may be given to the chemical imagination. Enzyme action, of which, however, little of value is said, will probably furnish the key to organic synthesis and cleavage within the living organism, and, until that action has been more fully explained, there is no harm in manufacturing equations and mechanical devices to represent these changes.

One point, however, must be borne in mind—namely, that these changes must take place with comparatively small energy changes, so that the equilibrium may be easily induced to shift, and the balance of a reversible reaction thrown, to one or other side of the normal point; in short, vital reactions, if the expression may be used, must occur within a small range of temperature. In this respect such reactions as the synthesis of pyridine derivatives from malic and citric acids, which were studied many years ago by v. Pechmann and others, and the more recent work on the synthesis of tropinone by Robinson, have an unequivocal significance. J. B. C.

OUR BOOKSHELF.

The Science and Practice of Manuring. For the Use of Amateur, Market, and Professional Growers, Orchardists, etc. By W. Dyke. With introduction by J. Wright. Revised and enlarged edition. Pp. 157. (London: The Lockwood Press (Harvey H. Mason), n.d.) Price 2*s.* net.

MR. DYKE is well known to horticulturists as a man with a strong scientific bent, and by those men of science who are interested in large-scale crop production he is recognised as possessing a considerable stock of problems still requiring solution. The scientific worker will, therefore, take up this book in the hope of finding a record of some of these observations. He will not be altogether disappointed, yet he will not find so much as he might hope; for Mr. Dyke, having written for the practical man and not for the plant physiologist, sets out some of the elementary scientific facts which he considers the grower needs, but he has not always recorded the growers' observations, which the scientific reader would like to have had, and which no doubt Mr. Dyke considered the practical grower did not need to be told.

Mr. Dyke knows his *clientèle* so well that he may safely be trusted to furnish a syllabus of the things they wish to know. To the horticultural lecturer this will be one of the most interesting features of the book.

The information given to the growers is largely sound and likely to be helpful. Some of the data might well be modernised, and a certain number of the figures need correction. In particular some of the statistics in the first chapter are inaccurate; some of the experimental data given in later chapters are old, and more modern figures are available. It is incorrect also to say, on p. 20, that agricultural chemists have "entirely overlooked" the possibility of the presence of ammonium nitrate in the soil. Large numbers of determinations have been made, but in no case is more than a trace of ammonia present either in cropped or uncropped soils. The amount of nitrate, however, may rise considerably. It is very doubtful whether the recommendation of ground leather is sound, and it is certain that a well-made superphosphate does not become wet and sticky, or lose soluble phosphate on keeping, at any rate so long as it is kept in a weather-proof shed.

The Life and Discoveries of Michael Faraday. By Dr. J. A. Crowther. ("Pioneers of Progress," Men of Science Series.) Pp. 72 + portrait. (London: Society for Promoting Christian Knowledge, 1918.) Price 2*s.* net.

IN these days, when, by the loom of science, strange and terrible patterns have been woven on our national life, and novel and improved designs are demanded on every side, it is refreshing to turn again to the history of one of the greatest pioneers in scientific discovery and renew our spiritual friendship with that "Just and Faithful Knight of God," Michael Faraday. The author of this little volume has done his work well, and given us a realistic picture both of the scientific enthusiast and of the humble and devout Christian. "Not half his greatness was incorporate in his science, for science could not reveal the bravery and delicacy of his heart." We could wish this book to be read by our legislators, by our manufacturers, and even by our educational authorities, in order to impress upon them "that research must be free to be powerful and that there is little to be gained from a servile science." Gradually but surely the ideas of Faraday have permeated physical science, and at no time since their publication have they met with such general acceptance as they do to-day. "It may fairly be claimed that modern English physics is the school of Faraday, applying his methods, led by his vision, inspired by his faith." H. S. A.

Cotton. By George Bigwood. ("Staple Trades and Industries," vol. ii.) Pp. viii + 204. (London: Constable and Co., Ltd., 1918.) Price 6*s.* 6*d.* net.

THIS volume gives a readable, popular account of the whole field which the cotton industry includes, beginning with the historical records, and passing successively through the cotton fields, the mills, and the markets. The book is well printed and illustrated, but, especially on the technical side, it would be improved by a number of corrections when it reaches the second edition. L. B.

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 Supposed "Fascination" of Birds by Snakes and the "Mobbing" of Snakes by Birds.

I HAVE received the following interesting notes by Dr. J. Burton Cleland, of 93 Macquarie Street, Sydney. I may add to the observations recorded towards the end of his letter the behaviour of a common grey African parrot brought to this country as a young bird in 1904, and almost certainly without experience of hawks. One wing is clipped from time to time and the bird given much freedom in the garden. Twice I have seen it drop with a scream and crouch on the ground when an aeroplane has flown overhead at a rather low elevation.

EDWARD B. POULTON.

Oxford, February 11.

"Some twenty years or so ago, whilst walking in a garden in the outer suburbs of Adelaide, my attention was attracted by the behaviour of a small company of white-plumed honey-eaters (*Ptilotis penicillata*, Gld.). The individuals were making a considerable noise, and kept flying down to the lower branches of a carob-bean tree (St. John's Bread), where these overhung the pathway, and then up higher again, their attention being apparently attracted by an object on this path. The object proved to be a stock-whip, with long, snake-like lash and short handle. As thrown carelessly down the lash certainly suggested serpentine coils, and my impression, as noted at the time, was that they had probably mistaken the lash for a snake. Their behaviour was that manifested by other Meliphagidæ—for instance, *Myzantha garrula*, Lath.—in the presence of an enemy such as a bird of prey. The birds congregate together, make much noise, and fly about excitedly. In this way they may indicate the resting-spot of an owl disturbed from its sleeping-place by day.

"Several interesting points are worth considering. First, these honey-eaters had probably never seen a snake, though rarely an occasional one has been noticed in the neighbourhood. Secondly, as the birds spend their time near the tops of the eucalypts and build at the end of fine branches, and the snakes near Adelaide do not climb trees, even had they seen snakes these could have done them no harm. Thirdly, if my interpretation of their behaviour be correct, they recognised the 'snake' by its form alone, as no movement could take place. Though other unusual objects, but not snake-like in outline, must have been common in a large garden and its surroundings inhabited by children, the same fuss was not noticed to be made over them. From the above it would appear, provided their actions were rightly interpreted, that the birds or their immediate ancestors had probably never seen a snake, and had certainly never been subjected to danger from such; and that, therefore, the behaviour manifested, presumably to harass and drive away an enemy, must have been purely instinctive. In other words, on presentation to vision of, in this case, a motionless object of snake-like form, the brain-centres concerned with the methods of combating a foe were automatically stimulated, quite apart from the sensitising of such centres by previous individual experience.

"It is interesting to note here that the fowls in the poultry-run of the same house make a great noise and run for shelter when a hawk flies past through the trees, though none, so far as is known, had ever been attacked by hawks. Strange to say, another Australian bird, *Graucalus melanops*, Lath., may give rise to the same reactions, and I think I remember having noticed them also when one of the larger cuckoos (probably *Cuculus pallidus*, Lath.) flew overhead. Both these birds have peculiar flights, more hawk-like than those of pigeons, which, though about the same size, do not, in my experience, frighten poultry. The general form of the large cuckoo is also suggestive of a hawk like the kestrel (*Tinnunculus cenchroides*, Vig. and Horsef.). These reactions are again obviously purely instinctive, and not the result of personal experience."

The Shortage of Research Workers.

IN a paper recently read before the Royal Society of Arts on "The Government and the Organisation of Scientific Research," Sir Frank Heath directed attention to the dearth of skilled research workers, who are urgently needed to investigate industrial problems. All who have studied the question are agreed that in the near future the necessity for industrial scientific research will be greater than ever, and it may, therefore, be well to point out some preventable causes which are likely to make the situation worse instead of better.

During the war research departments have been established at most universities and colleges for special war purposes, and many capable workers have thus been discovered. At the present moment many of these departments are in process of demobilisation, and no concerted effort is being made to retain the services of those who have proved their worth as research workers, who are being allowed to find their way into other occupations. This waste of invaluable material is deplorable at the present juncture, and could be avoided by proper co-ordination between Government departments. A second matter, not so easily remedied, relates to the large number of scientific men who gave their services gratuitously during the war, but cannot be expected to continue this sacrifice in peace-time. No funds appear to be available for the provision of payment to such workers in case they are willing to take up industrial research in their spare time. Even when workers are willing to continue for some time longer on a voluntary basis, with the view of completing work in hand, it is not always possible to procure the small funds necessary for covering the expenses incurred in the work. The writer is acquainted with one research committee, dealing with problems of wide industrial application, which has been compelled to suspend its work owing to the withdrawal of funds by the Government department which financed its operations during the war. Nothing could be more deplorable at the present juncture than the discouragement of voluntary research, and in such cases immediate steps should be taken to provide funds from other sources.

The most disquieting feature, however, is the present financial condition of the universities and colleges from which the research workers of the future must be obtained. Whilst the cost of equipment has at least doubled, the incomes of these institutions have remained, in most cases, stagnant. This not only prevents the acquisition of adequate appliances for advanced teaching, but also debars the members of the staffs from obtaining the increases in salary rendered necessary by the increased cost of living. Many skilled teachers who have been on active service are declining to resume their pre-war appointments for this reason, and a serious shortage of

capable instructors in advanced science is threatened. At present teachers of elementary science are better paid, on the average, than those engaged in the higher branches, and are additionally, in most cases, entitled to pensions under the Teachers' Superannuation Act. The obvious result of this anomalous state of things is that the ranks of higher scientific teachers will be depleted unless strong and prompt Government action is taken to place the universities and colleges on a sound financial basis. Unless this be done there is little prospect of obtaining the research workers necessary to secure the industrial future of the country.

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The Indian Rope Trick.

THE recent correspondence in the *Daily Mail* relating to the Indian rope trick is very similar to the controversies that have arisen from time to time in the Press in India, but nothing said seems to advance the evidence a jot further. The man who does the rope trick has yet to be produced!

During a considerable portion of a residence of more than thirty years in India, I studied Indian conjuring and made all the inquiries I could regarding this trick. I knew many of the best conjurers between Calcutta and Delhi, but never found one who had seen the rope trick. Several had heard of it, some believed in it, none could satisfactorily explain it.

Personally, I am of opinion that the rope trick is entirely mythical. I decline to accept the various theories put forward by amateurs in support of its practicability, such, for example, as hypnotism or substitution. The most likely explanation I have heard is that the trick is performed in a courtyard, that smoke obscures the view above, and that the rope is actually thrown up to a confederate, who fastens it to a beam which cannot be seen on account of the smoke; a lad then climbs up the rope and is similarly lost to view in the smoke, but even this theory is unlikely. It would not be impossible to arrange a scene on a stage where the rope trick could be performed as an illusion—not by a smoke screen, but by other means of hiding what happens above a certain height.

As to Indian conjuring generally, I consider it to be far behind European, though the sleight of hand is often extraordinarily good, and the methods occasionally ingenious, as, for instance, when conjurers apparently cause a few grains of wheat or gram to sprout in a few moments—a far better illusion than the overrated mango-tree trick.

Indian conjurers are very conservative and seldom produce new tricks, and they are very slow in discovering how a trick, new to them, is done even when performed by an amateur on well-known principles.

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THE USE OF HELIUM FOR AIRCRAFT PURPOSES.

SHORTLY after the commencement of the war it became evident that if helium were available in sufficient quantities to replace hydrogen in naval and military airships, the losses in life and equipment arising from the use of hydrogen would be enormously lessened. Helium, as is known, is most suitable as a filling for airship envelopes, in that it is non-inflammable and non-explosive, and, if desired, the engines may be placed within the envelope. By its use it is also possible to secure additional buoyancy by heating the gas (electrically or otherwise), and this fact might possibly lead to considerable modifications in the technique of airship manœuvres and navigation. The loss of gas from diffusion through the envelope is also less with helium than with hydrogen, but, on the other hand, the lifting power of helium is about 10 per cent. less than that of hydrogen.

Proposals had been frequently put forward by men of science in the British Empire and in enemy countries regarding the development of supplies of helium for airship purposes, but the first attempt to give practical effect to these proposals was initiated by Sir Richard Threlfall, who received strong support from the Admiralty through the Board of Invention and Research, under the presidency of Admiral of the Fleet Lord Fisher.

It was known that supplies of natural gas containing helium in varying amounts existed in America, and it became evident from the preliminary investigations made by Sir Richard Threlfall, and from calculations submitted by him as to cost of production, transportation, etc., that there was substantial ground for believing that helium could be obtained in large quantities at a cost which would not be prohibitive.

Prof. J. C. McLennan was invited by the Board of Invention and Research in 1915 to determine the helium content of the supplies of natural gas within the Empire, to carry out a series of experiments on a semi-commercial scale with the helium supplies available, and also to work out all technical details in connection with the large-scale production of helium and the large-scale purification of such supplies as might be delivered and become contaminated with air in service. In this work Prof. McLennan received assistance from his colleagues, Profs. John Satterly, E. F. Burton, H. F. Dawes, Capt. McTaggart, and Mr. John Patterson.

In the course of their investigations, which were carried out with the co-operation of L'Air Liquide Co., it was found that large supplies of helium were available in Canada, which could be produced at a cost of about one shilling per cubic foot.

In the summer of 1917, when the United States of America had decided to enter the war on the side of the Allies, and after the investigations referred to above were well under way, proposals were made to the Navy and Army and to the National Research Council of the U.S.A. to co-operate by developing the supplies of helium available in the United States. These were made, on behalf of the Admiralty, through the Board of Invention and Research by Sir Ernest Rutherford and a special Commission consisting of Commander Bridge, R.N., Lt.-Col. Lowcock, and Prof. John Satterly.

The authorities cited agreed to co-operate with vigour in supporting these proposals, and large orders were at once placed by them with the Air Reduction Co. and the Lynde Co. for plant, equipment, cylinders, etc. The Bureau of Mines also

co-operated in developing a new type of rectifying and purifying machine. By July, 1918, the production of helium in moderate quantities was accomplished, and from that time onward the possibility of securing large supplies of helium was assured.

Concurrently, all practical details of the production of helium-borne airships and of the navigation of this type of craft were developed by the airship production section of the Navy. At the same time, under the direction of Prof. McLennan, plans were prepared and steps taken to erect and equip a station for purifying the helium which might become contaminated in service. Experimental investigations were also initiated with the object of developing the possible technical and scientific uses of helium. In particular, balance and spectroscopic methods for testing the purity of the gas were worked out, studies on the relative permeability of balloon fabrics to hydrogen and helium were commenced, and experiments were begun to exploit the use of helium in gas-filled incandescent lamps, gas-filled arc lamps, and thermionic valves. The equipment provided for the purification of contaminated helium in large quantities supplied the major portion of the apparatus required to liquefy helium, and arrangements were therefore made to produce this gas in a liquid form.

The advances already made by the time the Armistice commenced warrants the opinion that at the end of another year large supplies of helium would have been produced within the Empire at a low cost, helium-filled aircraft would have been in service, and great progress would have been made in exploiting the technical and scientific uses of this gas.

Before the war a proposal to utilise helium as a filling for airships would have been viewed, even by men of science, as akin to a proposal at the present time to pave the Strand with diamonds. Thanks, however, to the enterprise, enthusiasm, and initiative of the Navy, backed by imagination, a suggestion—at one time considered to be chimerical—has to-day become a realisation.

BIRDS AND THE WAR.

WITHIN the limits of a short article it is not possible to do justice to our feathered friends. The services rendered by homing-pigeons to the Army, Navy, and Air Forces have been invaluable, and numerous stories of their gallantry and devotion, under fire and even when wounded, have already appeared in the daily newspapers. Canaries, long recognised as the miners' friends in detecting the presence of poisonous underground gases, have played their part in the war by being used in the trenches and dug-outs when the presence of German poison-gas was suspected. It is not so generally known that parrots, in the earlier days of the war, were employed on the Eiffel Tower to give warning of the approach of enemy aircraft. Sea-gulls, on more than one occasion, betrayed the presence of submarines and mines and thus prevented disaster to our sailors.

On the actual battlefield the behaviour of birds has been remarkable. Unperturbed by the terrible racket and the bursting of gas-shells, a nightingale trilled its sweetest, a soaring skylark poured out its song, a blackbird sang the more merrily the heavier the bombardment, swallows twittered around, and nested in, the battered ruins of Ypres Cathedral even when it was under fire; a "minnie-shell," which burst in the middle of a covey of partridges, did not alarm them and they went on feeding unconcernedly a few seconds later. In fact, it may be said that the birds, wherever they could eke out an existence, seemed oblivious to the life-and-death struggle going on all round them.

At home the consensus of opinion of trustworthy observers shows that birds were at first much upset by air raids. As these, however, became more frequent, their fears diminished. There can be little doubt that birds are adaptable creatures, and soon become accustomed to loud noises. As an example of this, it may be stated that when the bells of St. Paul's were rung, after a protracted silence, to celebrate "Armistice Day," the City pigeons, long unaccustomed to such sounds, appeared to be seriously alarmed, though in days of peace they paid no attention to the daily chimes.

The restrictions on food, imposed on all loyal citizens, made it an offence to feed birds and prosecutions ensued. A sportsman was fined for feeding pheasants on grain, and more than one kind-hearted person paid the penalty for feeding birds on scraps. Cage birds were difficult to keep, and never were parrots more freely offered on loan to the Zoological Gardens.

The strenuous orders issued to farmers to plough up the maximum amount of their land was followed by a misguided outcry against all birds. Thanks to the efforts of the Royal Society for the Protection of Birds, and a few reasonable ornithologists, the agriculturists were persuaded that, after all, the majority of birds do more good than harm. There are, however, several enactments made against birds (such as the extension of the period for burning heather, the prolongation of the shooting season for grouse and blackgame, and the "Destruction of Pheasants Order") which, it is to be hoped, will shortly be modified or repealed.

Reports are not yet to hand as to how birds fared in enemy countries; probably they were no better off than they were in Great Britain. Such items as have evaded the strict German censorship, regarding the shortage of food, tell us that rooks were sold and eagerly bought as articles of diet. It is amusing to note that a correspondence, carried on in one of our leading daily newspapers, as to the edibility of gannets, gulls, etc., was ingeniously interpreted by the German newspaper-men as showing that England was starving owing to the invincibility of the U-boats.

Migration does not appear to have been

affected; doubtless the travelling birds would be flying too high above the tumult of the battle-fields to notice it and, even if they encountered a "barrage," they could always "rise to the occasion." Before aeroplanes became as common as they did towards the end of the war, birds were considerably excited by them. Gulls and wild-fowl were observed to flee before them in panic-stricken rout, but on one occasion a flock of gulls is reported to have flown inquisitively after a seaplane. Incidentally, it may be noted that some interesting observations were made by our aviators as regards the height at which birds fly when on migration.

Perhaps the greatest effect of the war on bird-life in general will prove to be the lack of forests and woods. The abnormal felling of timber which has been carried out during the war must have an effect on arboreal birds for many years to come. The presence of the great spotted woodpecker in new areas in Scotland has already been announced, and is attributed to the fact that former haunts have disappeared under the axe. Owing to the absence of our gamekeepers an undeniable increase in "vermin" is widely reported. Jays seem to have been particularly numerous and wide-spread lately, and buzzards have been seen in many an unaccustomed place. But the benefits accruing from the lack of gamekeepers are not likely to be enjoyed for long.

Enough has been written to show that the subject of "Birds and the War" is one which demands more than a short article. I have compiled a book, now in the printers' hands, which deals (I think as fully as is at present possible) with the whole subject. Though I do not claim that my book attains finality, I trust that it may prove of some use to ornithologists, and also be of general interest; in any case, I offer it as a tribute to our friends the birds.

HUGH S. GLADSTONE.

PROF. G. CAREY FOSTER, F.R.S.

PROF. GEORGE CAREY FOSTER, whose death, on Sunday, February 9, at the age of eighty-three, we announced last week, was born at Sabden, in Lancashire. He received his education at University College, London, after which he proceeded to the Universities of Ghent, Heidelberg, and Paris. Carey Foster had held many official positions. He was appointed professor of experimental physics at University College at the age of thirty, his chair ultimately becoming the Quain chair, under the endowment of Sir Richard Quain. For four years, from 1900, he held the office of principal of the college. He was a fellow of the Royal Society, and one of its vice-presidents during the periods 1891–93 and 1902–3. He occupied the presidential chair of the Society of Telegraphic Engineers (now the Institution of Electrical Engineers), and also of the Physical Society of London. He was a fellow both of the University of London and of University College, and an honorary member of the Jewish Historical Society and of the American Philosophical Society.

In the last years advancing age compelled Carey Foster gradually to relinquish his official positions and to retire more and more into his country home. To the younger generation he is therefore known only by name, yet he played a leading part in at least three important movements connected with education in London.

First, in the eighties of last century, efforts began to be made to bring about an achievement of the aims of the original promoters of the foundation of the college as a university. Carey Foster (in his own words) looked upon the college not only as an important place of education, but also as an important expression of a most remarkable intellectual movement—"a movement which stood for free inquiry and effort towards improvement, intellectual and social." Education, untrammelled by extraneous considerations, could not be obtained in the days when his college was founded. Owing to the vicissitudes which the scheme met with, the teaching and examining functions of the institution had become distinct, the former being vested in the college, while the latter were carried on by the University as a separate body. Carey Foster threw himself, heart and soul, into, if he did not actually lead, the movement for the re-establishment of a teaching University in London, so that its teachers might have freedom in their teaching, untrammelled by the examinations of a distinct institution. This movement led to the establishment of the present University, which, however, only partly realised the wishes of its first promoters. In order still further to realise these aims, the college ultimately (January 1, 1907) allowed itself to be swallowed up in the University in order that it might, if possible, work the necessary reforms from inside. Carey Foster identified himself with the movement from first to last.

Next, still further to carry out the idea of emancipation, he was a hearty supporter of the projects for the admission of women to university teaching and privileges. Such a change was inevitable. It was regarded, in some quarters, as a hazardous step. Its extension within the college and to other colleges and universities in England and abroad is a justification of the pioneer work of the college.

The third movement was concerned directly with the teaching of the subject of which Carey Foster was professor. He laid the foundation of the physical laboratory as it exists to-day. When he himself was educated, laboratory work, as we now know it, did not form part of any curriculum. But, about 1866, in two rooms in his college, he created the first physical laboratory, in which students might repeat the standard methods of measurement which were then being rapidly developed—especially on the Continent—and be taught the conditions for success in such measurements. Cabinets of physical apparatus had existed before, but these were intended for the illustration of lectures. The spirit of change was in the air,

and physical laboratories sprang up in many directions. At the present day lectures without laboratory work are a deadly anachronism, even for, or perhaps particularly for, junior men.

As a thinker, Carey Foster was somewhat hesitant in forming definitive opinions on philosophical and scientific theories. To this cause, no doubt, is due the comparative fewness of his publications. It did not seem logical to him to derive extensive theories from a few experimental observations. For this reason he postponed publication both in his own case and in that of his students. But a method of measurement was another matter, and his published extensions of Wheatstone's bridge method of measuring resistances and of the measurement of mutual inductances are remarkable for their neatness and value. His services on the Electrical Standards Committee of the British Association for the Advancement of Science, and on the Kew Observatory Committee of the Royal Society, prove the direction in which his bent really lay. His publications include an article in Watts's "Dictionary of Chemistry," and he was joint author of a text-book on electricity and magnetism. In the first edition of the latter he strove to develop the subject on the lines laid down by Maxwell, according to which the electrical actions in the æther are all-important; but in later editions he gradually yielded to the pressing claims to recognition of the very large number of new phenomena discovered in the last twenty years, which require a modification of the most extreme of Maxwell's conclusions.

In his writings Carey Foster had the mastery over a lucid and logical prose of a remarkable order. He was much sought after as a sage counsellor, for his kindly method of criticism disarmed resentment when his counsel was adverse. He lived at peace with all men, his main aim being, as expressed in his last Christmas greeting, "to do all which may achieve and cherish a just and lasting peace among ourselves and with all nations."

NOTES.

THE following announcement is made in the political notes of Tuesday's *Times*:—"Sir Watson Cheyne has been appointed chairman of the newly formed House of Commons Medical Committee, which consists of Members who possess a medical or surgical degree, or are interested in medical or scientific matters. The Committee will exchange views upon all proposed legislation which has relationship to any medical or allied question. The main object of these deliberations will be the avoidance, so far as possible, of the expression of conflicting medical or scientific views in Parliamentary debate. The Committee will also invite reports from, and hold conferences with, medical and scientific bodies. Major Farquharson is secretary to the Committee, and Sir William Whitla, Lt.-Col. N. Raw, and Capt. Elliott form the executive committee." As men of science are not sufficiently organised to secure seats for members of their own body in Parliament, they should be glad to know that members of the medical profession are willing to consider scientific as well as medical matters of national interest. We should not like to think, however, that scientific men, knowing the needs of the country and the service of progressive knowledge to civilisation, will be content to remain permanently without representation among our legislators. Medicine is only one branch of science, but, as things are at present, science is a department of medicine so far as Parliamentary action is concerned.

A VIGOROUS attack on the policy of the Board of Agriculture was made in the House of Lords last week by two noble lords, both of whom in the past have had some share in directing the operations of the department. Criticism was directed to a recent circular in which it was announced, *inter alia*, that what has been known during the war as the "ploughing policy" would no longer be actively prosecuted, and that efforts should be concentrated on improving the condition of the existing arable land rather than on adding to its area. Lord Ernle had no difficulty in parrying the attack. He pointed out that much of the increase of ploughed land had been secured at the expense of the effective tillage of the existing acreage, and that an increase in food production would be secured at least cost by thoroughly cleaning and conditioning the land already under the plough rather than by breaking up new areas of grassland—at best always a speculative operation. The ideal which the President of the Board of Agriculture has set before the farming community is a modest one, merely to raise the general standard of farming to the level of that attained by the best farmers in the adjoining district. It is not generally recognised how wide is the gap indicated, but instances could be given where the value of land has been quintupled by the application of scientific knowledge without moving adjoining farmers a hair's-breadth from the ruts of their outworn practice.

A LEADING article in the *Times* of February 17 states that the Prime Minister has agreed to receive a deputation on the subject of fisheries administration. It points out that the present position of our sea fisheries is anomalous and unsatisfactory, and that the establishment of a Department of Fisheries would remedy this, giving the fishermen one special department, instead of half a dozen, to deal with; improvement in transport, a better regulation and supervision of the fisheries, and other urgent matters, would then receive attention. In relation to the alternative proposal for a Ministry of Water, the *Times* remarks that the question of the use of water-power is very remote from that of food supply, nor is it more favourably disposed towards the scheme of State control propounded by the Empire Resources Development Committee. The following reference is made to the need for scientific investigation:—"An important branch of the work of the proposed Ministry would be the organisation of scientific research into the habits and movements of fish. Although the study of marine biology and kindred subjects has made great strides in the United Kingdom in the last few years, our scientific equipment is utterly unworthy of the greatest fishing nation in the world. We have been far outstripped by the United States and by Canada, the splendid sea-fish hatcheries of which put us to shame." With the first two sentences we fully agree, but with regard to the last we may remark that the utility of hatcheries is disputed, and that we have far less reason to feel ashamed when looking at the sea-fish hatcheries of the United States than when considering what we, whose fisheries are as important as those of the rest of Europe, have to set against the marine investigations of the Norwegian Hjort, the Danes Petersen and Johannes Schmidt, and the Dutchmen Redeke and Hoek.

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THE Press of February 15 contained the full text of the scheme for a League of Nations, which had been unanimously accepted the previous day by the representatives of the fourteen Powers assembled at Versailles. This alliance of free States is based on the solid foundation of the confederacy that has defeated the autocratic Empires, and Germany and her satellites will be admitted to it only if and when they give evidence that they are sincerely disposed "to observe their international obligations and conform to such principles as may be prescribed by the League in regard to naval and military forces and armaments." As to the details of the scheme, they are of the nature of a sound working compromise between the projects of those who would have created an immediate super-State like the Holy Alliance of 1815 and the projects of those who would have been content with a restoration of the nineteenth-century Concert of Europe. The new international authority is to have a real control, exercised by means of an assembly of delegates, an executive council, and a permanent secretariat. At the same time its control is so limited in time and sphere that it does not interfere much more than existing treaty obligations do with the sovereign independence of the contracting States. It contemplates and makes provision for the employment of force, if necessary, in the vindication of its decisions. It insists on the publicity of treaties, though not of the process of negotiations. It wisely rejects the impracticable project of the creation of international armies and the establishment of international control over backward races, and substitutes the incomparably saner arrangement of mandatory Powers. In sum, the scheme is a hopeful and a workable one. Its preparation and its unanimous acceptance are excellent auguries both for the future work of the Conference and for the peace of the world.

A BILL to establish a Ministry of Health and a Board of Health to exercise in England and Wales, and in Scotland, respectively, powers with respect to health and local government, was presented to the House of Commons on February 17 by Dr. Addison and read a first time. The general powers and duties of the Minister of Health will be to take all such steps as may be desirable to secure the effective carrying out and co-ordination of measures conducive to the health of the people, including measures for the prevention and cure of diseases, the treatment of physical and mental defects, the collection and preparation of information and statistics relating thereto, and the training of persons engaged in health services. It is proposed to transfer to the Ministry (1) all the powers and duties of the Local Government Board; (2) all the powers and duties of the Insurance Commissioners and the Welsh Insurance Commissioners; (3) all the powers of the Board of Education with respect to attending to the health of expectant mothers and nursing mothers and of children who have not attained the age of five years and are not in attendance at schools recognised by the Board of Education; (4) all the powers of the Privy Council and of the Lord President of the Council under the Midwives Acts, 1902 and 1918; and (5) such powers of supervising the administration of Part I. of the Children Act, 1908 (which relates to infant life protection), as have heretofore been exercised by the Secretary of State.

BRITISH war-time propaganda, as directed by various Government departments ranging from the Ministry of Information to the Ministry of Food, ended at the Armistice with a spasmodic suddenness characteristic alike of its origin and of much of its conduct during hostilities. It was about the same time that other countries, notably the United States, redoubled their propagandist work to further the activities of peace. An example of the way in which this work is pursued by the United States was furnished by a correspondent of the *Times*, whose article appearing on February 11 described the "world's record advertising campaign" organised by the U.S. Government in South America. While the war was still in being a vigorous campaign, excelling the efforts of any other belligerent, had made South America fully aware of every phase of the United States war effort, and as a natural corollary of its plans for industrial construction, inventions, and so on. The information, supplied to newspapers free of charge and without any condition as to acknowledgment of its source, was prepared by practical newspaper men, who were well acquainted with a newspaper's need for "copy" that is exclusive, interesting, and novel. That was not all. If a newspaper wanted special information on United States industrial matters the representatives of the U.S. Public Information Committee in the large cities of South America were willing to cable for it and supply it. This is the kind of elastic and adaptable machinery which is very much wanted in Great and Greater Britain to enable the public to learn, and, above all, to make the public interested in learning, what is going on in British industries, in industrial science, discovery and invention. The Ministry of Information, joined to the Department of Scientific and Industrial Research, might have provided the machinery for some such distribution. At present the Board of Agriculture distributes leaflets and has its Journal, and the Board of Trade Journal also publishes for a public of its own. But what is needed is some organisation which, while having as its principal functions those of informing special publics at home and in the Dominions, should make it its business to get at the general public through the newspapers.

A RECURRENCE of influenza has set in over the British Isles. In the south of Ireland the renewed outbreak is said to be of a virulent type, and is particularly severe in parts of Kerry and Cork. The Registrar-General's return for the week ending February 8 shows a marked increase in the deaths from the epidemic, the number for the County of London being 100, which is greater than in any of the preceding six weeks. In the ninety-six great towns of England and Wales, including London, the deaths from influenza were 604, which is also greater than in any of the six preceding weeks. The deaths from pneumonia in London were 182, and from bronchitis 226, which is more than in any of the preceding nine weeks. For the last eight weeks the deaths from bronchitis have been more numerous than those from pneumonia; prior to this, pneumonia had the larger number of deaths.

A GENERAL Order has been issued by the Local Government Board making malaria, dysentery, trench fever, acute primary pneumonia, enteric fever, relapsing fever, and typhus fever notifiable as epidemic and infectious diseases under the Public Health Act. The Order, which applies to England and Wales, comes into force on March 1. "Dysentery" includes the amœbic and bacillary varieties of the disease, and "enteric fever" includes typhoid and paratyphoid fevers. In cases of malaria the medical officer may supply the patient with mosquito-netting if necessary, and provide for quinine treatment. A person suffering from dysentery may be required to discontinue any occupation connected with the preparation or handling of food or drink for human consumption. In cases of trench fever the medical

officer may require steps to be taken to obtain the complete destruction of lice on the person and clothing of every occupant of the building. The powers conferred under the new Order should be of considerable value in the control of the diseases named, some of which are almost new to Britain.

THE death of Mr. Stephen Reynolds at Sidmouth on February 14, in his thirty-eighth year, deprives the country of one whose work for British fisheries will not soon be forgotten. As adviser on inshore fisheries to the Development Commission, and resident inspector of fisheries for the south-western area, Mr. Reynolds's practical knowledge and sympathetic interest have been of the utmost value in developing the fisheries of Devon and Cornwall, and the gap caused by his death will be difficult to fill. Mr. Reynolds was a B.Sc. of the University of Manchester, and studied at the Ecole des Mines in Paris, but ill-health led him to change his plans for a career, and in 1903 he became associated with the Woolley Brothers, fishermen, at Sidmouth, with one of whom he worked for several years. He was thus brought into close contact with the problems of English fisheries and fishermen, whose interests he eloquently advocated in many articles and other writings. The movement in favour of the further development of inshore and longshore fisheries was initiated by Mr. Reynolds, practically as the result of a remarkable series of articles in the *Times* of February 7, 10, and 17, 1912. These were followed by the appointment of Mr. Cecil Harmsworth's committee consisting of members of Parliament, and then by the Departmental Committee on Inshore Fisheries, which reported in April, 1914, and of which Mr. Reynolds was a member. The outbreak of war prevented legislation based on the report, but special activities—those of the Fish Food and Motor Loan Committee—were directed to the increased productivity of the smaller fisheries, and Mr. Reynolds took a prominent part in the practical working out of the schemes promoted under the Board of Agriculture and Fisheries. He was a most zealous inspector, and knew his district and men as no one else did. Though not a scientific investigator himself, he was still alert to any discoveries, and keen to apply them. He was widely human in his outlook on the fishing industry, thinking far more of the fishermen than of the material side of their occupation. He possessed philosophic insight into the results of modern scientific investigation, and a year or two ago had developed a system which applied to mental evolution Bergson's *élan vital*. It is to be regretted that he was unable to publish this work.

LT.-COL. SIR MARK SYKES, Bart., M.P., whose death occurred in Paris on February 16, in his fortieth year, made a close study of peoples and customs of the East, and was the author of several notable works upon them. His latest volume, "The Caliph's Last Heritage," published in 1915, is largely concerned with his travels in Asiatic Turkey in 1906–13, and covers a wide field in Syria, Mesopotamia, Kurdistan, Asia Minor, Turkish Armenia, and a journey in Lower Egypt. His personal narratives are full of vigour and reality, often highly and truly picturesque, and constantly enlightening. Among Sir Mark Sykes's other works are "Through Five Turkish Provinces" and "Dar-ul-Islam: Five Mansions of the House of Othman." He mapped the north-west region of Mesopotamia and the desert south of Jerusalem, and in the course of his travels made road-maps of five thousand miles of road previously unmapped in Asiatic Turkey. His intimate knowledge of Eastern peoples was of great value, and many will regret that the Empire should be deprived in these times of a statesman of his understanding and capacity.

SIR ROPER LETHBRIDGE, whose death at the age of seventy-nine is announced, occupied an important position in the Indian educational service, and, on his retirement, in English public life. After a distinguished career at Oxford he was appointed Government professor of political economy in the University of Calcutta, became secretary of the Education Commission in 1877, and then held the post of Political Agent. Sir Roper Lethbridge was best known in India as Press Commissioner for the supervision of the vernacular Press. He made a particular study of Imperial Preference as it affected India. On his return to England he became Member of Parliament for North Kensington, and held many public offices, among them president of the Devonshire Association and member of the Exeter Diocesan Board of Education. Sir Roper Lethbridge possessed a wide knowledge of Indian affairs and of English public life.

MR. THOMAS CLARKSON has been elected president of the Institution of Automobile Engineers for the ensuing year.

SIR OLIVER LODGE will deliver the Friday evening discourse at the Royal Institution on February 28 at 5.30 p.m. on "Ether and Matter." Owing to indisposition, Prof. J. A. McClelland will be unable to deliver his discourse on "Nuclei and Ions," as announced.

AT the annual meeting of the Malacological Society of London, held on February 14, Mr. G. K. Gude was elected president in succession to Mr. J. R. le B. Tomlin. Mr. Gude has for the past nine years filled the office of hon. secretary of the society.

WE learn from *Science* that the National Geographic Society has presented the Hubbard gold medal to Mr. V. Stefansson, whose explorations during the last five and a half years in the Arctic regions have resulted in the reduction of the unknown polar regions of the western hemisphere by approximately 100,000 square miles.

THE death is announced, in his fortieth year, of Dr. W. Erskine Kellicott, professor of biology at the College of the City of New York. Dr. Kellicott had previously held for several years a similar chair at Goucher College, Baltimore, and from 1908 to 1917 was director of the Marine Biological Laboratory at Woods Hole, Massachusetts. He had written several books on evolution, embryology, and kindred subjects.

WE regret to note that the death of Mr. George Pauling is recorded in *Engineering* for February 14. Mr. Pauling was the senior partner in the firm of Pauling and Co., Ltd., which constructed the whole of the Rhodesian railways, in addition to many miles of line in other parts of South Africa. From 1894 to 1896 he served as Minister of Mines and Public Works in Rhodesia, and was also a member of the Executive Council.

THE following officers and council of the Royal Astronomical Society were elected at the annual general meeting on February 14:—*President:* Prof. A. Fowler. *Vice-Presidents:* Sir F. W. Dyson, Astronomer Royal, Dr. J. W. L. Glaisher, Major P. A. MacMahon, and Prof. H. F. Newall. *Treasurer:* Mr. E. B. Knobel. *Secretaries:* Dr. A. C. D. Crommelin and Rev. T. E. R. Phillips. *Foreign Secretary:* Prof. H. H. Turner. *Council:* Prof. A. E. Conrady, Dr. J. L. E. Dreyer, Prof. A. S. Eddington, Brig.-Gen. E. H. Hills, Mr. J. H. Jeans, Dr. Harold Jeffreys, Mr. H. S. Jones, Lt.-Col. H. G. Lyons, Mr. E. W. Maunder, Dr. W. H. Maw, Prof. J. W. Nicholson, and Lt.-Col. F. J. M. Stratton.

SIR ARTHUR EVANS has presented to the British Museum the magnificent collection of ancient British and other Celtic coins made by his father, the late Sir John Evans. This collection, containing more than 1700 pieces, has long been famous, and by its acquisition the museum collection, already strong, is placed in a position far in advance of any similar assemblage. In addition to the Celtic coins, the gift includes a valuable Gaulish and Iberian series. Sir Arthur Evans, in the letter in which he announces this splendid gift, explains that, "as regards the ultimate destination of the ancient British collection, my father, realising the claims that might weigh with me on another side, has left me absolute discretion. I feel, however, that in presenting the collection to your department I am fulfilling his most intimate wishes. It is, moreover, a fitting tribute to his memory that it should be permanently connected with the museum, to the welfare of which, as trustee, he had so long and actively devoted himself." The British Museum is to be congratulated on a splendid acquisition, which will always be associated with the eminent antiquaries by whom it has been preserved.

AN article entitled "The Crucial Question of Patents," by Sir Robert Hadfield, published in the *Engineering Review* for December last, directs attention to the defects of our Patent Law and its practice, and, at the same time, makes certain recommendations with the object of improving matters. Whilst unanimity in opinions prevails in relation to the desirability of introducing some of the reforms proposed by Sir Robert Hadfield, different views exist as to certain of the other proposals. For instance, many inventors feel that the introduction into this country of the United States "file wrapper" system, which provides for the arguments of the examiners dealing with applications being open to inspection by the public generally, is likely to prove injurious to their interests, and may give an unfair advantage to capitalists in negotiations for the purchase of patent rights from inventors or their agents. Similarly, a great number of inventors do not view with favour any widening in the present functions of the Patent Office, so as to permit it to adjudicate, before making a grant, upon the relative merits of rival claims; yet it is only in this way that effect could satisfactorily be given to the proposal that the department which grants the protection should guarantee its validity. Again, as regards the proposal made to increase the original term of the patent from fourteen to seventeen years, having in view the fact that inventions are of many kinds, some being simple and requiring little expenditure to place on the market, whilst others are complex and require much time, skill, and capital to develop, the modification in the law likely best to meet the needs of the situation would seem to be that which would facilitate the grant of an extension for varying terms according to the particular merits of the invention and the nature of the difficulties which had been overcome by the inventor, the original term of fourteen years established by long usage being retained as at present. There is a consensus of opinion that the need for reform in our Patent Law is pressing, and that action in relation thereto should be taken by the Government without delay.

IN the January issue of *Man*, Mr. J. Reid Moir describes two Late Bronze age urns found near Manningtree, in North Essex, and at Ipswich. That recently discovered in the latter locality contained fragments identified by Prof. Keith as calcined human bones. Both these specimens were obviously cinerary urns. They are distinguished by a peculiar form of decoration, a series of pittings all over the surface, which seems to be characteristic of the type of a similar kind found in Essex.

CAPT. A. T. H. NISBET gives a description of the conditions found in amputation stumps by means of X-ray examination, removal of which is necessary before an artificial limb can be fitted. These include abscesses, pieces of dead bone, inflamed nerve-ends, inflammation and inflammatory outgrowths of the bone, and adherent scars. For the examination he recommends the use of a moderately soft X-ray tube, as it brings out the abnormalities more clearly than other forms of tube (*Archives of Radiology and Electrotherapy*, No. 222, January, 1919, p. 237).

THE Hunterian oration was delivered on February 14 at the Royal College of Surgeons by Major-Gen. Sir Anthony Bowlby. "Surgery in the Field" formed the subject of the oration, and it was shown how improved methods had been introduced with consequent saving of life. Thus in the earlier stages of the war gas-gangrene was prevalent, but in 1917–18 out of 25,000 patients at the base hospitals only 84 had serious gas-gangrene. Each year of the war had seen better surgical methods, better results, lessened suffering, and the saving of lives and limbs in constantly increasing numbers.

Symons's Meteorological Magazine for January is the index number for the preceding year; it completes the fifty-third volume. A short notice is given of the rainfall of 1918. In addition to the usual matter comprised, including the map of the Thames Valley rainfall, there is an article on "The Congress of Scandinavian Geophysicists in Gothenburg, August 28 to 31, 1918," by Dr. Hans Pettersson. It is stated that a highly representative congress of about fifty Danish, Norwegian, and Swedish geophysicists met. Prof. Hildebrandsson, of Upsala, was elected president, and Director Ryden, of Denmark, Prof. Bjerknes, of Norway, and Prof. Nordenskjold, of Sweden, were chosen as vice-presidents, Dr. Hans Pettersson being general secretary. Amongst the papers read at the general and sectional meetings were "Weather Forecasting," by Prof. Bjerknes, describing a new method of short-range prognostics for agricultural purposes in West Norway, based on synoptic observations chiefly of the wind, the percentage of the correct forecasts being stated as between 85 and 90. There were also papers on "Hydrographical Observations on the West Coast of Greenland," on "Some Observations of the Aurora Borealis," and on "Weather Forecasting for Airmen." In all, thirty papers were read. It is intended to call together a second congress in due course. The same issue also contains the conclusion of a series of articles on "Work and Water-power," by Dr. H. R. Mill. The statistics accumulated by the Rainfall Organisation are necessarily of high value in determining requisite factors. Dr. Mill says:—"In this country it may be said, roughly, that the proportion of the natural water-power which it would pay to utilise depends on the price of coal. As the cost of fuel rises, it becomes worth while to draw on sources of water-power which, from remoteness or cost of works, could never pay while coal is cheap."

IN connection with a review in NATURE of January 9 of Dr. Silberstein's "Simplified Method of Tracing Rays through any Optical System," the author of the book has written to make an offer that should appeal to persons engaged in optical design. The reviewer suggested that there was some doubt as to the prac-

tical utility of the vectorial method of ray tracing, and expressed the desirability of further information on this point. Dr. Silberstein writes:—". . . In order to help the spread and the easy handling of the vector method, in the spirit of Dr. Brodetsky's closing sentence, I shall be glad to do personally all in my power to remove doubts and apparent difficulties. In this respect half an hour's personal conversation is certain to be more efficient than many hours dedicated to the writing of notes or papers for publication. The former has, moreover, the obvious advantage of being adaptable to the individual needs of the questioner. In order to meet, in part at least, these needs, I gladly offer myself to give free information on the subject in question to everybody who will care to call personally (not by letter) at 4 Anson Road, Cricklewood, London, N.W.2, where I shall be available for that purpose *on every Friday from* 5.30 *until* 7.30 *p.m.*" We have much pleasure in making public Dr. Silberstein's offer, and feel that some of our readers will gladly avail themselves of this unique opportunity of being initiated into the practical application of vector methods by a master of the subject. At the same time we suggest that Dr. Silberstein would be doing a service to a wider circle of those interested in optical work if he were to publish one or two detailed computations based on his formulæ.

THE following works are in the press for publication by the Carnegie Institution of Washington:—"The Duration of the Several Mitotic Stages in the Root-tip Cells of the Onion," H. H. Laughlin; "Contributions to the Genetics of the *Drosophila melanogaster*," T. H. Morgan, C. B. Bridges, and A. H. Sturtevant; "The Genetic and Operative Evidence Relating to Secondary Sexual Characters," T. H. Morgan; and "Studies of Heredity in Rabbits, Rats, and Mice," W. E. Castle.

OUR ASTRONOMICAL COLUMN.

LUMINOSITIES AND DISTANCES OF CEPHEID VARIABLES.—In continuation of his important studies of stellar clusters, Dr. Harlow Shapley has investigated the luminosities, distances, and distribution of the Cepheid variables (*Astrophys. Journ.*, vol. xlviii., p. 279). Restricting the discussion to variables with definitely determined periods of less than forty days, there are forty-five stars which are of the "cluster" type and ninety-four ordinary Cepheids with periods greater than a day. The absolute magnitudes and parallaxes have been determined by means of the luminosity-period relation, with an average probable error estimated at 20 per cent. The cluster-type variables are found to have absolute luminosities a little more than one hundred times the brightness of the sun, while the ordinary Cepheids range from two hundred to ten thousand times that of the sun. Fewer than one-third of the stars have parallaxes greater than a thousandth of a second, and the most distant Cepheids now known are nearly 20,000 light-years from the sun. While the ordinary Cepheids are strongly concentrated towards the galactic plane, the cluster-type variables are indifferent to that plane. The wide dispersion of the latter may probably be accounted for by their relatively high velocities in space.

RADIAL VELOCITIES OF 119 STARS.—A preliminary account of the radial velocities of 119 stars, as determined at the Cape Observatory, has been given by Dr. J. Lunt (*Astrophys. Journ.*, vol. xlviii., p. 261). The number of these stars which probably have constant velocities is seventy-six, while the remaining forty-three are either known or suspected spectroscopic binaries. Eighteen of the stars in the first class were very frequently observed in connection with the spectroscopic determination of the solar parallax, the total number of plates obtained for them being 552. The following are among the results for some of the bright stars, as compared with the values obtained at the Lick Observatory:—

Star	Radial velocity Cape km.	Lick km.
α Arietis	−15·3	−14·0
α Tauri	+54·0	+55·1
α Can. Min.	− 3·6	− 3·5
β Geminorum	+ 3·2	+ 3·9
α Hydræ	− 4·6	− 3·5
ε Virginis	−14·3	−13·2
α Boötis	− 5·3	− 3·9
α Serpentis	+ 2·9	+ 3·4
λ Sagittarii	−43·4	−43·1
α Aquarii	+ 6·8	+ 7·5

Approach to the sun is indicated by a *minus* and recession by a *plus* sign.

"ANUARIO DEL OBSERVATORIO DE MADRID."—This useful annual for 1919 contains all the customary astronomical data, including the times of rising and setting of the moon (which might with great advantage be inserted in our own Nautical Almanac). There are also several essays; one, by A. Vela, gives a *résumé* of researches on the temperature of the sun's photosphere, concluding in favour of 7000°. C. Puente shows how to find time and latitude from the observed altitudes of two stars; this can be solved graphically by the well-known Sumner method. Dr. F. Iñiguez, the director of the observatory, gives an interesting monograph on Nova Aquilæ, with photographs of the spectrum from June 9 to September 4, and a light-curve, which appears to show that the period of variation was about twelve days in July, but more than a month in August and September.

Very full details are given of the sun-spots and prominences observed at Madrid in 1917; also the results of observations of solar radiation between 1917 September 1 and 1918 August 31.

The remainder of the volume is occupied by the meteorological observations of 1917.

THE CHEMISTRY OF SEAWEEDS.

THE scarcity of potash compounds, of iodine, and of foodstuffs caused by the great war has directed increased attention to seaweeds during the past four years, and to the possible extension of the use of these as a source of such materials. For some years before the war the giant seaweeds of the Pacific Coast were the subject of systematic investigation in the United States, especially with a view to their utilisation as a source of potash. After the outbreak of war, when many countries, including the United States and the countries allied against Germany, were cut off from their usual supplies of potash compounds from the German mines, examination began to be made of all sources from which potash might be obtained independently of Germany, and seaweeds came in for an increased amount of attention.

If we consider the great supplies of seaweed which are available, especially in the case of an insular country like our own, with a long and deeply indented coast-line, it is remarkable how little has been done, either from the purely scientific or from the industrial point of view, for the thorough and systematic exploration of the chemistry of seaweeds. A criticism by Prof. C. Sauvageau,[1] of Bordeaux, of

[1] "Réflexions sur les Analyses Chimiques d'Algues Marines." *Revue Générale des Sciences*, 29e Année, No. 19, October, 1918.

the analytical work which has been carried out to determine the chemical composition of marine algæ brings out clearly how incomplete and scrappy is our knowledge of the chemical composition of these plants, and how untrustworthy and unscientific is much of the work which has already been done.

Prof. Sauvageau reviews what has been done in France, Britain, and the United States during recent times, and especially during the past thirty years, in the analysis of seaweeds, and he is specially severe on some of his own countrymen for their ignorance of botanical nomenclature and for the contempt with which they treat natural science, as shown by their failure to learn the rudiments of the language of botany before undertaking to deal with a botanical subject. Much of this criticism is just, and some of the examples given of the use of out-of-date and inexact nomenclature are sufficiently serious to show that it was necessary. While thus dealing faithfully with his own countrymen, Prof. Sauvageau recognises that some chemists have taken the trouble to identify with sufficient care the species which they have analysed. Thus he says that "the accuracy with which Stanford names the plants studied inspires more confidence in the reader than the uncouth appellations of Allary." He also recognises that American workers like Wheeler and Hartwell have taken care to obtain competent assistance in identifying the species they have examined.

At the same time Prof. Sauvageau appears to underestimate the difficulty in which the careful chemist who wishes to identify and name his species correctly sometimes finds himself. He himself offers a good illustration of this difficulty in his reference to the present writer's recent work on the composition of five of our commonest seaweeds collected on the coast of Scotland. Two of these belonged to the genus Laminaria, and are similar both in their appearance and structure and in their habitat. There is no difficulty to one who takes the trouble to make himself familiar with them either in distinguishing these species, or in recognising from Prof. Sauvageau's own description that what is called in my papers *L. digitata* is what he calls *L. cloustonii*, and that what I analysed under the name *L. stenophylla* he calls *L. flexicaulis*. But standard works of reference which were consulted were not agreed as to these names, which I used only after reference to a distinguished botanical colleague; and to make as certain as possible that there should be no mistake as to what species were intended, a standard work on seaweeds in accordance with which these names were used was referred to in one of my papers. Nevertheless, Prof. Sauvageau writes:—"His *L. stenophylla* is probably a mixture of that which English botanists call *L. digitata* (*L. flexicaulis*) and *L. stenophylla*, that being a close ally, if not a variety, of *L. flexicaulis*." He himself does not appear to be clear either as to the nomenclature of English botanists or as to the species which were identified with so much care. He can scarcely expect the chemist to do more than accept the best botanical guidance to be obtained on a point of this kind where, he admits, the practice of botanists is not uniform.

Another criticism which Prof. Sauvageau offers of the work of chemists is also valuable, and requires careful attention from the chemist, but again one cannot help thinking he would have been more effective if he had not attempted to press his criticism too far. He points out that if the analyses are to have a scientific, and not merely an industrial, value, not only should species be properly identified, but also samples collected for analysis should be clean and biologically pure, and obtained, if possible, from the actual habitat, with a careful record of the season, the condition of growth, and the state of the plants, whether fertile or sterile. All these are important points which have too often been neglected. The large common seaweeds are frequently garnished with a great variety of other organisms, both animal and vegetable, making it difficult to procure even a reasonably pure sample. In some cases these foreign organisms can be removed, but it is generally difficult to remove them entirely. It also introduces errors, as great in many cases as those which are being avoided, if attempts are made to wash the samples, as compounds which properly belong to them are also removed in the wash-water. All that one can do is to collect reasonably pure samples and to pick off all the foreign organisms which can be distinguished. In many cases, however, the chemist was not attempting to analyse a pure botanical species, but to determine the composition of the impure substance used for some industrial purpose, such as the drift-weed which is washed up on the beach, and used as manure or for kelp-burning. The value of such analyses is limited by the object in view.

Prof. Sauvageau has performed an important service in directing the attention of chemists to the precautions which they require to take when they enter on the systematic study of the composition of seaweeds or of any other species of plant. Our knowledge of the composition of seaweeds is still quite rudimentary, and very valuable work might be done in this field by chemists with a competent knowledge of the botany of seaweeds, or working in collaboration with botanists who would collect and identify the samples for analysis. The recorded analyses show wide variations in the composition of seaweeds of the same species, and Prof. Sauvageau is inclined, on account of this, to cast doubt on the samples or on the conditions under which they were collected. In the present state of our knowledge this is scarcely justified. Numerous well-authenticated cases of similar wide variations in composition are found in the case of other plants, even when they appear to be grown under similar conditions in the same locality and are collected at the same stage of growth.

JAMES HENDRICK.

ITALIAN CLIMATOLOGY.

TWO more contributions by Prof. F. Eredia to our knowledge of the climate of Italy have recently appeared, one dealing with the normal mean values of annual rainfall in Italy, and the other with diurnal temperature variation in Sicily. In the first paper, "Le Medie normali della quantita' di Pioggia in Italia" (*Giornale del Genio Civile*, anno lvi., 1918), the mean values for each calendar month are shown for nine well-distributed cities on the basis of the fifty-year period 1866–1915; and it is calculated that the values are correct to within 5 mm. for the rainier winter months and 9 mm. to 12 mm. for the summer months of smaller rainfall and more irregular distribution. In northern or continental Italy, as exemplified by Milan and Turin, the seasonal variation of rainfall is not prominent, but the wettest periods are early summer and autumn, the highest figures being for May and October. In peninsular Italy the typical Mediterranean feature of wet winters and dry summers is conspicuous, especially in the extreme south. Thus at Palermo the figure for December, the wettest month, is 108 mm. (4·3 in.), and for July, the driest, only 7 mm. (0·28 in.). The wettest city quoted is Genoa, on the Ligurian coast, where the wettest month, October, has 190 mm. (7·6 in.), and the driest,

July, 47 mm. (1·9 in.); and here also the winter, as a whole, is considerably rainier than the summer.

The other paper, "La Variazione Diurna della Temperatura a Catania e a Messina" (*Bollettino dell' Accademia Gioenia di Scienze Naturali in Catania*, fascicolo xliv., Luglio, 1918), shows that, excepting the months of June, July, and August, which have practically identical mean temperatures at Messina and Catania, ranging between 22° and 26° C. (72° to 79° F. *circ.*), the latter place is distinctly colder. The greatest difference is in January, when the mean for Catania is 9·5° C. (49·1° F.), and for Messina 11·6° C. (52·8° F.). The difference is attributed to the fact that for the major portion of the year Mount Etna, being snow-clad, exerts a chilling effect upon the air at Catania, rendered the more marked from the circumstance that the prevailing wind direction is N.W. at both places. Thus the wind at Messina blows straight in from the warm sea surface, but blows down on Catania from the snows of Etna. The mean diurnal range of temperature is greater at Catania in every month of the year except August, the greatest difference occurring in November. In this month the daily range is 5·1° C. at one place and 2·9° C. at the other, or a difference of 2·1°. The regulating action of the sea is thus more marked at Messina. At both places the diurnal range of temperature is small, but, as is very generally the case, greater in summer than in winter.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Lord Moulton, of Christ's College, honorary fellow of St. John's College, has been appointed Rede lecturer for the present year.

Mr. A. Hopkinson, of Emmanuel College, has been appointed additional demonstrator of human anatomy for five years.

Capt. J. T. Saunders, formerly junior fellow of Christ's College, has been elected to a senior fellowship, and Capt. C. G. Darwin, lecturer in mathematics at the college, to a junior fellowship. Capt. Saunders is University demonstrator of animal morphology, and Capt. Darwin was bracketed Fourth Wrangler in 1909.

OXFORD.—By the death of the late Provost of Oriel, Dr. C. L. Shadwell, the University has lost a well-known and characteristic figure. Though but slightly in sympathy with many of the movements and aspirations of present-day Oxford, Dr. Shadwell gained universal respect by the acutely legal turn of his mind, by his remarkable business ability, and by the devotion with which he threw himself into the public affairs of both University and city. A life-long advocate of education on a wide and general basis, he yet found time and opportunity to become a master in many departments of curious and specialised learning, often surprising his hearers by the sudden display of some unusual piece of erudition. These *dicta* were delivered with a characteristic incisiveness, and not without a suggestion of latent and kindly humour. Amongst his accomplishments was a wide and thorough knowledge of botany, which he turned to account as a curator of the botanic garden. For the last four years he had been living in retirement, but his loss will be deeply felt by his own college and by the University at large.

On February 18 a decree was introduced by the Warden of Wadham providing for the acceptance by Convocation of an offer by the trustees of the Christopher Welch benefaction to provide 450*l.* a year each for five years for a lecturer in clinical physiology and in economic zoology respectively. Mr. H. C. Bazett, fellow of Magdalen College, and Mr. N. Cunliffe, Trinity College, Cambridge, were appointed lecturers, these being the first appointments made under the Welch bequest.

At the same meeting of Convocation the report for 1918 of the Committee for Rural Economy was presented, recording, amongst other items, that a farm of 355 acres at Sandford-on-Thames had been secured on lease for the purpose of providing facilities for experiments and demonstrations in connection with the work of the School of Agriculture and Forestry.

THE Regional Association—an organisation for the promotion of regional research—is arranging for a vacation meeting at Malvern from April 9 to April 16. All further particulars can be obtained from the hon. secretary, Mr. Geo. Morris, 7 West Road, Saffron Walden.

WE learn from the *Times* that at a meeting of the Edinburgh University Court, on February 18, a letter was read from the Treasury intimating that an advance of 7000*l.* by way of a grant from the Development Fund would be made to the University in aid of the endowment of a chair of forestry on the condition already accepted by the University—that the remaining 7000*l.* required was provided by the University from other sources. The Court resolved to institute a chair.

SIR ERNEST CASSEL has placed in the hands of trustees a sum of 500,000*l.* for the following educational purposes:—(1) The promotion of adult education in connection with the Workers' Educational Association or any other association or body approved of by the trustees. (2) The establishment of scholarships for the encouragement of the education of workmen or their sons and daughters. (3) The promotion of the higher education of women by the assistance of colleges for women. (4) The promotion of the study of foreign languages. (5) The establishment of a faculty of commerce in the University of London in such terms as may be approved by the trustees. The trustees are Mr. Asquith, Mr. Balfour, Miss Philippa Fawcett, Mr. H. A. L. Fisher, Lord Haldane, Sir George Murray, and Mr. Sidney Webb; their secretary is Mr. A. E. Twentyman, 6 Stanhope Gardens, Highgate, N.6.

ANNOUNCEMENT is made that the general committee of Lloyd's Register of Shipping will grant the following scholarships for the study of naval architecture and marine engineering:—Three scholarships in naval architecture at Glasgow, Durham, and Liverpool Universities, tenable for three years; three scholarships in marine engineering at the University of Liverpool, tenable for three years; and two scholarships in marine engineering in connection with the Institute of Marine Engineers, tenable for two years. The regulations governing the scholarships have been amended in order that the field of competition may be widened. Before 1915 five scholarships were competed for each year, and were of a value of 50*l.*; the committee has resolved to increase this amount to 100*l.*, and since no scholarships have been awarded during the past three years, and also that probably there will be a larger number of candidates offering themselves than has hitherto been the case, to authorise the grant of more than one scholarship to each institution for the present year, provided the authorities can recommend that such a course can be adopted with advantage. Full particulars of the qualifications and details of the subjects of examination can be obtained from the Secretary, Institute of Marine Engineers, 85-88 The Minories, Tower Hill, London, E.1.

In 1914 the Education Committee of the City of Coventry had made all arrangements for erecting a technical institute, which, with equipment, was estimated to cost 40,000*l*. The war prevented the scheme being carried out, and the expansion of the city during the war has been such that the scheme has had to be entirely rejected as inadequate. The site selected being too small, it was necessary to find another. There is every prospect of a better site being obtained, with the additional advantage that there will be ample provision for extensions when the necessity for these arises. The Education Committee has approached the Chamber of Commerce with the view of obtaining assistance to make the new technical college worthy of the city. The Chamber of Commerce has treated the proposal very sympathetically, and will probably give material help in providing for the cost of the equipment; 50,000*l*. is the sum mentioned. Messrs. Alfred Herbert, Ltd., have given an impetus to the scheme by a very generous gift of 5000*l*. towards the equipment, and it is confidently expected that the other firms in Coventry will be relatively as generous. It is gratifying to note that the manufacturers, as a rule, take a keen interest in the technical education of their employees, and the interest shown by the Chamber of Commerce will probably lead to active co-operation between the Education Committee and the manufacturers. It is estimated that the whole scheme will cost between 100,000*l*. and 120,000*l*.

At a meeting of the Committee for the Furtherance of University Education in South-West England, held at Exeter on January 27, a report was given of the recent deputation to the President of the Board of Education to urge the matter. The deputation sought for the approval of the Government for the scheme of a university for the South-West, which should comprise colleges at Exeter, Plymouth, Newton Abbot, and Camborne, each doing the type of work suitable to its own locality. No fewer than ninety-one publicly elected councils have supported the scheme, and more than 250 Labour organisations are in favour. In reply, Mr. Fisher pointed out that in the university proposed for the South-West it appeared that the several faculties were to be widely separate from one another. Mining would be located at Camborne, agriculture at Newton Abbot, engineering and marine biology, and possibly commerce, at Plymouth, and the humanities and pure science at Exeter. In regard to finance, he felt that it would be difficult to establish a first-rate university of the South-West with the funds which at present seemed likely to be available. The number of university students would depend upon the development of secondary education in the area from which the university would draw. The 10,000 pupils given as the number in the secondary schools of the area concerned might be expected to yield rather fewer than 700 university students, and with some 200 of these probably going to Oxford or Cambridge, there would scarcely be enough left to justify the creation of a South-Western University. He would be very glad to see a really effective university set up in the West of England, but at the present moment, and in view of existing circumstances, he did not think that there was a sufficient promise of students, teachers, or financial support to justify the establishment of a degree-giving body in the two western counties, and that before such a step could be properly taken a good deal of preliminary work had still to be accomplished, not only in the sphere of secondary education, but also in the development of the higher forms of education at both Exeter and Plymouth. With these views before it, the committee decided to direct the executive committee to invite representatives of the governing bodies of University College, Exeter, Seale-Hayne College, and the Cornwall School of Metalliferous Mining, as well as the education authorities of the South-West, to confer with them in regard to the prospects of the further development of such institutions.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, February 6.—Sir J. J. Thomson, president, in the chair.—A. **Mallock**: Note on the elasticity of metals as affected by temperature. The present note is an account of some preliminary experiments on the variations with temperature of Young's modulus for fifteen selected metals. The choice was influenced largely by the ease with which specimens could be procured. No alloys are included. The metals chosen were rhodium, platinum, iron, palladium, nickel, copper, gold, silver, magnesium, aluminium, zinc, lead, cadmium, bismuth, and tin. The procedure was to determine the frequency of the vibrations of a stiff rod carried at its lower end by a small thin plate of the material to be tested, the other end of the plate being clamped to a fixed support. The plate and its support could be immersed in fluid of any desired temperature without wetting the rod or in any way interfering with the mounting. The temperatures employed were those of liquid air, 0° Centigrade, ordinary temperature (10°–15°), and as near 100° C. as was practicable. The measured frequencies of vibration at these temperatures furnished the necesary data for determining the changes in Young's modulus. The results showed that the more infusible the metal, the less the modulus was affected for a given change of temperature, and this suggested that there might be a real connection between the variation of the modulus (M) and the melting point θ_M in Absolute temperature. A diagram is given comparing the experimental results with what they would have been had the relation $dM/d\theta=\theta_M$ been true. If this relation holds, and θ_1, θ_2 are two temperatures for which the moduli are M_1, M_2, then would

$$M_1/M_2=\theta_M-\theta_1/\theta_M-\theta_2,$$

and if θ_1 is Absolute zero and $\theta_2=0°$ C., then in this case $M_1/M_2=\frac{\text{melting point Absolute}}{\text{melting point Centigrade}}$ for any two temperatures differing by 270° C. The experimental results show a distinct resemblance to those obtained on this supposition.—W. L. **Cowley** and H. **Levy**: Vibration and strength of struts and continuous beams under end thrusts. In a previous communication, "The Critical Loading of Struts and Structures," the authors investigated the stability of a strut under end thrust and simply supported at a number of intermediate points. The method of analysis has been extended in the present paper to include the more general problem of the vibration of such a system when the lateral load is periodic and the supports are assumed in a state of vibration. The flexural rigidity and the end thrust, constant along each bay, are taken for further generality to vary from bay to bay. These conditions correspond closely with those originated in a wing spar of an aeroplane when in flight and influenced by engine-throbbing. A very general form of the equation of three moments is derived, and the conditions for resonance and crippling are expressed in a convenient determinantal form. The general case where the end thrust, the flexural rigidity, and the mass per unit length vary between the supports according to any assumed law is discussed, and the method of solution illustrated in the particular case

of the crippling of a strut of variable flexural rigidity. The result is expressed in a form extremely convenient for graphical treatment.—A. **Dey**: A new method for the absolute determination of frequency. (With a prefatory note by C. V. Raman.)

Aristotelian Society, February 3.—Prof. T. P. Nunn, hon. treasurer, in the chair.—Prof. H. Wildon **Carr**: Philosophy as monadology. The monad is a substance conceived as an active subject owning its activities, and not as a substratum of qualities or attributes. Monads are a mental or spiritual order not to be confused with physical atoms, which are an external order. In ordinary experience we find it necessary to regard the world from two points of view: (1) as an extended sphere of activity in which space, time, and matter are common to all subjects, and (2) as a private universe existing only for, and reflected into, one individual subject. Monads are windowless. This negative attribute is not a defect, but a positive character distinguishing the monadic order from the atomic. Every centre of life or consciousness possesses the unity of a subject of experience, and every change of its state is wholly within itself. No monad by intercourse parts with its substance or deprives another monad of its substance. There are not monads and atoms. When we view existence as a monadic order there are no atoms; when we view it as a system of external relations, atoms, there are no monads. The two orders, though each effacing the other, are not of equal validity. Monads alone are real; atoms are an abstract view of reality for a practical end.

Physical Society, January 24.—Prof. C. H. Lees, president, in the chair.—S. **Skinner**: Notes on lubrication. Experiments on the pressure of air in the neighbourhood of a flywheel running in contact with a flat tangential board are described to exhibit the properties of a compressible lubricant. A comparison of the compressibilities and viscosities of the vegetable and mineral oils leads to the conclusion that the special property of "oiliness" is the physical property of incompressibility. In note ii. Worthington's experiments on the adhesion of two solids immersed in a stretched liquid are explained as an illustration of the phenomena of lubrication in a stretched liquid. In note iii. the effect of glass beads, etc., in promoting the free boiling of air-free water is explained by the occurrence of cavitation behind the moving beads, etc., the steam entering the cavities thus produced and dilating them into large bubbles.—Prof. W. B. **Morton**: Sir Thomas Wrightson's theory of hearing. The theory seeks to explain the power possessed by the ear of analysing into its component tones a compound aerial disturbance. It assumes (1) that impulses act on the mechanism of the ear corresponding with the maxima and minima of the compound vibration-curve, and also with the points where the curve crosses the axis; (2) that among the spacings of these impulse-points there is a preponderance of intervals which approximate to the periods of the component tones, their lower octaves and their combination tones, and that these spacings determine the sensations of the component tones. The present note is concerned with the second of these assumptions. Graphs are drawn which exhibit the way in which the distribution of impulse-points varies when relative intensities and phase-relation of the component notes are changed. Difficulties are found in (1) the large number of other spacings presented to the ear, (2) the variations of the spacings with loudness-ratio and phase relation, and (3) the fact that in a single pure tone the spacing is a quarter of the period of the vibration.—Dr. A. **Russell**: Electrical theorems in connection with parallel cylindrical conductors. Many problems in connection with parallel cylindrical conductors occur in practical electrical work. The formulæ for the capacity between the conductors and for the effective inductance are well known, but the values of the capacity and potential coefficients and of the inductance coefficients have not yet been determined. It is shown that for the case of a cylinder inside a cylindrical tube their values can in all cases be easily computed. When the cylinders are external to one another it is proved that the three capacity coefficients are connected by two very simple relations. Limiting values between which these coefficients must lie are found, and methods of obtaining closely approximate values in special cases are given. Practically identical formulæ enable us to find the current density and the inductance coefficients with high-frequency currents, both for a cylinder inside a cylindrical tube and for two parallel cylinders. In the latter case it is shown that when the phase difference between the currents is less than 90°, the mechanical force between the cylinders is repulsive when they are close together and attractive when they are far apart. At a definite distance apart, therefore, the cylinders when carrying high-frequency currents are in stable equilibrium. Since the potential coefficients can always be determined experimentally, it follows that the inductance coefficients for high-frequency currents, which are equal to them, are also found by the same experiments.

Royal Anthropological Institute, January 28.—Sir Hercules Read, president, in the chair.—Sir Hercules **Read**: Presidential address: War and anthropology. The president dealt with some of the scientific problems that confronted the institute as a consequence of the war, and suggested that it would be good for the institute, as well as for the world at large, if such societies were to take up the consideration of the physical well-being of the people regarded from every side. He referred first to the research work that had been done by his predecessor, Prof. Keith, in regard to the change in shape of the jaw and face contours of the British race in consequence, to some extent, of improper diet. He insisted upon the great importance of such investigations, and upon the duty that lay upon the Government to take measures to prevent degeneration owing to neglect of the obvious measures that would put a stop to such a decline. The institute had done excellent work in the establishment of a Bureau of Anthropometry, a branch of investigation that had been put to practical use in the Army, and no doubt numberless records had accumulated during the last four years. These would be of very great value as a demonstration of the physical condition of the British population, and in particular of the great gain that had resulted to the youths during their period of training—a period generally of very short duration, but of enormous benefit to the recruit. The president strongly advocated the continuance of such training, insisting upon the obvious advantages to the race on the physical side, and holding as strongly to the view that if in the course of training the youth could at the same time attain to the condition of being able to defend himself and his belongings against any aggressor, it would be an added advantage. Sir Hercules then dealt briefly with the difficulties connected with the Government scheme for the housing of the people, especially in relation to the healthiness of the proposed dwellings.

Zoological Society, February 4.—Dr. S. F. Harmer, vice-president, in the chair.—Sir Douglas **Mawson**: Australasian, Antarctic, and sub-Antarctic life. A large series of lantern-slides was exhibited, illustrating the

scenery, mammals, and birds of the South Polar zone. The author commented on the urgent need of international measures to preserve the fauna of these regions.

Mathematical Society, February 13.—Mr. J. E. Campbell, president, in the chair.—Prof. H. S. **Carslaw**: Diffraction of waves by a wedge of any angle.—T. C. **Lewis**: General or non-orthogonal pentaspherical co-ordinates.

MANCHESTER.

Literary and Philosophical Society, February 4.—Mr. W. Thomson, president, in the chair.—R. S. **Adamson** and A. McK. **Crabtree**: The herbarium of John Dalton. The paper consisted of a short account of the history of the collection and of Dalton's botanical work. Some of the more important points of botanical interest in the collection were dealt with.

PARIS.

Academy of Sciences, February 3.—M. Léon Guignard in the chair.—M. Pierre Viala was elected a member of the section of rural economy in succession to the late A. Muntz.—A. **Angelesco**: Two extensions of algebraic continued fractions.—E. **Maillet**: The gradually varied movement and the propagation of bores.—L. **Décombe**: Sadi Carnot and the principle of equivalence of heat and work; his calculation of the mechanical equivalent of heat reconstituted with the aid of data taken exclusively from the "Réflexions sur la puissance motrice du feu." Following Clausius, the reproach has frequently been made against Carnot that he adopted the material theory of heat, but it should not be forgotten that this was done with serious reserves, and this is shown by passages from his memoir. In the manuscript notes of Sadi Carnot, quoted in full, is a series of objections to the material theory of heat, followed by a formal enunciation of the principle of equivalence, in the following terms:—"From some ideas which I have formed on the theory of heat, the production of one unit of motive power necessitates the destruction of 2·70 units of heat." This figure of Carnot leads to 370 kg. for the mechanical equivalent, as against the 365 kg. given at least ten years later by Mayer. Carnot also sketched out a programme of experiments practically identical with those carried out fifteen or twenty years later by Joule, Colding, and Hirn.—MM. **Gutton** and **Touly**: Non-deadened electric oscillations of short wave-length. The apparatus, which is described in detail and with a diagram, furnishes waves of less than two metres in length, and the harmonic vibrations are extremely small.—G. **Claude**: A new application of viscosity. An account of the use of a very viscous liquid in connection with the recoil of artillery. A diagram shows the increased accuracy of shooting obtained by this method of control when compared with the gun in current use.—P. **Gaubert**: Liquid crystals of agaricic acid.—P.-W. **Stuart-Menteath**: The tectonic of the Pyrenees.—A. **Nodon**: Researches on a new method of meteorological prediction. The method is based on the connection between the visible disturbances of the solar surface, electrical and magnetic disturbances on the earth, and those of the atmosphere.—M. **Mirande**: The chondriome, the chloroplasts, and the nucleolar corpuscles of the protoplasm of Chara.—M. **Marage**: The timbre of the voice in the partially deaf.

WASHINGTON, D.C.

National Academy of Sciences, November, 1918 (Proceedings, vol. iv., No. 11).—L. B. **Arey** and W. J. **Crozier**: The "homing habits" of the pulmonate mollusc Onchidium. *O. floridanum* lives during high tide in "nests," *i.e.* rock cavities, containing a number of individuals. The individuals leave the nest in low water to feed, and return simultaneously to it before the tide rises again, giving evidence of homing behaviour.—W. J. **Crozier**: (1) Growth and duration of life of *Chiton tuberculatus*. The growth-curve is obtained on the assumption that the age of a Chiton may be estimated from the growth-lines upon its shell. The mean duration of life is probably a little less than eight years. (2) Growth of *Chiton tuberculatus* in different environments. Growth-curves obtained under different conditions are compared.—C. **Barus**: The interferometry of vibrating systems. The high luminosity of the achromatic interferences and the occurrence of but two sharp fringes make it possible to utilise them even in cases when the auxiliary mirrors vibrate. The vibration interferometer is quite sensitive, provided the average currents are of the order of several micro-amperes.—Sir Joseph **Larmor**: The essence of physical relativity. A general discussion of the physics underlying relativity, with particular reference to an article by Leigh Page.—C. **Barus**: Gravitational attraction in connection with the rectangular interferometer. The rectangular interferometer is so sensitive in the measurement of small angles that it may be used for the measurement of the Newtonian constant of gravitational attraction.—W. P. **White**: The general character of specific heats at high temperatures. The general law covering the behaviour of atomic heats from the lowest temperatures up demands that at sufficiently high temperatures all atomic heats at constant volumes should have the value 5·96. A contrary hypothesis has been made, namely, that atomic heats continue to increase with the temperature. The substances here examined give evidence that the atomic heats do increase above the value 5·96.—G. M. **Green**: Certain projective generalisations of metric theorems, and the curves of Darboux and Segre. The continuation of earlier work by the same autnor in the Proceedings.—C. **Barus**: The rectangular interferometer with achromatic displacement fringes in connection with the horizontal pendulum.

BOOKS RECEIVED.

Astrographic Catalogue, 1900·0, Hyderabad Section. December −16° to −21°. From photographs taken and measured at the Nizamiah Observatory, Hyderabad, under the direction of R. J. Pocock. Vol. ii. Measures of Rectangular Co-ordinates and Diameters of 61,378 Star-images on Plates with Centres in December −18°. Pp. xlix+218. (Deccan, India: Nizamiah Observatory, 1918.) 16*s.* net.

Annuaire Astronomique et Météorologique pour 1919. Par Camille Flammarion. 55e année. Pp. 364. (Paris: Librairie Ernest Flammarion, 1919.) 3.50 francs.

Meddelanden Från Statens Skogsförsöksanstalt. Häfte 15. Pp. 288+xxxii. (Stockholm: Aktiebolaget Nordiska Bokhandeln, 1918.) 4.50 kronor.

Essays and Discourses. By Sir P. Chandra Rây. With a biographical sketch and a portrait. Pp. xxxii+349. (Madras: G. A. Nathesan and Co., 1918.) 3 rupees.

Organic Thio-compounds, with Special Reference to Tautomeric Changes and the Formation of Polysulphonium Derivatives. Part i. By Sir P. Chandra Rây. Pp. iii+70. (Calcutta: The University, 1919.)

Traitement des Psychonévroses de Guerre. Par G. Roussy, J. Boisseau, and M. d'Oelsnitz. Pp. 191. (Paris: Masson et Cie, 1918.) 4 francs.

Mirrors, Prisms, and Lenses: A Text-book of Geometrical Optics. By Prof. J. P. C. Southall. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1918.) 3.25 dollars.

Recent Advances in Physical and Inorganic Chemistry. By Dr. A. W. Stewart. With an introduction by Sir William Ramsay. Third edition. Pp. xv+284. (London: Longmans, Green, and Co., 1919.) 12*s*. 6*d*. net.

Recent Discoveries in Inorganic Chemistry. By J. Hart-Smith. Pp. x+91. (Cambridge: At the University Press, 1919.) 4*s*. 6*d*. net.

The Great War Brings it Home. The Natural Reconstruction of an Unnatural Existence. By John Hargrave ("White Fox"). Pp. xvi+367. (London: Constable and Co., Ltd., 1919.) 10*s*. 6*d*. net.

The Voice Beautiful in Speech and Song: A Consideration of the Capabilities of the Vocal Cords and their Work in the Art of Tone Production. By Ernest G. White. New and enlarged edition of "Science and Singing." Pp. viii+130. (London: J. M. Dent and Sons, Ltd., 1918.) 5*s*. net.

The Cultivation of Osiers and Willows. By W. P. Ellmore. Edited, with introduction, by Thomas Okey. Pp. x+96. (London: J. M. Dent and Sons, Ltd., 1919.) 4*s*.

The Theory of Modern Optical Instruments. A Reference Book for Physicists, Manufacturers of Optical Instruments, and for Officers in the Army and Navy. Translated from the German by Dr. A. Gleichen, H. H. Emsley, and W. Swaine. With an Appendix on Rangefinders. Pp. xii+376. (London: H.M.S.O., 1918.)

Mikrographie des Holzes der auf Java Vorkommenden Baumarten, im Auftrage des Kolonial-Ministeriums. Unter leitung von Prof. J. W. Moll. Bearbeitet von Dr. H. H. Janssonius. Fünfte Lieferung. Pp. 337–764. (Leiden: E. J. Brill, 1918.)

DIARY OF SOCIETIES.

THURSDAY, FEBRUARY 20.

ROYAL INSTITUTION, at 3.—Prof. H. M. Lefroy: Insect Enemies of our Food Supplies.

ROYAL SOCIETY, at 4.30.—Jean Dufrenoy: Note on the Metabolism of the Glucosides of the Arbutin Group.—S. S. Zilva and E. M. Wells: Dental Changes in the Teeth of the Guinea-pig produced by a Scorbutic Diet.—W. E. Bullock and W. Cramer: A New Factor in the Mechanism of Bacterial Infection.—Major W. J. Tulloch: The Distribution of the Serological Types of *B. tetani* in Wounds of Men who received Prophylactic Inoculation, and a Study of the Mechanism of Infection in and Immunity from, Tetanus.

INSTITUTION OF MINING AND METALLURGY, at 5.—S. J. Truscott: Slime Treatment on Cornish Frames: Supplements.—Edwin Edser: The Comparison of Concentration Results, with Special Reference to the Cornish Method of Concentrating Cassiterite.—C. W. Gudgeon: The Giblin Tin Lode of Tasmania.—G. F. J. Preumont: Wolfram Mining in Bolivia.

LINNEAN SOCIETY, at 5.—C. E. Salmon: Drawings of British Orchids and Sea Anemones, by Mr. T. A. Stephenson.—R. H. Burne: Specimens of Sound-producing Organs in Invertebrates and Fishes.

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—G. L. Addenbrooke: Dielectrics in Electric Fields.

CHEMICAL SOCIETY, at 8.—R. G. Fargher and F. L. Pyman: Nitro-, Arylazo-, and Amino-glyoxalines.—J. Knox and M. B. Richards: The Basic Properties of Oxygen in Organic Acids and Phenols; and the Tetravalency of Oxygen.—W. N. Rae: Note on the Action of Chlorine on Tetramethyl Ammonium Iodide.

FRIDAY, FEBRUARY 21.

GEOLOGICAL SOCIETY, at 3.—Annual General Meeting.

ROYAL INSTITUTION, at 5.30.—A. T. Hare: Clock Escapements.

INSTITUTION OF MECHANICAL ENGINEERS, at 6.—Annual General Meeting.—*Resumed Discussions:* T. T. Heaton: Electric Welding.—H. Cave: The Development of the Oxy-acetylene Welding and Cutting Industry in the United States.—J. H. Davies: Oxy-acetylene Welding.—F. Hazledine: Oxy-acetylene Welding.

SATURDAY, FEBRUARY 22.

ROYAL INSTITUTION, at 3.—Hon. J. W. Fortescue: The Empire's Share in England's Wars—Western Europe.

MONDAY, FEBRUARY 24.

ROYAL SOCIETY OF ARTS, at 4.30.—Prof. J. A. Fleming: Scientific Problems of Electric Wave Telegraphy.

ROYAL GEOGRAPHICAL SOCIETY, at 8.—Lt.-Col. H. S. L. Winterbotham: Geography with the British Armies in France.

TUESDAY, FEBRUARY 25.

ROYAL INSTITUTION, at 3.—Capt. G. P. Thomson: The Dynamics of Flying.

ROYAL SOCIETY OF ARTS, at 4.30.—E. J. Duveen: Key Industries and Imperial Resources.

INSTITUTION OF CIVIL ENGINEERS, at 5.30.—F. J. Mallett: The Flow of Water in Pipes and Pressure Tunnels.—A. A. Barnes: Discharge of Large Cast-iron Pipe-lines in Relation to their Age.

ILLUMINATING ENGINEERING SOCIETY, at 8.—A. Cunnington: Some Notes on Railway Lighting and its Maintenance.

WEDNESDAY, FEBRUARY 26.

ROYAL SOCIETY OF ARTS, at 4.30.—W. L. Hichens: The Wage Problem in Industry.

GEOLOGICAL SOCIETY, at 5.30.—Lieut. E. H. Pascoe: The Early History of the Indus, Brahmaputra, and Ganges.

ROYAL AERONAUTICAL SOCIETY, at 8.—Capt. F. S. Barnwell: Some Points on Aeroplane Design.

THURSDAY, FEBRUARY 27.

ROYAL INSTITUTION, at 3.—Prof. H. M. Lefroy: How Silk is Grown and Made.

ROYAL SOCIETY, at 4.30.—*Probable Papers:* Hon. R. J. Strutt: Scattering of Light by Solid Substances.—Sir James Dobbie and Dr. J. J. Fox: The Constitution of Sulphur Vapour.—Dr. W. G. Duffield, T. H. Burnham, and A. H. Davis: The Pressure upon the Poles of the Electric Arc.

CHILD-STUDY SOCIETY, at 6.—Dr. P. B. Ballard: The Claim of the Individual Child.

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—Dr. S. F. Barclay and Dr. S. P. Smith: The Determination of the Efficiency of the Turbo-alternator.

FRIDAY, FEBRUARY 28.

PHYSICAL SOCIETY, at 5.—Philip R. Coursey: Simplified Inductance Calculations, with Special Reference to Thick Coils.—Dr. Ralph Dunstan: Demonstration of Some Acoustic Experiments in Connection with Whistles and Flutes.—G. A. Brodsky: Demonstration of a New Polariser.

ROYAL INSTITUTION, at 5.30.—Sir Oliver Lodge: Ether and Matter.

SATURDAY, MARCH 1.

ROYAL INSTITUTION, at 3.—Hon. J. W. Fortescue: The Empire's Share in England's Wars—Eastern Europe.

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