THURSDAY, NOVEMBER 9, 1916.

THE EMPIRE AT THE CROSS-ROADS.

Eclipse or Empire? By Dr. H. B. Gray and S. Turner. Pp. x+316. (London: Nisbet and Co., Ltd., 1916.) Price 2*s.* net.

THIS book will serve the useful purpose of directing popular attention afresh to the important questions of education and scientific research in relation to national prosperity, on which so many eminent scientific men have given emphatic warnings. It is the joint production of a scholar and of a man of business, and although primarily addressed to the man in the street, deserves attention from everyone concerned with education or with commercial manufacture. Its principal aim is to show that Great Britain, which forty years ago was the workshop of the world, is so no longer. It supports this statement by an inquiry into the reason for this decadence and by useful statistics.

The book is divided into three parts. The first is concerned with the development of the main thesis of the book and an analysis of the causes of this falling off in British productiveness, and then with a discussion of the defects of British education in its several stages of primary, secondary, technical, and university rank. The second part of the book deals more particularly with industry in its relation to pure science and to the State, and the third part is a glossary, or detailed examination, of various trades and industries, with the object of supporting the contention that in the last twenty to forty years most of the new ideas, inventions, and developments have been given to the world by other countries than our own.

The second chapter, on "The Englishman at Home," contains a short but searching analysis of our national character, its love of sport and recreation, restiveness under discipline, and dislike of State organisation. The third chapter, on "The Slackening of Momentum," shows by telling figures and statistics how serious has become our competition with better organised or more hard-working nations. Fifty years ago Great Britain produced per annum, according to the authors, nearly 5 million tons of iron and 225,000 tons of steel. Germany produced barely 1 million tons of iron and 100,000 tons of steel. Yet in 1913 German production of both iron and steel had risen to 19 million tons of each, whilst English production had only increased to 10½ million tons of iron and 7½ million tons of steel.

We find the same deficiency in whichever direction we look. British production has increased at a far less rate than that in Germany or in the United States. As regards home-grown wheat it has fallen by 20 per cent. in the last thirty years in England, and increased in Germany by 50 per cent. Only 5 per cent. of the cultivated land of Great Britain is devoted to-day to wheat production. In the last thirty years the cost of raising coal to the pit's mouth has nearly doubled in England, but has slightly decreased in the United States. The value of the annual output per man in ten different trades reveals not a single case in which it is not much greater in the United States than in the United Kingdom.

In the third part of this book these facts and figures are extended, and it is shown how fatal in its results has been the cherished conviction of the manual labourer and trade-unions that restriction of output operates to the benefit of the working classes. The direct opposite is, in fact, the truth, that high wages and high rate of production go together. Tracing, then, the causes of these erroneous ideas in the minds of manual workers, and the neglect of science in its applications by the manufacturer, our authors find it primarily in our defective systems of primary, secondary, and university education. They sketch out in detail the reforms that are required, and with their main suggestions most scientific men will be in sympathy. Science, they say, should be the first wheel of the educational coach and not the fifth. For our primary and public-school education they demand a more rational and useful syllabus, and a reduction in the time spent over the grammar of dead languages. We think, however, that the authors do not lay sufficient stress on the necessity for ethical and civic training. The man in the street regards the Germans, as seen in the light of the present war, as a nation of moral decadents, to whom cold-blooded murder, lies, cruelty, and treaty-breaking are only the natural expression of character. He says, though very illogically, if this be the result of a widely diffused scientific education, then the less we have of it the better. On the other hand he sees that our inefficient systems of education have at any rate produced a nation of young heroes, and he draws the conclusion that they cannot be so bad after all. The point which needs pressing is that the German character is the result, not of an over-cultivation of science, but of a disastrous perversion and deficiency in moral and ethical training. We have nothing to fear from educational programmes which give predominance to science, provided only that they give the right position to character training as well.

The second part of this book deals with the relation of science to industry and to the State. The authors do not, however, sufficiently distinguish between pure and technical research. The former will always be chiefly conducted in the universities and technical colleges, and in public or private research laboratories. The technical research must be conducted by voluntary associations of the trades concerned. The authors have not given sufficient attention to the opinions of those who have practical experience in this side of the subject. What is required from the State is a proper support for the existing institutions. The authors call for State endowed and provided laboratories, but the real difficulty is to find the right men and not the apparatus.

One lamentable result of the war is the loss

to the country of many brilliant and promising members of the younger research workers, who cannot be quickly replaced.

The glossary contains a large amount of interesting information. Some sections are contributed by experts, but we think that in many cases British work is unduly depreciated or neglected. In the section on "Telephones" the name of David E. Hughes, the inventor of the microphone, is not even mentioned, nor that of Oliver Heaviside, whose mathematical work led to the invention of the loaded cable.

The section on "Wireless Telegraphy" is very inadequate as a sketch of the subject. The writer seems to think that the coherer is still used as a receiver, whereas it has long since been abandoned. Two out of three of the actually used modern detectors are British inventions. Marconi's work, all carried out in England, is not sufficiently appreciated.

British invention in connection with submarine cable work, almost entirely a British industry, is ignored. The initiative quality of British scientific research is not sufficiently acknowledged. Nevertheless there remains sufficient to justify the main contentions of the book. We have all to turn over a new leaf, to reform educational methods, to work much harder, play much less, and bring the scientific method to bear on everything, or else the eclipse the authors foresee most certainly awaits us in the post-war struggle for commercial empire. J. A. FLEMING.

VINEGAR.

Vinegar: its Manufacture and Examination. By C. Ainsworth Mitchell. Pp. xvi+201. (London: Charles Griffin and Co., Ltd., 1916.) Price 8*s*. 6*d*. net.

THIS book seeks to fill an admitted void in the technology of an important fermentation industry. Works on the subject are to be met with in French and German literature, but their bearing on English procedure is only indirect, since the methods and conditions of acetification in this country are fundamentally different from those prevailing on the Continent.

Strictly speaking, the manufacture of vinegar—that is, the commercial preparation of a dilute acid from wine, capable of being used as a condiment or preservative, is not, and never has been, a British industry, since wine is not one of our native products. A similar, but by no means identical substance, was made in this country, even in very early times, by the souring of beer, and was known as "alegar"—a term practically now obsolete, or only to be met with in certain local glossaries. Formerly a clear distinction was drawn between the Continental and the native commodity. Thus Boorde's "Dyetary" (1542) speaks of "Soure and Tarte Thynges as Venegre and Aleger," and for many years the term vinegar was restricted to the imported variety derived from wine. So little was known in this country concerning the manufacture of this special article that the Royal Society, in one of the early volumes of its Transactions, published "The Way of making Vinegar in France: Communicated to the Publisher by an Ingenious Physician of that Nation, living at a Place where much of it is Made."

With us the manufacture of vinegar—using that term in its generic sense—still bears the impress of how it originated in this country—that is, from beer. Formerly the only useful way of disposing of sour beer, whether in the brewery or the household, was to turn it into vinegar. But as the demand for vinegar increased some more regular supply than "sick" or badly brewed beer was needed, and the manufacture was gradually placed upon a systematic and independent basis. Still this connection between the brewer and the vinegar maker long persisted. The fiscal authorities at least swept them into a common net—the fermented malt-product, no matter whether it was sweet or sour, coming within the purview of the gauger—although "Vinegar-Beer," as a Revenue Act of Charles II. termed the product, was let off with a lighter impost. "Vinegar-yards," as distinguished from the "common brew-houses," seem to have been first established in this country about the middle of the seventeenth century.

In the book under review Mr. Ainsworth Mitchell, who acts as chemist to the well-known firm of Messrs. Beaufoy and Co., one of the oldest and largest vinegar manufacturers in this country, has brought together a body of valuable information concerning the history of vinegar in general, its different varieties, and various modes of production, with special reference to English procedure; and this information he has presented in an interesting and eminently readable form. In his historical retrospect he begins his account at the period when vinegar received a certain amount of scientific attention from the early alchemists, and their immediate followers, the iatro-chemists, who speculated upon its nature and physiological action. It is interesting to note that certain of their crude theories still persist in old wives' fables, and in the practice of quacks. The author touches lightly upon the early theories of acetification, but of course he deals with the suppositions of Liebig and the far sounder views of Pasteur, Nägeli's mechanical theory, and the more modern Enzymic theories. This is followed by a description of the acetic bacteria, their various species, zooglæal condition, and involution forms, and the effect of light and oxygen upon them. These chapters are fully illustrated, showing the morphological changes of the bacteria due to age, and the character of the medium. They do not pretend to be exhaustive, as they are intended rather for the general reader than for the specialist, but so far as it goes the account is sound, and no important point is omitted. The chemical reactions in acetification are next dealt with, including the production of aldehyde, acetal, and the various esters which confer upon the different vinegars their characteristic aroma and other peculiarities. Next follows a description of acetic acid, its chemical and physical properties, and its

preparation from verdigris, from spirit vinegar, and from pyroligneous acid, and there is a short reference to a few of the processes which have been described (and patented) for the synthetic production of acetic acid by inorganic methods.

But perhaps the most interesting section of the book to the lay reader is the description of the modern methods of making vinegar from an infusion of malt or malt and grain, as practised in England, and it is here that the author's technical knowledge and experience give his work a special value. The processes are described in detail, and are well illustrated, showing the most approved forms of mash-tuns, mashing machines, sparges, refrigerators, fermenting tuns, acetifiers, sterilisers, etc. The remaining chapters deal with the chemical methods of examining vinegar, and with the characteristics of different vinegars.

The author as a chemist concerned with the manufacture of vinegar has naturally something to say on the relations of that substance to the Food and Drugs Acts, and on what is known as the malt vinegar question. At present both the law and the practice are admittedly in a somewhat chaotic condition. What is held to be legitimate trading in one county renders a dealer liable to a criminal prosecution in another. The Local Government Board has no power to fix legal definitions of food substances, but in response to the appeal of the Association of Vinegar Brewers it has suggested certain definitions. These definitions have not been universally accepted by public analysts, nor, when accepted, have they been regarded as obligatory by certain stipendiaries who are more concerned to dispense law than justice. The consequence is there is a considerable amount of confusion in administration, and malpractices tend to be perpetuated which might readily be put an end to by the exercise of a little common sense on the part of judicial authorities.

INVARIANT THEORY.

A Treatise on the Theory of Invariants. By Prof. O. E. Glenn. Pp. x+245. (London: Ginn and Co., 1915.) Price 10*s.* 6*d.* net.

LIKE many other branches of mathematics, the theory of invariants has gone through stages similar to those of gold-mining. We may reckon Gauss, Lagrange, and Eisenstein among the pioneers; Boole, Cayley, Sylvester, and Salmon found the first big nuggets; and Aronhold's symbolic method may be compared to the rocker which extracted gold-dust from alluvial deposits. Finally, the refractory problem of finding complete systems led Gordan to invent his transvectant formulæ, corresponding to the stamps and cyanide tanks now used in South Africa.

The present book illustrates very well the state of the subject at present. The author gives all the important methods, both for binary and ternary forms, including annihilators of sources, polar theory, Aronhold's symbolic method, and Gordan's series. Complete systems are given for binary forms up to the quintic inclusive, and for certain pairs of forms; tables are also given for two ternary quadratics, and for the ternary cubic. Gordan's theorem is proved with the help of Hilbert's theorem and a lemma by Jordan, which simplifies the analysis. In the ternary theory an account is given of Clebsch's translation (*Uebertragung*) principle; nothing is said, however, about connexes.

The main novelty of the work is the account of modular invariants, the invention of Prof. Dickson. This remarkable theory illustrates once more the striking difference there is between umbral and arithmetical analysis. Fundamental problems, such as finding a complete system, assume an entirely new aspect, and lead to quite different results. Whether this new theory will have wide applications is uncertain; but there is no doubt of its theoretical interest and of the new turn it has given to a somewhat stereotyped part of analysis.

In connection with Gordan's theorem and the use made of Hilbert's theorem we may add a few remarks. To us, at any rate, there is some vagueness both in the statement and the proof of Hilbert's theorem; fortunately, however, so much of it as is wanted for the proof of Gordan's theorem practically amounts to the fact that linear diophantine equations of a certain type must have solutions that form what Dedekind calls a finite modulus. Hilbert's theorem is that any definite set of polynomials forms the whole or part of what Kronecker calls a modulus $(F_1, F_2, \ldots F_m)$, *i.e.* the aggregate of all expressions

$$\sum_{1}^{m} G_s F_s$$

where $G_1, G_2, \ldots G_m$ are arbitrary polynomials. The difficulty we feel may be illustrated by taking the case of four homogeneous variables and considering those polynomials which, equated to zero, represent all surfaces of given "deficiency" p; do these all belong to a finite modulus of the Kronecker type? To speak, as Prof. Glenn does, of polynomials as "formed according to any definite laws" is so very indefinite as to make us fear some tacit and illegitimate assumption in the proof. Very likely our difficulty is owing to our stupidity, but there it is; of course there is no great trouble in showing that the theorem does apply in a large number of important cases.

The present work is in many ways similar to that of Messrs. Grace and Young; it is rather more analytical in character, though there are a fair number of articles on geometrical applications and interpretations. We sometimes wish for another Clebsch to appear and give geometrical embodiment to these immaterial formulæ. The trouble is that the simplest analytical concomitants do not, as a rule, correspond to the simplest geometrical derivatives. For instance, a binary quintic has four linear covariants; suppose we represent the quintic by five points on a conic, each of the linear covariants must give a point on the conic derivable by projective construction from the original five; but it is not by any means

obvious what these constructions should be. On the other hand, we can easily get covariant sets of points by construction, but it is then troublesome to find their analytical equivalents. The results for the cubic and quartic are so simple and elegant that one would like to have some development, if possible.

It should be noted that Prof. Glenn has given, as an appendix, forty-eight very good and instructive exercises; and we may add that, in spite of its conciseness, the book seems as easy to read as the subject will permit. G. B. M.

THE GROWTH OF TELEPHONY.

The Telephone and Telephone Exchanges: their Invention and Development. By J. E. Kingsbury. Pp. x+558. (London: Longmans, Green and Co., 1915.) Price 12*s.* 6*d.* net.

THIS book covers most of the ground relating to telephony from its earliest stages to the present time. It may, indeed, be regarded as a "Short History" of telephony, and, as a matter of fact, the author's original intention was to write a history, but circumstances were not favourable to the project. However, the future historian will find in Mr. Kingsbury's volume much useful historical matter and many finger-posts indicating different avenues of development which merit much fuller treatment than has been possible in this work.

A marked and valuable feature of the book is the numerous extracts from circulars of early telephone companies and from unpublished reports of experts and of telephone conferences, held principally in the United States. Only a person very intimately connected with the industry from its infancy could have obtained this exclusive information and made such judicious selection of material. Telephone engineers interested in the growth and development of their instruments and systems will feel indebted to Mr. Kingsbury for the masterly way in which the subject is dealt with in the work under review. If ever "scissors and paste" can be justified, this is a case in point; for here one gets the views of inventors and pioneers in their own words, "hot from the anvil" as it were, and free from any form of distortion due to narration by a second party. The work is not of the text-book order; persons desiring technical details of the latest instruments and appliances should consult other treatises, but those who wish to study early telephonic devices and the way they developed into present-day models will find in the volume much that they require presented in a very readable form.

The book is conveniently divided into thirty-three chapters and two appendices, one of the latter giving telephone statistics of the world, and the other relating to the increased telephone rates in Great Britain. In the first six chapters—headed, respectively, i., Introductory; ii., The Spoken Word; iii., The Growth of an Idea; iv., The Undulating Current; v., The Solution of the Problem; and vi., Development and Demonstration—the author traces the early uses of the word "telephone" for speaking-trumpets and speaking-tubes, for instruments depending on the transmission of sound through rods of glass, wood, etc., as in the "enchanted lyre," to the electrical transmission and reproduction of musical sounds, and eventually of human speech, by currents of varying strengths.

Subsequent chapters relate how the beautiful scientific instrument patented by Alexander Graham Bell in 1876 was, by the prevision and business acuity of the inventor and his American associates, made the basis of a new branch of electrical industry of enormous benefit to the public, and in a few decades permeated all parts of the civilised world and utilised capital amounting to some 400 millions sterling. The headings of these chapters are as follows:—vii., The Production of a Commercial Instrument; viii., The Application to Commercial Uses; ix., The Telephone Exchange; x., The Battery or Variable Resistance Transmitter; xi., The Microphone; xii., Philipp Reis and his Work; xiii., Call Bells; xiv., The Telephone Switchboard; xv., The Organisation of the Industry in the United States; xvi., Competition, Consolidation, and Development; xvii., Introduction of the Telephone in Europe and Abroad; xviii., Public Apathy and Appreciation; xix., The Multiple Switchboard; xx., Outside or Line Construction; xxi., Ten Years' Progress; xxii., The Development of Dry-core Cable; xxiii., Early Exchange "Systems"; xxiv., Telephone Engineering on a Scientific Basis; xxv., The "Branching" System; xxvi., The Common Battery System; xxvii., Automatic and Semi-Automatic Switchboards; xxviii., Long-Distance Service; xxix., Instruments; xxx., Rates; xxxi., The Economics of the Telephone; xxxii., The Telephone and Governments; xxxiii., Conclusion.

Chap. xii., on Reis's work, should, chronologically, be near the beginning of the book, but it is put later because "its consideration is facilitated by the preceding chapters." On the question of priority the author maintains that Reis invented a musical telephone and not a talking telephone, and that "his work had no direct effect on the invention of the speaking telephone, for Bell fortunately went on entirely independent lines and without any reference to the prior work of Reis." Throughout the book the work of Bell and his colleagues is given especial prominence, sometimes to the detriment of others, such as Reis, Hughes, Gray, and Edison. In fact, the "pro-Bellism" of the author is a feature to which some exception might be taken. In a similar way, when dealing with long-distance service, Pupin's work is highly and deservedly appreciated, whilst that of O. Heaviside (who made the discovery that by increasing the inductance of lines their speaking qualities could be improved) is insufficiently recognised. These, however, are minor blemishes in an exceptionally valuable book. T. MATHER.

OUR BOOKSHELF.

Subtropical Vegetable-Gardening. By P. H. Rolfs. Pp. xviii+309. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1916.) Price 6*s.* 6*d.* net.

THE Rural Science Series, under the able editorship of Prof. L. H. Bailey, enjoys a deserved reputation for the high standard of excellence reached by its constituent volumes, and the one before us is no exception in this respect. Those whose lot is cast in the hotter parts of the world ought to be grateful to Mr. Rolfs for his practical and sensible work on subtropical vegetable growing. The author is the director of the experimental station of Florida. In America the exploitation of the land is looked on as a proposition of chief importance, and much enterprise, brains, and money are devoted to the solution of the multifarious problems that confront the cultivator.

Although Mr. Rolfs's book is designed primarily to meet the needs of the Florida people, it will be found, none the less, of great use in other parts of the tropical and subtropical belts, and the suggestive way in which difficulties of all kinds are indicated and disposed of should render it good reading to the dwellers of temperate zones as well.

The chapter on irrigation is an example to the point, for the water-question is certain to turn up in one form or another in all gardens, wherever they may be situated. The present writer has seen something like the subterranean methods of irrigation there described applied with remarkable results, even in this country. The cultural notes respecting the different vegetables are good, and the hints as to suitable manures, as well as the accounts of the various pests likely to be encountered, will be useful. In fact, the author is able to draw on a wealth of experience and knowledge which is at his disposal as head of an important experimental station, and we have no hesitation in cordially recommending the book to all whom it may concern, and furthermore in congratulating the author on the skill with which he has discharged his part of the matter.

Earliest Man. By F. W. H. Migeod. Pp. xii+133. (London: Kegan Paul, Trench and Co., Ltd., 1916.) Price 3*s.* 6*d.* net.

THESE are the musings and observations of one who has had long experience of life among primitive men and wild animals. While resident in the Gold Coast Colony the author not only devoted himself with well-known success to the study of the native languages, but was also a keen and thoughtful observer of the various tribes and their environment. He is, therefore, well equipped by first-hand knowledge for making suggestions as to the manner in which the earliest men may have gradually acquired the various habits and manifestations of intellect which distinguished them from their ape-like ancestors.

Mr. Migeod assumes that "if a creature of some species low in the scale of evolution can perform certain acts tending to operate on inanimate nature, another creature no lower, such as Pre-man, cannot be denied the possession of the same capacity. Further, if there are natural occurrences which can cause lower species to act out of their usual habits, and evince undoubtedly new mental activities, the same potential capacity must also be allowed in the case of Pre-man." He then discusses in order the possible origin of man's primary instincts, the making of implements, the use of fire, the beginning of speech, and his special social organisation, with the dawn of religion. He concludes with an interesting observation that when an ordinary monkey dies in the forest, the rest of the troop simply leaves the corpse and abandons the place, at least for a time; while when an ape such as a chimpanzee dies, its companions drop the body into a hole in the ground if one can be found, and in any case cover it with a great heap of sticks and branches.

Some of Mr. Migeod's conceptions of the laws and causes of organic evolution will by no means commend themselves to those who are accustomed to approach the subject from a wider point of view, but the novelty of the circumstances in which his little book was written makes it stimulating and interesting. A. S. W.

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.*]

A Nomenclature for "Resistance Derivatives."

IT is evident from Mr. Bairstow's National Physical Laboratory papers that the notion of "resistance derivatives" is likely to play a permanent part in the experimental study of aeroplane motions, as well as in the theoretical rigid dynamics associated with them. It therefore becomes important to have a uniform nomenclature for these quantities which shall be independent of the choice of axes, and thus free from any possible ambiguity or source of difficulty.

The following names are used by Mr. Bairstow to distinguish the quantities depending on translation and rotation respectively:—

Translational.	*Rotational.*
Longitudinal.	Rolling.
Normal.	Yawing.
Lateral.	Pitching.

Now, it will be found that a possible word of four letters can be made by combining the first two letters of any one of these names with the first two of any other, and such words are not more objectionable than nine-tenths of the names that are introduced to cover new inventions. The nine resistance derivatives for the longitudinal oscillations will then be designated as follows:—

Lolo	Lono	Lopi.
Nolo	Nono	Nopi.
Pilo	Pino	Pipi.

While the names of the lateral derivatives will be:—

Lala	Laro	Laya.
Rola	Roro	Roya.
Yala	Yaro	Yaya.

In the symbolic notations hitherto used the force component is always written first and the component of motion producing it is written after it as a suffix. It is therefore important that the same convention should be followed in the proposed nomenclature. Thus "Lopi" will stand for the X_r of my "Stability in Aviation," while "Pilo" stands for N_u. These words take no longer to write than $\log x$ or $\sin x$, and it would be easy to employ them in writing down formulæ, which would thereby gain much in clearness and suggestiveness. G. H. BRYAN.

Plastic Flowing of Metals.

REGARDING the interesting research work published from time to time on the plastic flowing of metals under stress, might not these results have a bearing on the action of the fusion of wires by electric currents? For instance, it is well known to electrical engineers that erratic results are obtained by the use of the present formulæ for calculating the so-called "fusing" currents of wires.

At present, so far as the theory of electrical fuse wires is concerned, these theories deal merely with the generation of heat per unit length in the wire, and the loss of heat per unit length of the wire. Now, whatever the gain or loss of heat may be, that in itself is surely merely a cause increasing the plasticity of the wire, and thereby allowing the mechanical stresses acting on the wire to break it. Consequently, it would appear that any theory which omits all reference to the mechanical stresses set up by the heating is necessarily incomplete, and represents only a portion of the process.

At present, owing to lack of experimental data, it is impossible to say whether one can predict the fusing for any metal of given dimensions, but so far the results obtained seem more promising than by the older methods. W. H. F. MURDOCH.

Westerlea, Mill Hill, Middlesex, November 1.

Optical Deterioration of the Atmosphere and Volcanic Eruptions.

IN NATURE of October 5 it is stated that the cause of the optical deterioration of the atmosphere in July and August "is for the time being still in doubt. Up to the present no reports of volcanic eruptions have come to hand from any part of the globe."

I wish to state that in July a strong outburst occurred of the Stromboli volcano, and that on July 4 there was an extraordinary eruption of fluid and incandescent lava to a great height, followed by a thick rain of lapilli and ashes. The emission of enormous columns of black cloud lasted many days.

A. RICCÒ.

R. Osservatorio di Catania ed Etneo,
October 30.

POSITION AND PROMISE OF BRITISH DYESTUFF MANUFACTURE.

THE question is frequently asked: "What is being done to produce British dyes?" Broadly, it may be said, the problem is being dealt with as efficiently as could be expected under present conditions. The difficulties may be roughly classified as follows:—

(1) The raw materials necessary for dyestuff manufacture are also in the main the raw materials from which high explosives are made, as well as other important products of the utmost value in the present war. It is only with great difficulty that the necessary raw materials are released by the Munitions and other Government Departments.

(2) There is an extraordinary shortage of adequately trained chemists. This shortage has been accentuated owing to the great demand for chemists in explosives works, the sending of chemists to the Front to study questions of gas poisons, etc., the recruiting for military service, and the failure of tribunals to appreciate that one clever chemist working at home may discover the means of saving thousands of our men and accounting for the destruction of thousands of the enemy.

(3) The problems to be solved by chemists are not only numerous, but many are exceedingly intricate and complex. The patents taken out by Germans in this country for many years past have been drawn up in an extraordinarily skilful manner by the help of our ablest lawyers, patent agents, and experts, so as to disguise in every conceivable way the method of arriving at the production of the patented article or its manufacture. This has been a scandal that has been allowed to gain force year by year. It is almost incredible that we should have allowed ourselves to be hoodwinked in this way, granting these great privileges to powerful German firms in order to restrain manufacture in this country.

(4) A serious difficulty will have to be faced in settling the question as to how to distribute amongst chemical manufacturers the many problems that await solution. It is most desirable to avoid overlapping of effort in research, etc., or quite unnecessary duplication of plant. Otherwise we shall have, say, one firm trying to solve too many problems and others, quite competent and suitable, making no efforts at all. These questions, it is proposed, shall be dealt with by some central authority, such as the recently formed Association of British Chemical Manufacturers, one of whose objects is to help manufacturers in this and many other desirable ways, *e.g.* to unite their efforts to fight the common foe rather than to compete with one another at home. Had such an association been in existence early in the war, these particular troubles would have been largely avoided, and much valuable time and money saved.

(5) The U.S.A. Government, although relatively a Free Trade one, has lately promised duties of more than 100 per cent. on dyestuffs and chemical products after the war so as to help America to build up what to all intents and purposes is for them, as it is for us, an infant industry. Our Government has so far resolutely refused any definite indication in that direction; and yet, without heavy protective duties, the chemical industry of the finer products, including dyestuffs, cannot possibly be built up and firmly established in this country.

(6) It is now quite clearly recognised that only very large undertakings can afford to carry on the kind of research that is essential for the success of the dyestuffs industry. This is perhaps the chief,

if not the sole, excuse that could be adduced for Government support of a very substantial character to one firm only rather than helping a relatively large number of smaller concerns, which many now believe would have produced more immediately satisfactory results.

(7) In spite of manifold difficulties much has been done by universities and technical institutions of the higher order to help industry. Professors, lecturers, and post-graduate students have vied with each other in endeavours to meet many demands made upon them, and their collaboration with manufacturers has led in many cases to extraordinarily gratifying results. If all the facts could be published it would be a most agreeable surprise to many, who have taken an altogether too gloomy view of the possibilities of this collaboration. Leeds University and the Manchester School of Technology have started new departments for chemical research for special objects, such as the study of problems in connection with the dyestuff industry. Remarkably fine and eminently useful work has been carried out also for the Army and Navy. A great deal more could have been done in that direction but for the aforesaid shortage of well-trained chemists, the relatively small number of whom are at last "coming into their own." Salaries that would have been thought preposterously large a few years ago are now gladly paid. It is to be hoped that this will tend to attract to the profession a large number of suitable and able men as well as women. It may indeed be said that unless this takes place there is not much hope for the establishment and maintenance on an adequate scale of the dyestuffs and allied industries; and not only must those who have to deal with the scientific and practical side of the industry be chemists, but what is equally important, the men who direct the administrative side of the business must also be well-trained chemists of business experience, or good business men with a chemical training. It is facts such as these that are appreciated far less than they deserve to be. But the war is teaching us many things, and as we have perhaps at last realised the importance of the work of the chemist in war-time, so it is just conceivable that the nation may in time come to realise that in peace-time also industrial and material progress is going to depend more than it ever did before on the successful work of the chemist.

A. R.

PRESERVATION OF NATURAL COLOUR IN PLANTS.

SO long ago as 1908 Prof. J. W. H. Trail described in the *Kew Bulletin* a method which he had worked out for fixing the green colour in plants. By placing the plant for a shorter or longer period in a boiling solution of copper acetate dissolved in acetic acid, a combination of the copper salt with the chlorophyll was formed which rendered the colour permanent when the specimen was exposed to the light after drying or placed in a preservative solution such as alcohol.

The method deserves to be more widely known than it seems to be among those interested in preparing plant specimens for exhibition in museums or for lecture purposes. It is essentially a method the results from which gain by experience; different plants lend themselves to the treatment with different degrees of success, and require very different periods of treatment; the time for which it is necessary to keep the plant in the boiling solution varies from one minute to forty minutes, according to the action of the copper salt upon the plant. If the action is proceeding satisfactorily, a period of one to five minutes should suffice; the end of the operation is easily judged by the colour or by treating two different specimens for different periods; a specimen that by such comparison appears to require longer treatment can always be reimmersed to get the desired effect. Many plants, notably the leaves of evergreen shrubs, are more difficult and generally less satisfactory in the ultimate colour, probably owing to the presence of mucilaginous or decomposition products or tannins. These require long treatment varying from twenty to forty minutes; after the first immersion they turn yellowish, and then after a time the yellow gradually gives place to green, generally an olive-green. Other plants, notably Aucuba, fail entirely, as they pass from the yellow to a muddy-brown or black colour.

After treatment the plants should be washed (like photographic prints) in running water for about two hours. They are then dried under as light pressure as is compatible with keeping the plants from twisting, or, after shaking off as much water as possible, may be dried in hot sand. In many cases the plants are rendered so flaccid by boiling that sand-drying is difficult or impossible. Plants that have required long boiling not infrequently revert to a bad colour when sand-dried.

Young parts of plants green better than old; better results may be expected from "spring" leaves than from "autumn" leaves.

A stock solution is made by saturating commercial strong acetic acid with powdered copper acetate. For treatment, dilute the stock solution with water in the proportion of three or four parts of water to one of stock solution. The solution is heated in a non-metallic vessel, glass beakers being probably the most suitable, and wooden, not metal, forceps should be used for manipulating the specimens.

This method has been used at the Natural History Museum for some time past in the preparation of plants for exhibition purposes, and good results have been obtained with cryptogams as well as flowering plants; ferns especially give satisfactory results, and, as Prof. Trail has noted, fresh green Algæ can be successfully treated. Proceeding out of these investigations, experiments have been made with the object of preserving the natural colour of seaweeds or of intro-

ducing a colour that is natural and permanent. The exhibition of Algæ in the Botanical Gallery, which has been recently rearranged, shows an appreciable success for the red Algæ and some satisfactory results for the brown Algæ. It is proposed to present an account of these experiments shortly before one of the scientific societies.

A. B. RENDLE.

DR. J. O. BACKLUND.

ASTRONOMERS will hear with regret of the death of Dr. Backlund at Pulkova on August 29. He was a native of Sweden, having been born at Langhem, in Wermland, on April 28, 1846. He studied mathematics and astronomy at the University of Upsala, and in 1873 went to Stockholm Observatory as assistant to Prof. Gylden, whose new methods of perturbations he studied with enthusiasm. After a brief return to Upsala in 1875, he left Sweden for Russia, where he remained permanently. He was at Dorpat Observatory for three years, and in 1879 went to Pulkova as assistant to Dr. Otto Struve. On Prof. Bredichin's death in 1895 he was appointed director of the Observatory, retaining this post until his death.

Dr. Backlund is best known for his immense researches on the motion of Encke's comet, for which he received the gold medal of the Royal Astronomical Society in 1909. Encke had detected the acceleration in the comet's mean motion, which he ascribed to the action of a resisting medium. After his death in 1865 von Asten took up the research, adopting some of Gylden's methods. He was unable to represent the comet's motion by any constant value of the acceleration, and died at Pulkova in 1878 without solving the problem completely. Backlund took up the matter, receiving grants from M. E. Nobel and the Petrograd Academy of Sciences for assistance in computing the perturbations, which were redetermined from 1819 to 1891, and afterwards to 1911.

Backlund found clear evidence that sudden changes in the amount of acceleration took place in the years 1858, 1868, and 1895. He later found evidence of a fourth change about 1905; after this the acceleration had only one quarter of its value before 1858. He also studied the changes in brightness of the comet (it is generally brighter before than after perihelion), and made the tentative suggestion that its particles are flat and oriented parallel to a particular plane, so that when seen edgewise they reflect little light.

A valuable by-product was the determination of the mass of Mercury, the value being 1/9,700,000 of the sun. This mass cannot be found except by comets, for even Venus is not appreciably perturbed by Mercury. Several approaches of the comet to Mercury yielded accordant results.

Dr. Backlund showed great energy in administration; he found that the climate of Pulkova was unsuited for delicate astrophysical researches, and succeeded in establishing branch observatories at Odessa, and Feodosia, in the Crimea. He took part in the Russo-Swedish determination of an arc of the meridian, visiting Spitsbergen for this purpose. A valuable new method of determining the flexure of transit-circles was introduced at Pulkova under his auspices. In conjunction with Dr. Hough he formed a list of stars to be used as fundamentals in astrographical reductions, and arranged that the "Star Corrections" for several hundreds of them should be printed at Pulkova.

The British observers who visited Russia for the eclipse of August, 1914, remember with gratitude his kind help in the difficulties which arose from the outbreak of war.

NOTES.

WE notice with much regret the announcement, in the *Times* of November 6, that Prof. H. H. W. Pearson, Harry Bolus professor of botany, South African College, Cape Town, died on November 3, at Mount Royal Hospital, Wynberg, at forty-six years of age.

THE many friends of Major T. Edgeworth David, professor of geology in the University of Sydney, will be delighted to learn that he has recovered from the effects of serious injuries received while conducting mining operations in northern France, and hopes shortly to rejoin his regiment.

IN answer to a question by Mr. Montague Barlow in the House of Commons on October 26, suggesting the adoption of the metric system of weights and measures, the Prime Minister stated that he was aware that the proposal to adopt the metric system had a certain measure of support, but that it was difficult to say how far this was general. He understood that the attention of Lord Balfour of Burleigh's committee had already been directed to the subject. This reply will probably not be regarded as encouraging by those who are of opinion that the immediate obligatory adoption of the metric system is urgently necessary in order that we may be fully prepared, when the war is over, to cope with competition in foreign trade. Though the metric system has been legal for all purposes of internal and export trade for nearly twenty years, very little advantage has so far been taken of it by the trading community generally; while the large body of retailers are still completely ignorant of the nomenclature and equivalents of the system.

EMERITUS PROFESSOR JOHN FERGUSON, who last year resigned the Regius chair of chemistry in the University of Glasgow, died, after a very brief illness, on November 3. Prof. Ferguson was in his eightieth year, and had held the chair since 1874. His connection with the University had been continuous, as student, assistant, and member of the Senate, for well over sixty years. Among his pupils or assistants were Prof. J. M. Thomson, Sir William Ramsay, Sir J. J. Dobbie, Prof. G. Henderson, Prof. W. Lang, Prof. Carrick Anderson, Prof. M. A. Parker, Dr. A. W. Stewart, and other distinguished chemists. He had made many contributions to the history of chemistry, to bibliography, and to archæology, the most notable being his "Bibliotheca Chemica," published in two quarto volumes in 1906. He was an LL.D. of St. Andrews, and an honorary member of many British and foreign learned societies, including the Imperial Military Academy of Medicine, Petrograd, and the Société Française d'Archéologie. Last year, on his retirement from the chair, he was appointed honorary curator of the

books and MSS. in the Hunterian Library, on the catalogue of which he was engaged at the time of his death. On many occasions he was sent to represent the university at centenary and other academic celebrations at home and on the Continent. His fine presence and courtly manner made him an acceptable delegate on such occasions. He had accumulated a vast collection of medieval books and manuscripts dealing with alchemy, natural magic, "secrets," and "origins." It is to be hoped that the collection will be kept together for the benefit of students of scientific history.

THE leading article in *Engineering* for November 3 is devoted to a discussion on the status of the engineer. The divorce of the engineer from public affairs, and the minor place he occupies in popular estimation, are causing disquietude on the other side of the Atlantic, where a case has occurred recently of a lawyer having been appointed to the post of county engineer because it was held that the post must be filled by a politician. The actual engineering work has therefore to be done by deputy. This is characteristic of our own national services, where it has been common to appoint clerks as heads of departments, even when these are concerned with highly technical matters. The official view is that expert knowledge is unnecessary in such cases, as trained assistants can be secured to do the work, whilst the nominal chief signs the inevitable forms. As Lord Sydenham puts it, the results of such a system are that the man who knows all about some subject has to refer to, and be overruled by, someone who knows nothing whatever about it. The working of the system as exemplified during the recent times of stress has been more instructive than edifying.

WE record with much regret the death on November 5, in his forty-ninth year, of Prof. H. M. Waynforth, professor of engineering, King's College, University of London.

PROF. G. CAREY FOSTER, a past president of the Institution of Electrical Engineers, has been elected by the council an honorary member of the institution.

THE opening of the next annual meetings of the Institution of Naval Architects has been fixed for Wednesday, March 28, 1917.

DR. D. F. LINCOLN, a former secretary of the American Social Science Association, died recently in Boston at the age of seventy-five. He was the author of "School and Industrial Hygiene," "Electro-Therapeutics," "Hygienic Physiology," and "Sanity of Mind."

WE regret to note that *Engineering* for November 3 records the death of Dr. C. A. Harrison at the age of sixty-eight. Dr. Harrison was for many years engineer-in-chief to the North-Eastern Railway; the structures which remain as monuments to his skill are principally bridges. He was for a time a member of the council of the Institution of Civil Engineers, and received the degree of D.Sc. at Newcastle in 1906, as a tribute of honour to his work in connection with the King Edward Bridge.

THE death on October 29 of Prof. O. V. Muller is announced. Prof. Muller was professor of history and political economy at Elphinstone College, Bombay. A *Times* correspondent writes that during the plague in Bombay he laboured hard to persuade the plague-stricken to allow themselves to be taken to hospital, and for his efforts towards stamping out the plague he received the Kaisar-i-Hind medal. Prof. Muller was a keen archæologist, and formed valuable collections of Danish, English, and Indian stone and bronze antiquities.

THE death is announced, in his seventy-first year, of Mr. V. G. Bogue, a leading American engineer. He was a member of a commission appointed by President Harrison to investigate the methods for improving the navigation of the Columbia River, and acted as consulting engineer for the Government of New Zealand on the proposed railway across South Island. He prepared the plan and report for Greater Seattle and for the harbour of Tacoma. While employed from 1880 to 1886 as an assistant engineer in the construction of the Northern Pacific Railway, Mr. Bogue discovered the Stampede Pass in the Cascade Mountains. From 1886 to 1891 he was chief engineer of the Union Pacific.

WE regret to learn of the death of Lance-Corpl. J. W. Hart, who, having volunteered in the early days of the war, was killed on September 15, while taking part in the first wave of an attack against the enemy trenches. Mr. J. Hart received his early training at University College, Reading, and showed the greatest promise as a student. He obtained the diploma in horticulture at Reading, and afterwards the B.Sc. (war) degree of London University. At the beginning of the war he held the post of horticultural assistant at Bedford College, London, and was in charge of the botany garden, the successful development of which was largely due to his skill and energy. Mr. Hart was no militarist; hating the wastefulness of war, he abandoned the constructive work he had at heart for that greater cause for which he believed his country to be fighting. His death will be keenly felt by the many friends to whom his manly, enthusiastic, and cheerful outlook on life had endeared him, while scientific horticulture has lost one of its most promising adherents.

A QUOTATION in the *Morning Post* from the *Gazette de Hollande* emphasises the use made in Germany of geological advice in trench warfare, and Prof. Salomon, of Heidelberg, is said to have urged the formation of a special organisation of geologists in connection with the Army. It is probably no secret that excellent use has been made by the British military authorities of our own Geological Survey staff, members of which have been of technical assistance in fields as wide apart as the deeply dissected strata of Gallipoli and the undulating Cretaceous expanses of the Paris-Brussels basin. The geologist has been found of service in military mining as well as in questions of water supply, and the memoir recently issued by the Geological Survey on "Sources of Temporary Water Supply in the South of England and Neighbouring Parts of the Continent" (see NATURE, vol. xcv., p. 244) was drawn up specially to meet the needs of camps.

A LECTURE was delivered at the Royal Society of Medicine on October 31 by Dr. Sherman, of Pittsburg, on the method of sterilising wounds introduced by Dr. Carrel, the well-known American surgeon. The method consists in opening up the wound so far as necessary to reach every part of it, and rubber tubes are passed into all the recesses, and are kept in place by gauze packing. An antiseptic solution is then allowed to flow from a container, and by means of the tubes flushes out every part of the wound. This is done every two hours, and the wound is re-dressed every day. The effect is very striking, and the wound is rendered completely sterile in a few days. The antiseptic solution employed by Dr. Carrel is Dakins's solution somewhat modified; this was finally adopted after a trial of 200 different antiseptics. The solution consists of chloride of lime, sodium carbonate, and sodium bicarbonate in ordinary water compounded in a particular manner, details of which will be found in the *Lancet* of November 4, p. 800. It is claimed that

by this method of treatment the healing of wounds is greatly accelerated.

DR. C. D. WALCOTT, secretary of the Smithsonian Institution, and Mrs. Walcott have just returned to Washington, D.C., after several months' field work on the Continental Divide, which forms the boundary line between Alberta and British Columbia south of the Canadian Pacific Railway, studying the Cambrian rocks. Mrs. Walcott visited Glacier, British Columbia, where she measured the position of two large glaciers, and determined that the front ice foot, in each case, had retreated at the rate of 100 ft. a year during the past two years. Steel plates were placed on the ice on the present surveyed boundary lines. The plates will be buried beneath the winter snows, but, since their positions are relatively low as to altitude, the snow will be melted off next summer, and their locations then will indicate the amount of forward flow of ice during the year. Mrs. Walcott's studies show that the ice has been steadily retreating during the past six years, and her measurements agree with observations made in Alaska. During the field work a large number of photographs were taken, including a dozen or more panoramic views, exposures being made on continuous films 8 ft. in length.

LIEUT. JOHN HANDYSIDE, who fell in one of the recent advances on the Somme, at the age of thirty-five, was a distinguished graduate of Edinburgh and Oxford, and since 1912 had been lecturer in philosophy in the University of Liverpool. At Edinburgh he carried off all the honours open to students of philosophy, and at Oxford, after taking a first in Greats, he was elected a fellow of St. John's College. On the completion of his Oxford course he returned to Edinburgh, and acted for three years as assistant to Prof. Pringle-Pattison. After his appointment to Liverpool, the long illness of Prof. Mair threw upon him the chief responsibility for the work of the philosophical department. It was a severe test, and Mr. Handyside proved himself a successful teacher and a most helpful colleague. In 1915 he was granted leave of absence for military service, and obtained a commission in the 16th Batt. King's Liverpool Regiment. He had been between three and four months at the front, and was mortally wounded while rallying his men during an attack. His engrossment in teaching work during the last years prevented him from writing much, but he had completed a translation of two of Kant's smaller treatises, which he intended to equip with a critical introduction, and he had also in view some independent work in ethics. It is hoped, therefore, that some specimen of his work may yet be published.

QUICKLY after Ehrlich and Metchnikoff, his fellow Jews, has passed Prof. Albert Neisser, of Breslau, whose name will ever be associated with theirs in the history of the scientific advance against venereal disease. He was only twenty-four when, in 1879, he identified the gonococcus, a markedly characteristic form of diplococcus which is the cause of gonorrhœa. He devoted all his later years to the study of venereal disease, contributing largely to the biochemical tests for the identification of syphilitic infection, and being the founder, fourteen years ago, of the German society which corresponds to our National Council for Combating Venereal Diseases, founded in London last year. Though the discovery of the gonococcus has not led, as yet, to the construction of any direct chemical remedy, such as salvarsan in the case of syphilis, or to the production of an antitoxin, as in the cases of diphtheria and tetanus, Neisser's discovery has nevertheless been of incalculable value in the treatment, the identification, and, in our own times, the prophylaxis of the disease. Thanks to him, the gonorrhœal nature of *ophthalmia neonatorum* has been demonstrated, and the dependence of many cases of rheumatism or arthritis upon the same organism; while gynæcology tells us that at least one-half of all the cases where a major abdominal operation is required in women are due to gonorrhœal infection, which is, in fact, the great steriliser of femininity, and a leading enemy of the birth-rate everywhere. Thanks also to Neisser, the treatment of the disease has been vastly improved, the introduction of protargol being due to him, and his warnings and the microscopic resources which we owe to him enable us to know that the disease is still present in many cases where it would otherwise have been ignored.

AT a time when it is strongly urged that more capital must be employed in food production, any method that will enable the farmer to calculate the risk of his crops being destroyed by unfavourable weather conditions deserves careful study. In the July issue of the *Geographical Review* (New York) Messrs. W. G. Reed and H. R. Tolley show how the risk for a crop which is in a condition to be damaged by frost between any two dates in spring and autumn may be computed if sufficient observations for that district are available. Using the well-known method of mean squares, "standard deviation" figures are calculated for 569 stations in the United States. These constants are a measure of the departure from the average dates of the last killing frost of spring and the first killing frost of autumn. Naturally these standard deviations are lowest for the central areas and highest for maritime States like Florida and California. If a crop is in a condition to be damaged on the average date of the last killing frost in spring, the risk is 50 per cent. In the case of a station with a standard deviation of 14·4 the risk falls to 10 per cent. nineteen days later than the average date. By combining the risks in spring and autumn the total risk may be computed for a crop which is exposed to both dangers. The risk of loss which may be profitably carried naturally varies with the crop and the economic conditions. Given the necessary data, the authors believe that risks from weather conditions other than frost may be computed in this way.

IN the Proceedings of the American Philosophical Society (vol. lv., No. 3) Dr. Raymond Pearl describes some interesting experiments on the effect of continued administration of alcohol to the domestic fowl. Comparing the control group and the alcoholised group, he finds that there is no evidence that specific germinal changes have been induced by the alcohol treatment, at least in those germ-cells which produced zygotes, and that the germ-cells which produced zygotes were not in any respect deleteriously affected. Although the results are apparently in contradiction to those of some observers with mammals, the writer believes that the contradiction is more apparent than real. The discrepancy, he argues, is fundamentally due to a difference in the resistance of the germ-cells to alcohol.

DR. CARL HANSEN-OSTENFELD has published (Mem. Acad. Roy. Copenhagen, Sect. Sc., 8 ser., t. ii., No. 2, 1916) an account of the Protozoa found in the samples of plankton taken in Danish seas from 1898 to 1901. Some of these organisms, *e.g.* ciliates of the genus Tintinnopsis, are indigenous, but the majority, *e.g.* the two recorded species of Heliozoa, several species of Radiolaria and of Tintinnoid ciliates, appear to have been carried by currents from the North Sea into the Skager Rak or the Cattegat, but it is evident that most of them do not penetrate far, as they meet with water of low salinity from the Baltic, which is inimical

to them. Noctiluca—a globular Cystoflagellate, about 1 mm. in diameter, and well known for its phosphorescence—is occasionally present in enormous quantities in Limfjord, but cannot maintain itself inside the Skager Rak; it disappears each winter and is reintroduced in the following autumn by the "Jutland current." A few planktonic organisms are carried into the Danish area by the outgoing current from the Baltic. One of these—*Ebria tripartita*, referred to a new order Pyritoflagellata, near the Silicoflagellata—is found to be capable of living under wide variations of salinity (4 per mille to 25 per mille). A short account is given of the occurrence of Vampyrella (parasitic in the diatom, *Chaetoceras boreale*) and of Hyalosaccus (parasitic in Ceratium), both organisms of uncertain affinities. A list is appended of the phytoplankton and protozoa recorded from Danish waters.

SEVERAL articles dealing with different aspects of the geography of New York occupy the September number of the *Geographical Review* (vol. ii., No. 3). Mr. Ellsworth Huntington, writing on the water barriers of New York City, shows the important part that ferries and bridges play in the economy of the city, and the inevitable tendency towards crowding that arises from the island site. This results on one hand in "sky-scrapers" and high rents, and on the other in weakened health and nervous strain. Another article, by Mr. E. P. Goodrich, on some problems incident to the growth of New York City, is particularly valuable on account of the number of maps reproduced. Although these are necessarily much reduced, and in cases a little difficult to decipher, they illustrate many important considerations in town planning and municipal organisation which are essentially questions within the province of the geographer. Some of these maps incorporate useful suggestions for other towns.

THE recent formation of a conference of representatives of electric power supply companies to consider the best methods of linking up generating stations in the Greater London area, and the formation of a National Power Supply Joint Committee covering a still wider area, both point to a greater uniformity in orders and rules for the regulation of electric supply in the near future. It is to the interest of neither consumer nor supply company that a piece of apparatus which is pronounced dangerous or inefficient on one side of the street should be deemed adequate on the other side. That the same desire for greater uniformity in the rules for the regulation of electric supply is felt at the present time in America is shown by the recent issue by the Bureau of Standards of a circular of 260 pages dealing with the most important of the factors which determine the safety and efficiency of electric supply. It has been drawn up after conference with the supply companies and others concerned, contains rules and regulations suitable for companies under either State or municipal control, and gives specifications for the approval of the various types of electricity meters.

THE appendix to the annual report of the Board of Regents of the Smithsonian Institution for the year ending June 30, 1915, as usual, consists of a selection of miscellaneous memoirs of interest to all engaged in the promotion of knowledge. The articles for the most part are those of the year 1915. Many are translations into English of foreign contributions to science, and among these may be mentioned the following:—A review of astronomy for the year 1913, by M. P. Puiseux, of the Paris Observatory; the earthquake in the Marsica, Central Italy, by M. Ernesto Mancini, secretary of the Royal Academy of the Lincei; Atlantis, by M. Pierre Termier, director of the service of the Geologic Chart of France; construction of insect nests, by Prof. Y. Sjostedt, of the Royal Museum of Natural History, Stockholm; excavations at Tell-El-Amarna, Egypt, in 1913–14, Herr Ludwig Borchardt; and vaccines, by Prof. L. Roger, of the Paris University. The original contributions to the report include:—Evidences of primitive life, by Dr. C. D. Walcott, secretary to the Smithsonian Institution; olden-time knowledge of Hippocampus, by Dr. C. R. Eastman, of the American Museum of Natural History; progress in the reclamation of arid lands in the Western United States, by Mr. J. B. Beadle, of the U.S. Reclamation Service. The appendix, as is customary, is illustrated by a profusion of beautiful plates.

THE recent issue of the *Central*—the organ of the Old Students' Association of the City and Guilds (Engineering) College, South Kensington—is virtually a special number, in which some of Prof. Armstrong's old students have sought to put on record their impressions of the work of the Chemical Department of the college during the period from 1884 to 1914. The most remarkable feature of the record is perhaps the great variety of the subjects in which work of real value was done in a department which was always small in numbers, but for that very reason received an intensive cultivation which would have been impossible in a larger school or department. The writers include Prof. Pope, Mr. W. M. Heller, Prof. Compton, Dr. Lowry, Prof. Lapworth, Sir Henry Miers, Prof. Wynne, and Dr. Eyre, and Prof. Armstrong himself has added some "Personal Notes on the Origin and Development of the Chemical School at the Central." The chemical subjects touched upon in the record will be familiar enough to those who have followed the developments of chemical science during the past thirty years, but an even wider circle will welcome Mr. Heller's account of the "Reform in Education" with which Prof. Armstrong's name will always be associated. Sir Henry Miers has given an account of the school of crystallography at the Central, probably the only school in which the subject was taught regularly to all matriculated chemical students, and Dr. Eyre describes the biological investigations which became an important feature of the work of the department from 1900 onwards. The periodical contains an excellent photograph of Prof. Armstrong on holiday in 1909, and a list of careers of the students who passed through the chemical laboratory.

MR. C. BAKER, 244 High Holborn, London, has issued his October list of second-hand scientific apparatus. The list contains the usual large assortment of instruments, and all are guaranteed to be in perfect working order before being sent out. In view of the comparative scarcity of new apparatus owing to the demands of the war on manufacturers, this catalogue deserves the careful attention of science lecturers and others. The 1500 pieces of apparatus are for sale or, with some exceptions, for hire. The catalogue deals with microscopes and microscopic apparatus, surveying and drawing instruments, telescopes and accessories, spectroscopes, and a great variety of other physical apparatus.

MESSRS. H. SOTHERAN AND CO. (Strand and Piccadilly) have just issued the sixth and last part of their catalogue—"Bibliotheca Reuteriana" of modern standard works on mathematics, astronomy, physics, chemistry, engineering, crystallography, and meteorology, forming the final supplement to the "Bibliotheca Chemico-Mathematica." Messrs. Sotheran announce that after the war they will publish a library illustrated edition on fine paper of the "Bibliotheca Chemico-Mathematica" complete. It will contain

about 125 full-page plates and an analytical subject-index.

MESSRS. J. WHELDON AND CO., 38 Great Queen Street, W.C., have just published No. 76 of the new series of their catalogue. It deals with the journals and transactions of many scientific societies, and with English and foreign literary and scientific periodicals. There are also addenda giving particulars of remainders of books relating to natural history. The catalogue should be of interest and service to many students of science.

MR. F. EDWARDS, High Street, Marylebone, has recently circulated a very interesting illustrated catalogue of autograph letters, manuscripts, and historical documents. A section of the catalogue is composed of documents relating to the United States, Canada, and the West Indies.

THE two following volumes are in preparation, among others, for appearance in the "University of Chicago Science Series" (*Cambridge University Press*):—"A Factorial Theory of Evolution," by W. L. Tower, and "Chemical Signs of Life," by S. Tashiro.

OUR ASTRONOMICAL COLUMN.

THE RADIAL VELOCITY OF β URSÆ MAJORIS.—From observations of the radial velocity made at Potsdam some years ago it was concluded by Ludendorff that β Ursæ Majoris was a spectroscopic binary with a period of 27·16 days and total range of 15½ km./sec. Subsequent observations made at the Lick Observatory, however, gave a range of velocity no greater than that to be expected in the determinations for a constant-velocity star of type A. Further interest in the question was aroused last year by Guthnick and Prager's observations of the star with a photo-electric photometer, from which a variation through 0·02 mag. in a period of 0·3122 day was deduced; the Potsdam radial velocity values were thought to be consistent with this period. A further investigation of the radial velocity, with special reference to short-period changes, has since been undertaken at Mt. Hamilton (Lick Observatory Bulletin No. 284). Thirty-six plates were taken on three nights during February, 1916, but, as in the case of the earlier photographs, these do not appear to indicate a variation through any appreciable or dependable range of velocities. Prof. Campbell hopes that someone with less observing opportunity and more opportunity for computation will make a further effort to discover a periodicity of very small amplitude. The plates are available for loan to any experienced measurer of spectrograms who may have a plan for remeasuring them.

RADIAL MOTION IN SUN-SPOTS.—Mr. Evershed has recently reported on some further investigations of the radial motion in sun-spots discovered by him in 1909 (Kodaikanal Observatory Bulletin 51). Improved results have been obtained by the use of instruments which reduced the times of exposure, and by working only under the best conditions as to definition of the spot image. It now appears that the radial motion displacement may be very unequal at equal distances from the umbra, and the two spots investigated showed larger displacements on the limb side than on the side towards the centre. There is usually an acceleration of velocity from the umbra to the outer limits of the penumbra, and then a sudden fall to zero, or to a lesser speed which diminishes to zero at some distance outside the spot. The radial movement may amount to as much as 4 km./sec. at one edge of the penumbra for lines of intensity 0 and 1 in large spots. The diminution of the indicated velocity with increased intensity, which was found by St. John, and attributed by him to differences of effective level, is confirmed by the new measures. In opposition to St. John, however, no difference was found for enhanced lines of iron as compared with the arc lines of like intensity. Mr. Evershed further concludes that while movements at right angles to the radial motion may occur in the penumbræ, rotational movement is not a constant feature.

WOLF-RAYET BANDS IN THE NUCLEI OF NEBULÆ.—In continuation of the work of Wright, the nuclei of three additional planetary nebulæ have been found by G. F. Paddock to give the Wolf-Rayet type of spectrum (Lick Observatory Bulletin, No. 284). The nucleus of N.G.C. 6826 shows a fairly bright band at 4686, and a fainter band at 4657, which is not given in Campbell's list of Wolf-Rayet lines. In N.G.C. 418, the band 4686 is faintly seen in the nucleus, while that at 4650 is fairly bright. Four bright bands were found in the nucleus of N.G.C. 40, namely:—

Wave-length		Width		Intensity
4862·2	...	14 A.	...	Faint.
4788·3	...	13 A.	...	Faint.
4687·4	...	15 A.	...	Fairly strong.
4652·1	...	22 A.	...	Very strong.

The band at 4652 is strongest near its violet edge, and seems to shade off towards the red. That at 4862 corresponds to H_β.

BARNARD'S HIGH PROPER-MOTION STAR.—Some interesting details relating to the discovery of the star with the largest known proper motion have been given by Prof. Barnard (*Popular Astronomy*, vol. xlvii., p. 504). The star was shown on plates taken in 1894, 1904, 1907, and 1916, and the images were so far apart as to seem to represent different objects, which might be new or variable stars. It was found, however, that all the images were in a straight line, and that the different photographs could be reconciled by supposing the images to have been made by a star with an annual proper motion of about 10″, in a direction almost exactly north. At the epoch 1916·423 the R.A. of the star was 17h. 53m. 43·60s., and the declination +4° 27′ 48″; it was 9·1s. following, and 51″ north of B.D. +4° 3560. The star is situated in the northern part of Ophiuchus, and is of about the 10th visual magnitude. The movement may easily be detected in the course of a few months, and photographs and charts are given for the benefit of those desiring to observe the star.

Mr. Adams has found that the type of spectrum is M*b*, and that the star is approaching the earth with a velocity of 91 km./sec. The relative intensities of certain spectral lines suggest a parallax of 0·2″, and it would follow from this that the star's real velocity in space is 260 km./sec.

A CATALOGUE OF METEORITES.—An illustrated handbook and descriptive catalogue of the meteorite collections in the United States National Museum, prepared by Dr. G. P. Merrill, has recently been published by the Government Printing Office, Washington. Though the handbook is intended primarily for the general public, it is so arranged as to provide also for the needs of the student and investigator. At the beginning of the present year the collection included 329 falls and finds, and an equal number of thin sections for microscopic study. There is a brief introduction, giving an interesting account of the characteristics of meteorites, and of the system of classification, following in the main that proposed by Brezina. In a large number of cases the results of analyses are given.

MEMORIAL TO THE LATE SIR WILLIAM RAMSAY.

ON Tuesday, October 31, a public meeting was held at University College, London, to consider the steps to be taken to raise a memorial to the late Sir William Ramsay. The assembly included the Ministers of Belgium, Roumania, Serbia, Chile, China, a representative of the American Embassy, and various officials and members of scientific and academic bodies, many of whom took part in the proceedings.

The Rt. Hon. Lord Rayleigh presided, and, in the course of his introductory speech, made brief references to his work with Sir William Ramsay. We heard, he said, a great deal of the research which was needed in connection with industry, but there seemed to be no thought of the difficulty of getting the right kind of people to do it. Among every six people who were able to understand, form intelligible opinions, and explain scientific matters, there was probably not one who had the gift of scientific initiative. This Sir William Ramsay had to an extraordinary degree. Lord Rayleigh paid a tribute to his thoroughness of method and his indifference to criticism which did not rest on cogent argument. Ramsay's discovery of helium he described as one of the most romantic pages of science, and his further discovery that helium appeared during the breakdown of radium was most important. Sir William's gifts were not only scientific; he was a master of several languages, and this faculty placed him in touch with the scientific genius of the world; combined with his extraordinary experimental skill and rapidity, it went a long way to explain his success. In conclusion, Lord Rayleigh spoke of Sir William's unusual power of influencing people, as the result of which many things had been done since the war began that but for him would not have been done at all.

The following was the main resolution of the meeting:—"That steps be taken to raise a substantial fund as a memorial to Prof. Sir William Ramsay, K.C.B., F.R.S., such fund to be utilised for the purposes of promoting chemical teaching and research under a scheme to be approved hereafter by the subscribers."

The resolution was moved by the Rt. Hon. J. A. Pease, Postmaster-General, formerly President of the Board of Education. He laid stress on the importance of discoveries such as those of Sir William Ramsay, because they widened the horizon of all educated people, irrespective of country or of race; they enforced an essential unity of knowledge among civilised people, just as we were struggling for a similar unity of standard in conduct among the civilised States. One of the lessons of the war has been that we have learnt as a State to respect and be guided by scientific method and scientific men to a degree which nothing but a great necessity could have achieved. The work of Ramsay illustrates not only the necessary co-operation of sciences, but the necessary co-operation of nations. Was it therefore too much to ask that his memorial should be an international as well as a national one? A magnificent response has been made to an appeal for funds for the memorial to a great figure in the field of war, Lord Kitchener; cannot a similar response be made to an appeal for the memorial to a great figure in the field of science? To a people who could raise five millions a day for the purposes of the war, surely it is possible to raise this memorial to show their belief in Ramsay's work and what it stood for? The form in which that belief shall be clothed can be determined later.

The President of the Royal Society (Sir Joseph J. Thomson), in seconding the resolution, dwelt on the more scientific aspect and importance of Ramsay's work and influence.

His Excellency the Belgian Minister (a vice-president of the University of Brussels) paid a graceful tribute to the memory of Ramsay, recalling a visit he paid to Brussels and the part he played in connection with the foundation by Solvay of the Institut International de Chimie; Ramsay did not merely belong to his own country; he belonged to humanity. Mr. W. H. Buckler, representing the American Ambassador, recorded the veneration in which Ramsay and his work were held in the United States.

In moving "That this meeting resolve itself into a General Committee for the purpose of raising the fund for the memorial to Prof. Sir William Ramsay," Sir Hugh Bell, Bart., referred to a suggestion made to him by Ramsay some time ago as to the possibility of distilling small seams of coal *in situ*. Probably no person other than Ramsay would have been able to persuade him that the experiment was at all possible, but, like others, he fell under the glamour of an entrancing personality, and arrangements were made for trying the experiment under extremely favourable conditions. These were nearly complete on the outbreak of war; the place was ready, and, if there were anyone found bold enough to pursue Sir William's suggestion, he would gladly put the preparations at the disposal of such person.

Prof. J. Norman Collie, the chairman of Convocation of the University of London and vice-chairman of the University College Committee (Sir Edward Busk), the president of the Chemical Society (Dr. Alexander Scott), Sir William A. Tilden, Dr. Morris Travers, Sir Joseph Larmor, and Prof. E. C. C. Baly also spoke.

The following were appointed an Executive Committee to make such arrangements as they deem desirable for furthering the memorial:—The Rt. Hon. Lord Rayleigh, the Rt. Hon. Lord Parmoor, Sir Hugh Bell, Bart., the Rt. Hon. Sir John Brunner, Bart., Sir Ralph C. Forster, Bart., Sir Charles Bedford, Sir G. T. Beilby, Sir James Dobbie, Sir Robert Hadfield, Sir Alexander Kennedy, Sir William Tilden, the President of the Royal Society, the President of the Chemical Society, the President of the British Science Guild, the President of the Society of Chemical Industry, Prof. Baly, Mr. Chaston Chapman, Prof. J. Norman Collie (hon. treasurer), Prof. F. G. Donnan, Mr. Alex. Duckham, Dr. T. Gregory Foster, Prof. F. Francis, Mr. Gathorne-Young, Mr. J. Gretton, Dr. R. Messel, Dr. Robert Mond, Dr. H. F. Parshall, Dr. Walter Seton, Dr. Samuel Smiles (hon. secretary), Lieut.-Col. Smithells, Dr. Morris Travers, and Prof. James Walker.

The proceedings terminated with a vote of thanks to Lord Rayleigh for presiding, moved by the Vice-Chancellor of the University of London (Sir Alfred Pearce Gould, K.C.V.O.), and seconded by Prof. F. G. Donnan, Sir William Ramsay's successor in the chair of general chemistry at University College, London.

After the meeting, Prof. J. Norman Collie delivered a memorial lecture on "The Scientific Work of Sir William Ramsay."

THE SWISS SOCIETY OF NATURAL SCIENCES.

THE yearly meeting of the Société Helvétique des Sciences Naturelles was held in August at Schuls-Tarasp, in the Engadine. The chief object was an excursion into the National Park of Switzerland, which, though officially opened a year or two ago, had not yet been visited by the great society which has been primarily interested in its foundation.

We would recall to our readers the history of this institution. A large portion of the country in a mountainous region has been obtained from the communes

of Zernez and Tarasp on a ninety-nine years' lease by the Société Helvétique and the Ligue Suisse pour la Protection de la Nature, backed by the Federal Government itself. This has been set apart for the beasts and the birds and the plants to live in, there to breed and to struggle for existence in their own untrammelled way.

There is no other place in the world corresponding to this. The Yellowstone Park is open to the tripper, and the wilds still unexplored in Brazil and elsewhere, even when free from savage man, may at any moment be exploited by the rapacious European or American. But the creatures of the National Park of Switzerland are protected against the lord of creation by a charter, which, it is to be hoped, will never be treated as a mere scrap of paper. Picnickers even are forbidden, and it was only by special permission that the members of the Société Helvétique were supplied with excellent refreshment in a flowery pasturage within the precincts.

As you pass along the solitary paths you have to check the impulse to cull the many-coloured flowers that carpet the borders, and even spring up between the stones at your feet. This is one of the first rules of the park, and brings home to the visitor the fact that the park is no more for the collector than it is for the tourist.

It was in the earliest dewy morning of a beautiful August day that some two hundred members of the society started up the Gorge of the Clemgia. By ten o'clock they had reached a rocky ridge, the Alp Minger, dominating a flowery mead, untouched by the scythe. Here Prof. Schröder, one of the originators of the movement to which the park owes its origin, addressed the members in German. By midday the party had reached a magnificent height, the Col de Sur Il Fass, at the boundary of the park. Here they rested on the short velvety grass; it was too high for the luxuriance of vegetation which had marked the lower slopes. In front the ground fell sharply down into a ravine, on the other side of which a line of snowy peaks stood up clear against the sky. On this grand spot another of the originators, Prof. Paul Sarasin, of Basel, addressed the assembly in French, welcoming the society to the park, and characterising the aims of its institutors. He stated that the project is being entertained of founding a second park of the same kind in French Switzerland.

When he had finished, before the party left the park, it was characteristic of such Swiss functions that one of the many beautiful Swiss airs should be sung in chorus. The words were particularly appropriate, "Salut, glaciers sublimes."

This expedition took place on the last of the three days (August 7–9) devoted to the meeting. On the first day a lecture was given by Prof. Edouard Fischer, of Berne, on "The Notion of Species in Fungi," and by Dr. Briner, of Geneva, giving an account of the experiments carried out by himself and others on "The Rôle of Pressure in Chemical Phenomena."

The Schaefli prize was awarded to Prof. Gogel, of Fribourg, for a valuable memoir on "The Radioactivity and Electricity of the Atmosphere," and we may note, as perhaps the most interesting event of the meeting from a scientific point of view, the presentation by the veteran Zürich geologist, Prof. Heim, of the volume of memoirs of the society concerning the Rhone Glacier. The observations chronicled in this volume cover a period of forty years; they have for a long time been carried on under the direction of Col. Held, supported financially by the Alpine Club; the task of digesting the results has been ably effected by Prof. Mercanton, of Lausanne.

A large number of interesting communications were made in the sections of mathematics, physics, geophysics and meteorology, chemistry, geology and mineralogy. For a list of these we must, for want of space, refer our readers to the *Enseignement Mathématique*, where also abstracts of many of the papers will be found.

GRACE CHISHOLM YOUNG.

ANTHROPOLOGY AT THE BRITISH ASSOCIATION.

PROF. RIDGEWAY, in a paper on "The Origin of the Actor," pointed out that an examination of Greek drama and its descendants in Europe, as also of non-European drama, led him to the conclusion that tragedy originated in the honouring or commemoration of the dead. Pantomimic dances representing events in the life of the dead were like funeral games—a means of keeping the dead in remembrance. The wearing of masks was a concomitant of such mimetic dances. Cases were quoted from many parts in which the masks represented the spirit in whose honour the ceremony was held. In some instances, as in Manipur, a living member of the community is regarded as the actual residence of the spirit of the departed until his final send-off to spirit-land, and dresses in the clothes of the deceased and takes his place at the family table until the last rites are performed. In ancient Rome the dead man was personated by an actor dressed to represent him, who copied his peculiarities and was accompanied by masked attendants to represent his ancestors. It is probable that these were regarded as the temporary receptacles of the spirits of the deceased and his ancestors. If in Greek time the actor was still regarded as the temporary abode of the hero's spirit Solon's anger against Thespis is explained.

Prof. Keith, in a paper entitled "Is the British Facial Form Changing?" described some interesting facts derived from a comparison of a series of ancient and modern complete skulls. He finds that the malar bone is becoming tilted as a result of a gradual atrophy from disuse of the zygomatic processes of the temporal and maxillary bones—a natural result of the change in dietetics which has occurred since the early years of the Christian era, cooked food and soft cereals replacing tough meats and imperfectly ground corns. Besides the obvious maxillary shrinkage in a lateral direction, bone has been laid down so as to increase the vertical dimensions of the jaws and also around the orifice of the nares. This deposit Prof. Keith regards as inexplicable on the mechanical theory as if due merely to disuse of the jaws, but thinks it to involve some change in the mechanism of bone production under the influence of the internal secretions of the ductless glands, hazarding the suggestion that it may be in some way associated with the increased prevalence of adenoids. Associated with the dietetic changes, it is interesting to note that in early British skulls, while the teeth were much worn and dental abscesses and pyorrhœa were common, ordinary dental caries was unknown.

In the discussion Miss Freire-Marreco pointed out that these changes in the incidence of dental disease could be observed occurring within a single generation among the Pueblo Indians.

Mr. W. G. Collingwood, in a paper on "Early Christian Monuments in Northumbria," traces the history of the Anglian crosses from finely ornamented forms with well-drawn saints and angels with elaborate plaits and leaf scrolls by a gradual debasement of figure drawing, simplification of interlaced patterns, and the conversion of scroll-work into dragonesque

ornament. All stages were shown, from early Anglian, in some respects resembling early Welsh, through the best Anglian period of native art and the decadent pre-Danish period, to the full Viking-age Scandinavian, which, however, received its fullest development beyond the boundaries of Northumbria.

Dr. Rivers presented a communication on "The Cultivation of Taro." In Melanesia and Polynesia taro is cultivated by means of irrigation, which is used for this purpose only. Perry has shown that irrigation has a distribution which corresponds closely with that of megalithic monuments, sun-cult, and other objects and customs which seem to have been carried over the earth by one migration or a connected series of migrations. The exclusive use of irrigation for the cultivation of taro in Oceania suggests that it also belongs to the group. This is confirmed by the distribution of the plant, which, when its tropical habit is taken into account, corresponds in general with that of other elements of the megalithic complex. An exception to this general correspondence occurs in the New Hebrides, where taro is absent or unimportant in a large part of the island of Malekula, although this island possesses a highly developed megalithic culture. Other evidence shows that the megalithic culture reached Melanesia in two chief waves, an earlier associated with mummification of the dead, and a later with interment of the dead in the extended position. The distribution of the cultivation of taro by irrigation in southern Melanesia points to its carriage by the earlier of these two migrations.

In "Personal Experience as an Element in Folk-tales" Miss Freire-Marreco pointed out that the striking resemblances between the dreams of children and those of adults of low mentality on one hand, and the myths of uncivilised peoples on the other, are to be explained, not by a semi-mystical analogy between the childhood of individuals and that of the race, but by supposing that very many folk-tales are founded on reported dreams, day-dreams, and trance experiences.

A study of "The Organisations of Witches in Great Britain" by Miss M. Murray showed that the witches practised a definite religion, with chief festivals, or sabbaths, at Candlemas, Roodmas, Lammas, and Hallowmas. The chief of the witches, called by Christian writers "The Devil," was regarded as a god incarnate in a man, or, when disguised in the skin of an animal, as incarnate in that animal. The ritual of admission into the society comprised the renunciation of any previous religion, dedication of body and soul to the god of the witches, vows of absolute obedience, baptism and the giving of a new name, and finally the signing of a contract or marking on the body, possibly by tattooing.

In papers on "A Summer and Winter among the Natives of Arctic Siberia" and on "The Physical Type of the Northern Tungus" Miss Czaplicka gave a descriptive account of the country and the native manners, customs, and types. Generally she showed that the Tungus in the north approach in type the Palæo-Siberians, and in the south the Mongols.

Mr. and Mrs. Scoresby Routledge described some of the results of their expedition to Easter Island, in the course of which they mapped and excavated the region of the terraces and of the images, and collected all that was still known of the old native culture. Little is now known by the natives with regard to the statues, though the last was overthrown so recently as 1830. The various features of the statues were, however, traced to customs of which knowledge remains. The life of the island appears to have turned on the finding of the first egg of a certain migratory bird, and it is possible that the statues were portrait-models on a large scale erected each year to commemorate the official discoverer of the egg. There were ten clans on the island perpetually at war, and cannibalism was rife. A special sanctity attached to the Miru clan, who alone had an Ariki, or chief, who was an authority on the tablets in an as yet unknown script found on the island, and who presided when these were read. It is not certain that these are very old, for white men who came in ships were regarded as gods, and ceremonies in their honour could be traced back for three generations.

In discussing the relations between "Magic and Religion," Dr. Jevons emphasised the importance of distinguishing from the earliest times between practices thought to be beneficial and of a religious character and those thought to be harmful and universally reprobated of a magical kind. Contrary to the views of Dr. Marett, he maintained there never had been or ever could be a magico-religious period or any practices which could be described as both magical and religious.

AN IMPERIAL DEPARTMENT OF MINERALS AND METALS.

PROF. HENRY LOUIS described in NATURE of October 5 (p. 91) the need for the organisation of the mineral and metal resources and industries of the Empire. We reprint below the memorandum which has been sent to Sir William S. M'Cormick, administrative chairman of the Advisory Council for Scientific and Industrial Research, by the leading technical societies concerned with the subject. The proposal for the establishment of a central Department of Minerals and Metals has also been communicated to the Dominion Governments.

On behalf and by authority of the councils of the following institutions:—The Iron and Steel Institute (incorporated by royal charter as representing the iron and steel industries); the Institute of Metals (incorporated as representing the users and manufacturers of non-ferrous metals and alloys); the Institution of Mining Engineers (incorporated by royal charter as representing coal and iron ore mining and allied industries); and the Institution of Mining and Metallurgy (incorporated by royal charter as representing the mining of minerals other than coal and iron ores and the production of metals other than iron and steel); We, the undersigned, have the honour to submit the following considerations and recommendations in the hope that, through the intervention of the committee of the Privy Council for Scientific and Industrial Research, measures may be taken to provide the necessary machinery for the protection and advancement of the economic welfare of the mineral and metal industries of the Empire.

The absence of effective co-ordination of the organisations of these vital industries has been demonstrated and brought into prominence by the war, in many directions. The grave results to the national interests are generally admitted.

There are highly organised geological surveys and departments of mines in nearly all foreign countries, and their influence in the development of mineral resources is a factor of the first importance. There are similar well-organised departments in some of the British Dominions, but there is no connecting link or central "clearing-house" in the metropolis of the Empire to co-ordinate information on its mineral resources, to stimulate their development, and to safeguard Imperial interests.

Various departments of the Home Government, such as the Geological Surveys and Museum of Practical Geology, the Board of Trade, the Home Office, the Imperial Institute, and, since the outbreak of the

present war, the Foreign Office, the Admiralty, the War Office, and the Ministry of Munitions, have all been concerned with the collection of information bearing on the sources of supply of minerals and the production of metals. There does not appear, however, to have been any serious attempt to co-ordinate and render available even such information as has been collected by these departments, and it is certain that there have been considerable overlapping and duplication of effort with corresponding waste and confusion.

It is, we submit, obvious that the overlapping and confusion will be seriously increased if the various technical committees appointed by the Advisory Council attempt to collect the information which is essential to enable the beneficent object of the committee of the Privy Council to be attained, in its wider aspects, in regard to the mineral and metal industries.

We respectfully urge this view upon the serious attention of the Advisory Council, as already there are evidences of increasing overlapping and consequent waste of time and energy, which we believe it is one of the main purposes of the committee of the Privy Council to eliminate so far as possible.

In the opinion of the institutions represented by us the organisation of a central Department of Minerals and Metals is imperatively necessary in the public interest, and the work of organisation, which will necessarily take much time to complete, should be commenced at the earliest possible moment.

It cannot be doubted that if a properly organised and efficiently conducted Department of Minerals and Metals had been in existence, much valuable time, many lives, and vast sums of money would have been saved to the nation in the conduct of the present war, and much of the cost and inconvenience to British industries depending largely for their raw materials on mineral products would have been saved, with corresponding advantages to the prosecution of the war and to many industries.

A Department of Minerals and Metals should not only be in intimate relationship with the Geological Surveys and Mines Departments of the Dominions, but also with the organisations representing the different branches of the mining and metallurgical industries, whose co-operation in the work of the department should form a vital part of its machinery.

The Geological Surveys of Great Britain and Ireland and the Museum of Practical Geology should also form an integral part of the department.

The functions of the department should be active and constructive. All overlapping by other Home Government departments, and also by the institutions representing the industries, should be absolutely prevented.

The duties of a Department of Minerals and Metals would include :—

(1) Arrangements for expediting the completion of mineral surveys of the United Kingdom and of the Crown Colonies and other British possessions.

(2) The systematic collection and co-ordination of information bearing on the occurrence, uses, and economic value of minerals and their products, special attention being devoted to securing industrial applications for newly discovered minerals or metallurgical products and to finding mineral materials required for new metallurgical products or inventions. Some of this information should be promptly and widely disseminated in summarised form to those interested in the industries, through the medium of the existing publications of the institutions directly concerned.

(3) The investigation of all questions and problems relating to the utilisation of the mineral or metallurgical resources of the Empire.

(4) The co-ordination and dissemination of information on mining laws, development of mineral areas, output, processes of extraction, plant, capital employed, markets, etc.

(5) A general review from time to time of the developed and undeveloped mineral resources and of the position of each mineral or metal, to ensure that the mineral wealth of the Empire is being exploited with due regard to Imperial interests.

(6) Generally, to advise the Imperial Government on all questions bearing on the mining and metallurgical industries. To perform this function efficiently, it is essential that complete information should be available, and also that the industries concerned should be consulted through their respective organisations.

We feel sure that the Advisory Council will fully appreciate the urgency of the question and the necessity for prompt action, so that the process of co-ordination may be inaugurated at once.

WM. BEARDMORE, *President.* G. C. LLOYD, *Secretary.*	The Iron and Steel Institute.
GEORGE BEILBY, *President.* G. SHAW SCOTT, *Secretary.*	The Institute of Metals.
W. THORNEYCROFT, *President.* L. T. O'SHEA, *Hon. Secretary.* P. STRZELECKI, *Secretary.*	The Institution of Mining Engineers.
EDGAR TAYLOR, *President.* C. MCDERMID, *Secretary.*	The Institution of Mining and Metallurgy.

THE BRITISH ASSOCIATION AT NEWCASTLE.

SECTION I.

PHYSIOLOGY.

OPENING ADDRESS (ABRIDGED) BY PROF. A. R. CUSHNY, M.A., M.D., F.R.S., PRESIDENT OF THE SECTION.

On the Analysis of Living Matter through its Reactions to Poisons.

I WISH to-day to discuss an aspect of pharmacological investigation which has not been adequately recognised even by pharmacologists themselves, and which it is difficult to express in few words. In recent years great advances have been made in the chemical examination of the complex substances which make up the living organism, and still greater harvests are promised from these analytic methods in the future. But our progress so far shows that while general principles may be reached in this way, the chemistry of the living organ, like the rainbow's end, ever seems as distant as before. And, indeed, it is apparent that the chemistry of each cell, while possessing general resemblances, must differ in detail so long as the cell is alive. No chemistry dealing in grams, nor even microchemistry dealing in milligrams, will help us here. We must devise a technique dealing with millionths to advance towards the living organism. Here I like to think that our work in pharmacology may perhaps contribute its mite; perhaps the action of our drugs and poisons may be regarded as a sort of qualitative chemistry of living matter. For chemical investigation has very often started from the observation of some qualitative reaction, and not infrequently a good many properties of a new substance have been determined long before it has been possible

to isolate it completely and to carry out its analysis. For example, the substance known now as tryptophane was known to occur in certain substances and not in others long before Hopkins succeeded in presenting it in pure form. And in the same way it may be possible to determine the presence or absence of substances in living tissues, and even some of their properties, through their reaction to chemical reagents—that is, through the study of the pharmacology of these tissues. I do not claim that pharmacological investigation can at present do much more than the qualitative testing of the tyro in the chemical laboratory, but even a small advance in the chemistry of living matter is worthy of attention.

All forms of living matter to which they have free access are affected by certain poisons, and some of these have obvious chemical properties which suggest the method of their action; thus the effects of alkalies and acids and of protein precipitants scarcely need discussion. Others, such as quinine and prussic acid, which also affect most living tissues, have a more subtle action. Here it is believed that the common factor in living matter which is changed by these poisons is the ferments, and quinine and prussic acid may therefore be regarded as qualitative tests for the presence of some ferments, notably those of oxidation, and, in fact, have been used to determine whether a change is fermentative in character or not.

In other poisons the action on the central nervous system is the dominating feature, and among these the most interesting group is that of the simple bodies used as anæsthetics and hypnotics, such as ether, chloroform, and chloral. The important use of this group in practical medicine has perhaps obscured the fact that they act on other tissues besides the central nervous system, though we are reminded of it at too frequent intervals by accidents from anæsthesia. But while they possess this general action, that on the nervous tissues is elicited more readily. Not only the nerve-cell, but also the nerve-fibre react to these poisons, as has been shown by Waller and others. And even the terminations are more susceptible than the tissues in which they are embedded, according to the observations of Gros. The selective action on the nervous tissues of this group of substances has been ascribed by Overton and Meyer to the richness in lipoid substances in the neurons, which leads to the accumulation of these poisons in them, while cells containing a lower proportion of lipoid are less affected. In other words, Overton and Meyer regard these drugs as a means of measuring the proportion of lipoids in the living cell. This very interesting view has been the subject of much discussion in recent years, and, in spite of the support given it by several ingenious series of experiments by Meyer and his associates, no longer receives general acceptance. Too many exceptions to the rule have to be explained before the action of these bodies can be attributed wholly to their coefficients of partition between lipoids and water. At the same time, the evidence is sufficient to justify the statement that the property of leaving water for lipoid is an important factor in the action of the bodies, although other unknown properties are also involved in it. And whatever the mechanism of the characteristic action, these substances in certain concentrations may be regarded as tests for the presence of nervous structures, and have been employed for this purpose.

More interest has been displayed in recent years in the alkaloids which act on the extreme terminations of various groups of nerves. These are among the most specific reagents for certain forms of living matter which we possess. Thus, if an organ reacts to adrenaline, we can infer that it contains the substance characteristic of the terminations of sympathetic fibres with almost as great certainty as we infer the presence of a phenol group from the reaction with iron. And this sympathetic substance can be further analysed into two parts by means of ergotoxine, which reacts with the substance of the motor sympathetic ends, while leaving that of the inhibitory terminations unaffected. Similarly, the endings of the parasympathetic nerves are picked out with some exceptions by the groups represented by atropine and pilocarpine, and here again there must be some definite substance which can be detected by these reagents.

Further, some light has been thrown on, at any rate, one aspect of these nerve-end substances by the observation that they all react to only one optical isomer in each case. Thus the dextrorotatory forms are ineffective in both atropine and adrenaline, and this suggests strongly that the reacting body in the nerve-ends affected by these is itself optically active, though whether it bears the same sign as the alkaloid is unknown. This very definite differentiation between two optical isomers is not characteristic of all forms of living matter. For example, the heart muscle seems to react equally to both lævo- and dextro-camphor. The central nervous system contains substances which react somewhat differently to the isomers of camphor and also of atropine, but the contrast is not drawn so sharply as that in the peripheral nerve-ends.

The tyro in the chemical laboratory is not often fortunate enough to be able to determine his analysis with a single test. He finds, for example, that the addition of ammonium sulphide precipitates a considerable group of metals, which have then to be distinguished by a series of secondary reactions. The pharmacologist, as an explorer in the analysis of living matter, also finds that a single poison may affect a number of structures which appear to have no anatomical or physiological character in common. But as the chemist recognises that the group of metals which react in the same way to his reagent have other points of resemblance, so perhaps we are justified in considering that the effects of our poison on apparently different organs indicate the presence of some substance or of related substances in them. A great number of instances of this kind could be given, and in many of these the similarity in reaction extends over a number of poisons, which strengthens the view that the different organs involved have some common reacting substance.

One of the most interesting of these is the common reaction of the ends of the motor nerves in striated muscle and of the peripheral ganglia of the autonomic system. It has long been known that curare and its allies act in small quantities on the terminations of the motor nerves in ordinary muscle, while larger amounts paralyse conduction through the autonomic ganglia. These observations appear to leave no question that there is some substance or aggregate common to the nerve-ends in striated muscle and to the autonomic ganglia. Other analogies exist between the ganglia and the post-ganglionic terminations of the parasympathetic, as is shown by their reactions to the tetramethyl ammonium series; between the heart muscle and the cardiac inhibitory centre, as shown by digitalis and aconitine; between kidney-cell and ordinary muscle, as shown by caffeine and other purine bodies.

Many other examples might be cited in which organs which are apparently not related, either morphologically or in function, react to poisons in quantities which are indifferent to the tissues in general. And this reaction in common can only be interpreted to mean that there is some substance or group of related substances common to these organs. The reaction may differ in character; thus a drug which excites one organ to greater activity may depress another, but the fact that it has any effect whatever on these organs

in preference to the tissues in general indicates some special bond between them, some quality which is not shared by the unaffected parts of the body. I have, therefore, not differentiated between excitation and depression in discussing this relation. It seems probable that in this instance and in others the difference in the effect of these bodies in the tissues arises from differences in the behaviour of the molecule as a whole rather than in differences in the affinities of its special parts; that is, that the action of these poisons is due to their physical properties rather than to their chemical structure, although this, of course, is the final determining cause.

In the same way the common reaction of tissues, which I have so far ascribed to their possessing some substance in common, may arise from community of physical relationship, and I wish to avoid the implication borne by the word "substance," which I have used in the widest sense. The reaction of living tissue to chemical agents may arise from a specific arrangement in its molecule, but may equally be attributed to the arrangement of the molecules themselves. And the curious relationships in the reactions of different tissues may indicate, not any common chemical factor, but a common arrangement of the aggregate molecules. We are far from being able to decide with even a show of probability which of these alternatives is the correct one, and my object to-day has been to direct attention to these relationships rather than to attempt their elucidation.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

BIRMINGHAM.—The Vice-Chancellor, Lieut.-Col. Gilbert Barling, has been appointed consulting surgeon to the British Forces in France, and left Birmingham on November 1 to take up his duties. For some time past Col. Barling has acted as a consulting surgeon in the Southern Command. During his absence from Birmingham, which will extend over some months, his duties at the University will be discharged by Alderman F. C. Clayton, pro-Vice-Chancellor.

CAMBRIDGE.—The Vice-Chancellor has appointed Dr. R. T. Glazebrook to the office of reader on Sir Robert Rede's foundation for the ensuing year.

Mr. W. G. Palmer, who obtained first-class honours in both parts of the Natural Science Tripos, 1913–14, with distinction in chemistry, and was awarded the Hutchinson Studentship, has been elected to a fellowship at St. John's College.

Capt. E. Hindle, assistant to the Quick Professor of Biology, and formerly Beit Fellow for Medical Research, has been elected to the recently founded Charles Kingsley Lectureship in Natural Sciences at Magdalene College.

LONDON.—Lieut.-Col. H. R. Kenwood, professor of hygiene and public health in the University of London, will deliver a public lecture at University College, Gower Street, on "Hygiene: Some Lessons of the War," on Friday, November 17, at 5.30 p.m. The chair will be taken at this lecture by Surgeon-General Sir Alfred Keogh, Director-General, Army Medical Service. The lecture is open to the public without fee or ticket.

OXFORD.—The Rhodes Estate Bill, having now passed the Committee stage, has been reported to the House of Commons in its original form. Lord Hugh Cecil's suggestion, which met with some approval in Oxford, that the trustees should be left free, if they thought fit, to establish scholarships available to persons within or without the British Empire, did not prove acceptable to the trustees, who preferred to be left without discretion in the matter. It was explained by Lord Milner that unless it were clearly laid down that the new scholarships should only be tenable by students within the Empire, much disappointment would be caused to applicants from other countries. Many will think this scarcely a sufficient reason for the trustees to wish to have their hands tied in the way proposed by the Bill.

WE learn from Wednesday's *Times* that Mr. H. Laming has just given 10,000*l.* to Queen's College, Oxford, to establish four scholarships of 100*l.* per annum, tenable for either three or four years, one to be offered each year. The scholars will, as a rule, be expected to take the Russian language for their honours degree. The idea is to provide a university course for candidates intending to follow a business career or to enter the consular service, and it is hoped that the scholarships may lead to a higher social and intellectual standard prevailing in those careers.

NOTICE has just been given of the next triennial prize at Guy's Hospital under the will of the late Sir Astley Cooper. The prize, the value of which is 300*l.*, will be awarded to the author of the best essay or treatise on "Gunshot Wounds of the Lungs and Pleura." The competition is open to all, with the exception of the staffs of Guy's and St. Thomas's Hospitals and their relatives. The competing essays, written in English, must be sent to Guy's Hospital on or before January 1, 1919. Further particulars of the competition may be obtained from Mr. C. H. Fagge, Guy's Hospital, S.E.

THE main thesis put forward by Mr. James Swinburne in a lecture on "Science and Industry," delivered at King's College, London, on November 1, Lord Moulton being in the chair, was that technology or applied science was outside the province of university teachers, who should concern themselves with imparting a knowledge of properties and principles, which they are eminently capable of doing, and leave the manufacturer to work out his own problems, of which academic people can have only second-hand knowledge. Mr. Swinburne understands, of course, that many great industrial advances have had their origin in what he called academic science, but what he wished particularly to emphasise was the difference between laboratory conditions and operations on an industrial scale brought to the point of commercial success. Purely scientific research must be free and independent, with the advancement of knowledge as its sole aim; but the manufacturer is only interested as a man of business in research which will give him financial advantage. Scientific knowledge is gained for the benefit of whomsoever may care to make use of it, whereas trade processes are kept secret or protected from adoption by industrial competitors by means of patents. The university should train workers in research methods, but the practical needs of industry can be understood only in the works themselves. Lord Moulton, in his remarks upon Mr. Swinburne's address, said that Mr. Swinburne was "picturesquely wrong" in the sharp distinction made by him between academic and technological science. It may also be suggested that the view that manufacturers are able to look after their own problems and interests assumes that they possess the necessary scientific knowledge, which, to say the least, is an assumption that will not admit of general application in this country. Instead of insisting upon the divorce between university science and technology, what should be encouraged is systematic exchange between academic and industrial posts, so that men may leave professorial chairs

to become managers of factories, while others leave factories to undertake teaching and scientific investigation. What is wanted is to bring science and industry in closer relationship, and that is not best accomplished by erecting a barrier of trade conditions between the laboratory and the factory.

THE Departmental Committee appointed by the President of the Board of Education to report upon the question of juvenile education in relation to employment after the war has considered it advisable, in view of the urgency of present circumstances, to issue an interim report recommending the Board to strengthen and extend, in co-operation with the Board of Trade, the system of juvenile employment bureaux and of local committees connected therewith. It emphasises the need also of after-care committees for juveniles from fourteen to seventeen years of age. The report directs attention to the fact that the exigencies of the war have caused large numbers of children to be drafted into employments that cannot be permanent and into other unsuitable employments, and that extensive dislocation, seriously affecting the conditions of juvenile employment, will surely arise after the war. It is stated that about 500,000 children enter into employment each year. To leave such children in the main without guidance is a serious dereliction of public duty, and requires that public bodies shall take up this necessary and urgent work. Having regard to the evidence placed before the committee as to school attendance, it might have been expected that it would have added to its recommendations in its interim report, in view of the serious evils which are induced thereby, the urgent need for the abolition of "half-time," so prevalent in Lancashire and Yorkshire, and of all exemptions which interfere with full-time attendance up to the age of fourteen. Two valuable handbooks, the like of which should be available in every area, dealing with the opportunities of employment of boys and girls in the cities of Edinburgh and Liverpool have been prepared, the former in 1908, the latter in January in the present year. Their purpose is to inform parents, and also to be a guide for teachers, of the conditions and possibilities of employment for their children. The oversight of children up to the age of seventeen at least is clearly within the province of the local education authorities, and it is to be hoped that the committee may further recommend in its final report the institution of measures which will ensure that all such children shall have facilities for continuing their education, both special and general, for at least six to eight hours per week within the usual hours of work.

AN interesting report of the proceedings of the Science Scholarships Committee of the Royal Commission for the Exhibition of 1851, dealing with the administration of the research scholarships since March, 1914, has just been issued, over the signature of Dr. Glazebrook, who has succeeded the late Sir Henry Roscoe as the chairman. The report deals with the science research scholars whose reports were examined in 1914–15, and includes scholars appointed so far back as 1909. Forty-five such scholars are reported upon, and it is gratifying to learn that out of this number the examiners were able to report that the work of thirty-nine of the scholars was satisfactory, and of seventeen of these eminently so as contributing results of high scientific value. It is interesting to observe that seven of the scholars took up industrial appointments on the conclusion of their period of research, whilst twenty-one entered upon university or scholastic appointments, and five entered the Government service to undertake specialised scientific work in the various research stations. Ten of the scholars entered directly into combatant service, either in the Army or Navy. Having regard to the vital importance of science in the development of industry, which the war has revealed with startling clearness, it would be very satisfactory to find a much larger number of research scholars entering into industry. The outbreak of the war rendered it impossible for scholars to proceed to German or other foreign laboratories, and other arrangements for their suitable employment in research were made. Many of the scholars elected to enter upon the prosecution of research bearing upon the requirements of the war. The committee had come to the conclusion to postpone all new appointments until after the war, but in deference to strong recommendations from the scientific advisers to the Government that it was desirable to maintain at the various university centres an adequate supply of qualified men to assist the Government in important investigations, it was decided not only to continue the scholarships, but also to offer six special war bursaries to organic chemists, the holders to undertake research under the direction of the Royal Society War Committee. The report indicates the manner in which the services of the scholars are being utilised in the preparation of explosives, drugs, dyes, etc., and in devising methods for improving war equipment or in combating disease.

SOCIETIES AND ACADEMIES.

LONDON.

Challenger Society, October 25.—Prof. E. W. MacBride in the chair.—G. H. **Fowler**: Physical conditions in the Kattegat. Seasonal variation was shown to depend on the sealing of the inner Baltic rivers by frost or their release by warmer weather.—C. T. **Regan**: Schmidt's second report on eel investigations. The importance of Schmidt's results in relation to the problem of the origin of species was pointed out.

Mathematical Society, November 2.—Annual general meeting.—Sir Joseph Larmor, retiring president, and afterwards Prof. H. M. Macdonald, newly elected president, in the chair.—Sir J. **Larmor**: (1) Presidential address. (2) The Fourier harmonic analysis: its practical scope, with optical illustration.—Prof. W. H. **Young**: Multiple integration by parts and the second theorem of the mean.—E. H. **Neville**: Moving axes and their uses in the differential geometry of Euclidean space.—J. **Hodgkinson**: Areas and conformal representation.

PARIS.

Academy of Sciences, October 16.—M. Camille Jordan in the chair.—P. **Vuillemin**: Anomalies resulting from traumatism in plants.—R. **Soreau**: The graphical anamorphosis of a topographical surface.—C. **Zenghelis** and S. **Horsch**: The chemical action of sodium peroxide upon the oxides of carbon. Carbon dioxide forms sodium carbonate, with a marked rise in temperature, oxygen being evolved. Carbon monoxide forms sodium carbonate, the rise of temperature not being so great as with the dioxide, although the heat of combination is greater. It is suggested that a percarbonate is the primary product of the reaction between sodium peroxide and carbon dioxide.—L. **Guitteau**: The action of sulphur on baryta in presence of water. Evidence is put forward that an unstable barium pentasulphide, BaS_5, can exist in solution; this decomposes into barium tetrasulphide, BaS_4, barium thiosulphate, hydrogen sulphide, and sulphur.—P. **Gaubert**: The crystalline liquids obtained by evapora-

tion of a solution. Studies on liquid crystals from anisal-*p*-amidoazotoluene, ethyl anisalaminocinnamate, *p*-azoxyanisol; some cholesterol esters, and amyl cyanobenzalalamocinnamate.—F. **Grandjean**: The orientation of liquid anisotropes on crystals.—C. **Sauvageau**: The biological variations of *Saccorhiza bulbosa*.—Ch. **Dhéré** and G. **Vegezzi**: The pigmentary composition of hepatochlorophyll.—J. **Amar**: Sense education and prothesis apparatus. The results. The apparatus used in the re-education of the tactile sensibility in the stumps left after amputation has been described in earlier papers. Some of the results obtained are now described.

BOOKS RECEIVED.

Electric Switch and Controlling Gear. By Dr. C. C. Garrard. Pp. xviii+656. (London: "The Electrician" Printing and Publishing Co., Ltd.) 15*s*. net.

The Elements of Engineering Drawing. By E. Rowarth. Pp. xii+131. (London: Methuen and Co., Ltd.) 2*s*. 6*d*. net.

Raymond: or Life and Death. By Sir Oliver J. Lodge. Pp. xi+403. (London: Methuen and Co., Ltd.) 10*s*. 6*d*. net.

Syllabus of Personal Hygiene for Colleges. By Prof. E. C. Howe Third revision. Pp. 207. (Wellesley, Mass.: Prof. Howe.)

Shakespeare and Precious Stones. By Dr. G. F. Kunz. Pp. 101+illustrations. (Philadephia and London: J. B. Lippincott Company.) 6*s*. net.

The Mechanical Star Bearing Finder. By E. T. Goldsmith. (London: G. Philip and Son, Ltd.) 5*s*. net.

My Life and Work. By E. K. Muspratt. Pp. xi+320. (London: J. Lane.) 7*s*. 6*d*. net.

De Strijkinstrumenten. By J. W. Giltay. Pp. xi+103. (Leyden: A. W. Lijthoff.)

DIARY OF SOCIETIES.

THURSDAY, NOVEMBER 9.

ROYAL SOCIETY, at 4.30.—Methods of Raising a Low Arterial Pressure: Prof. W. M. Bayliss.—Selective Permeability; the Absorption of Phenol and other Solutions by the Seeds of *Hordeum vulgare*: A. J. Brown and F. Tinker.—The Toxic Action of Dilute Pure Sodium Chloride Solutions on the Meningococcus: C. Shearer.—The *Rôle* of the Phagocyte in Cerebro-spinal Meningitis: C. Shearer and H. W. Crowe.—Investigation dealing with the Phenomena of "Clot" Formations. IV. The Diphasic Erosive Action of Salts on the Cholate Gel: S. B. Schryver and Mary Hewlett.—Some Photochemical Experiments with Pure Chlorophyll and their Bearing on Theories of Carbon Assimilation: Ingvar Joergensen and F. Kidd.

OPTICAL SOCIETY, at 8.—Some Notes on Glass Grinding and Polishing: J. W. French.

ROYAL GEOGRAPHICAL SOCIETY, at 5.—Natural Divisions of England: C. B. Fawcett.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Eighth Kelvin Lecture: Some Aspects of Lord Kelvin's Life and Work: Dr. A. Russell.

FRIDAY, NOVEMBER 10.

ROYAL ASTRONOMICAL SOCIETY, at 5.

MALACOLOGICAL SOCIETY, at 7.—Has Lymnæa an Auriculoid Ancestry? C. Hedley.—(1) *Anodonta cygnaea*, L., and *A. anatina*, L.; (2) *Pseudanodonta rothomagensis*, Locard: H. H. Bloomer and H. Overton.—Sexual Characters in the Shell and Radula of *Cyclostoma elegans*: Prof. A. E. Boycott.

PHYSICAL SOCIETY, at 5.—Note on the Diffusion of Liquids: B. W. Clack.—The Regularity in the Distribution of the Satellites of Spectrum Lines; with a Note on the Structure of the Green Line of Mercury and Terms of Correction in Using a Concave Grating: Prof. H. Nagaoka.

TUESDAY, NOVEMBER 14.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 6.—Ancient Stories of a Great Flood: Sir J. G. Frazer.

WEDNESDAY, NOVEMBER 15.

ROYAL METEOROLOGICAL SOCIETY, at 5.—A Meteorologist in China: C. E. P. Brooks.—The Storm of November 11-13, 1915, in its Passage over the British Isles: Lieut. A. E. M. Geddes, R.E.

ROYAL MICROSCOPICAL SOCIETY, at 8.—The Microscopic Work of the Accademia dei Lincei: Dr. C. Singer.—A New Tank and Pond-weed Holder for use with Greenough Immersion Objectives: S. C. Akehurst.

ENTOMOLOGICAL SOCIETY, at 8.—The Factors which determine the Cocoon Colours of *Plusia moneta* and other Lepidoptera: Mrs. P. A. Merritt Hawkes.

ROYAL SOCIETY OF ARTS, at 4.30.—Opening Address: The Stability of Great Britain: Dr. Dugald Clerk.

THURSDAY, NOVEMBER 16.

ROYAL SOCIETY, at 4.30.

INSTITUTE OF MINING AND METALLURGY, at 5.30.

CHILD STUDY SOCIETY, at 6.—Experiments in Hand-writing in Schools: Speed Tests in Manuscript Writing: Dr. C. W. Kimmins.—The Artistic Aspect of Manuscript Writing: W. Scutt.—Manuscript Writing in a Central School: J. W. Samuel.—Manuscript Writing in a Boys' Elementary School: A. Sinclair.

LINNEAN SOCIETY, at 5.—(1) Pedanios Dioscorides of Anazarba; his Writings and his Commentators; (2) The New Cabinets for the Linnean Herbarium: The General Secretary.—A New Australian Genus of Hydrocharidaceæ: Dr. A. B. Rendle.—Some Collections of the Littoral Marine Fauna of the Cape Verde Islands, made by Cyril Crossland in the Summer of 1904: A. W. Waters.

FRIDAY, NOVEMBER 17.

INSTITUTION OF MECHANICAL ENGINEERS, at 6.—Report of the Hardness Tests Research Committee.

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