NATURE

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

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NOTICE.

In consequence of the greatly increased cost of production it has been found necessary to raise the price of NATURE to 9d. The alteration will take effect beginning with the issue for October 24, from which date the Annual Subscription rates will be as follow:—Inland, £2 . 2 . 0; Foreign, £2 . 5 . 9.

ST. MARTIN'S STREET, LONDON, W.C. 2.

STREATFEILD MEMORIAL LECTURE.

The first of this series of annual lectures will be delivered by Professor W. J. POPE, C.B.E., F.R.S., at the City and Guilds Technical College, Finsbury, on THURSDAY, OCTOBER 17, at 4 p.m. Subject.—The Future of Chemistry. Admission Free. All interested are cordially invited.

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Vice-Chancellor—W. RIPPER, C.H., D.Eng., D.Sc., M.Inst.C.E., J.P.

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Education Department,
West Ham, E. 15.
September 18, 1918.

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Council House,
Margaret Street,
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Education Office,
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October 8, 1918. Secretary.

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September, 1918. Director of Education.

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THURSDAY, OCTOBER 10, 1918.

THE METALLURGY OF ZINC.

The Zinc Industry. By E. A. Smith. ("Monographs on Industrial Chemistry.") Pp. viii + 223. (London: Longmans, Green, and Co., 1918.) Price 10*s.* 6*d.* net.

RATHER more than four years ago an American metallurgist, in opening a discussion on the metallurgy of zinc, said wittily: "It is a time-honoured custom to throw bricks at the zinc man. The accusation is that he has borrowed a lime kiln and a gas retort and part of a sulphuric acid plant, hitched them together, and spent the last fifty years in regarding with holy veneration the reactions which take place in that retort. The copper man who thinks of zinc as something with which copper is adulterated to make brass, and the iron man who regards it as a sort of paint for corrugated sheets, and the lead man whose opinion as to zinc is not fit for publication, have long felt that when two or three of the minor details of their respective metallurgies were put in order, they would take a few days and fix up zinc on a modern basis."

It is true that there have been no such spectacular changes in the metallurgy of this metal as were wrought in that of steel and copper by the introduction of converters. Nevertheless, it is quite untrue to state, as is sometimes done, that there has been no change in its metallurgy since the first Belgian furnaces were built in the early part of last century. The main reason why there has been no revolutionary change is that the chemistry of zinc differs radically from that of the other metals, and that these differences control the type of apparatus that can be used.

In the first place, the temperature at which this metal is reduced by carbon from its oxide is considerably above its boiling-point under atmospheric pressure. It is, therefore, always produced as a vapour. In the second place, in order to obtain a merchantable product this vapour must be condensed at a temperature considerably above the melting-point of the metal. In practice, the temperature-range is from about 900° to 415° C. Above 900° C. the vapour is not condensed at all; below 415° C. it freezes to a powder consisting of finely divided metal with between 6 and 10 per cent. of oxide. More than this, the temperature necessary to condense the zinc as a liquid depends on the concentration of the vapour, and is lower the more dilute it is. Consequently the temperature of the condenser must be near that of the boiling-point of the metal at the end attached to the retort and very much lower at the opposite end. In the third place, the metal-vapour is extremely susceptible to oxidising influences, *e.g.* air, water-vapour, and even carbon dioxide. The charge must therefore at all stages contain a large excess of carbon, since the presence of even 0·25 per cent. of carbon dioxide is sufficient to oxidise the metal in this condition; moreover, the volume of gas carrying the zinc must be kept as small as possible. No other common industrial metal presents this combination of characteristics, which makes its smelting a by no means straightforward operation.

These and many other matters connected with the zinc industry are well set forth in Mr. E. A. Smith's book on the subject, which may be warmly commended to readers as giving, in the author's words, "a general survey of the development of the zinc industry and its present and possible future position in relation to the various metal industries of this country." In spite of the fact that the art of zinc extraction has been carried on in Great Britain for at least 150 years, its literature is very scanty, and Mr. Smith's book is therefore particularly timely, especially when it is remembered how gravely imperilled was the manufacture of certain munitions of war in this country by the cutting off of zinc supplies in 1914. Mr. Smith deals successively with the rise and development of the industry in various centres of production, the sources of supply and marketing of the zinc ores, their smelting and other methods of extraction—electrothermal and electrolytic—the properties of the metal and its industrial applications as such and in the form of alloys, its commercial compounds and pigments, and, finally, with the future of the industry in this country. As he points out, British smelters in the last forty years have lagged far behind their rivals in Germany and Belgium. The latter have greatly improved their practice, not only by getting increased extractions from the ore, but also by reducing costs in fuel, retorts, and labour, and this superiority has reflected itself in the value of their shares as compared with those of British companies.

Mr. Smith's book is well written, well balanced, and accurate. Considering how much work has been done in recent years to render the electrolytic production of zinc a commercial success, he might with advantage have devoted more than six pages to this aspect of the industry, but this appears to the writer the only blemish in a very admirable and valuable book. H. C. H. C.

THE NATURE OF SOLUTION.

The Nature of Solution. By Prof. Harry C. Jones. With a Biographical Sketch by Prof. E. E. Reid and Tributes by Profs. Arrhenius, Ostwald, and Woodward. Pp. xxiii + 380. (London: Constable and Co., Ltd., 1917.) Price 12*s.* 6*d.* net.

THE late Prof. H. C. Jones's book on "The Nature of Solution" represents undoubtedly his best and ripest work. The scope and outlook of the book are almost unexpectedly wide, in view of the somewhat closely specialised character of the author's own researches and of the enormous mass of detail which the generosity of the Carnegie Institution enabled him to pile up in connection with some three or four problems relating to the nature of solution. All this mass of reiterated detail, which compelled him to publish from time to time papers summarising the results of other papers, has been left behind in the present book, and the whole treatment of the subject is broad and satisfying. It is particularly refreshing

to find in a book written by a pupil of Arrhenius and Ostwald that the English work of Prof. H. B. Baker, by which the vital influence of moisture on chemical change has been brought out in so picturesque and striking a form, receives (probably for the first time in a text-book of physical chemistry) something like adequate treatment. The author was undoubtedly right, however, in putting these classical experiments in the forefront of his argument when seeking to justify the great stress that has been laid upon the condition of solution by so many workers in physical science. The work of Prof. Jones's colleague, Prof. Morse, on "The Osmotic Pressure of Solutions" finds a natural place in this volume, and the principal results of this investigation are quoted.

The principal features of the theory of electrolytic dissociation are described, but as the special work of the author dealt largely with the existence of hydrates in solution, the naked ion of the original theory is less conspicuous than is customary, and more than usual recognition is given to the part played by the solvent in electrolysis. There is also an important chapter on colloidal solution, in which a good account is given of the current position as regards both theory and practice. A brief chapter on "Solutions in Solids as Solvents" is, on the other hand, both inadequate and misleading; the formation of fusible alloys is quoted, without any evidence whatever, as an example of this type of solution. The whole effect of the chapter is to show that the author did not attempt to keep in touch either with crystallography, *i.e.* with the physical chemistry of solids, or with the scientific side of metallurgy, which affords so many and such valuable illustrations of the application of physico-chemical theory. The author's summary in the final clauses of this chapter—that "our knowledge both of pure solids and of solid solutions is very meagre. We have just scratched the surface, so to speak, of matter in the solid state"—is singularly inappropriate, in view of the work of Moseley and of Bragg, which has given us a knowledge of the solid state that is in many respects more exact and more detailed than our knowledge of solutions even after more than 100 years of controversy. This aspect of the theory of solution is, however, really outside the scope of the author's work and interest, and its virtual omission is not a serious fault in a book avowedly concerned in the main with the more ordinary type of liquid solution, and giving an excellent account of this important subject. T. M. L.

THE FUTURE OF THE SEA FISHERIES.

Fisheries of the North Sea. By Neal Green. Pp. vii + 178. (London: Methuen and Co., Ltd., 1918.) Price 4*s.* 6*d.* net.

MR. GREEN'S book is a very plainly written and (generally) a very accurate, short account of the British sea fisheries: it is quite the best of the modern works on the subject of which it treats. One may regard it as an attempt to anticipate the future by considering the present tendencies, and also by contrasting State administration here with that of France, the United States, and Germany. Political developments are noticed and their possible effects discussed: the Empire resources development schemes and the expected economic boycott of Germany are policies which the author regards as short-sighted and likely to be disastrous to us. The former proposals he describes as "impracticable and unjust," and the latter, he expects, will end in a great expansion of the fishery marines of both Norway and Germany, and the depreciation of the British herring fisheries: these theses are very well argued. Fishery organisation in foreign countries is described succinctly and rather to the disadvantage of France and Great Britain. "The administration of the fishing industry by the Norwegian Government is the best organised and most intelligent of all European countries." "More than any other country, France protects and subsidises the fishing industry in order to provide a naval reserve . . . the constant interference of the Government may be said to be the chief cause of the unprogressive spirit among the workers." America, Canada, and Japan have a chapter to themselves, and a picture of astonishing energy and progress is presented.

The contrast that is thus suggested is rather disheartening: "To-day scientific research in our fisheries is almost entirely absent; it is, in fact, probable that there are not three chemists employed in the whole industry; little is known of the food values of different fishes or the constituents of the by-products, or the most efficient and economical processes whereby the fullest advantage can be obtained from those values." The only big fish-preservation industry in Great Britain, that of the salt-cure of herrings, employs a process which has scarcely been modified throughout four centuries; the English industry of fish-canning is almost infinitesimal compared with that of America, and Germany, before the war, bought our fresh herrings greedily and built up a fish-preservation trade worth five millions a year. "At present there is not [in Great Britain] a single million-pound business engaged in the industry. There is far more capital engaged in the manufacture of soap than is used in the exploitation of the British fisheries." All this is a picture of the condition of business enterprise and administration and scientific research which is very unlike that usually placed before the public, and Mr. Green's book is the more interesting on that account. J. J.

THE BASIS OF MENTAL AND NERVOUS DISORDERS.

The Neurotic Constitution. Outlines of a Comparative Individualistic Psychology and Psychotherapy. By Dr. A. Adler. Translated by Dr. B. Glueck and Dr. J. E. Lind. Pp. xxiii + 456. (London: Kegan Paul and Co., Ltd., 1918.) Price 16*s.* net.

THE views of Dr. Adler, though expressed at length, lose in definition by being seen through the rather irregularly refracting medium of the

present English translation. To the author, the various traits of the neurotic constitution appear as formulations of what he terms the "masculine protest." The causal factor in this protest, which can be made either by the male or the female, is a feeling of inferiority. A continual attempt is made by the neurotic to dispel this feeling by ordering every detail of his life so that he may find that subjective security of which the feeling of inferiority has robbed him. This compensatory product, this aggressive endeavour at every point to achieve the "maximation of his ego," foredoomed to failure because of its false direction, exhibits itself in its protean forms as the psychoneurosis or psychosis.

Dr. Adler differs from many other workers in the field of psychoanalysis in that he attempts to attribute this lowered self-esteem to a definite inferiority of some bodily organ, and thus to give a physical basis for his psychological theory. The evidence for this view has been offered in a previous work, "Studie über Minderwertigkeit von Organen," which is now being translated into English.

While welcoming this tendency to broaden the general explanatory basis of mental and nervous disorders of this type by an attempt to conceive physiological as well as psychological factors underlying them, one is inclined to think that Dr. Adler's addition of a second supporting pillar to his theoretical structure has been accompanied by an undue attenuation of the first. Freud has laid enormous stress upon the importance of the sex instinct in the production of the psychoneuroses: Adler, his former pupil, ascribes a similarly exclusive *rôle* to the instinct of self-assertion. The writings of Jung, on the other hand, allow of the interpretation that each and every one of the instincts in man may play its part in the causation and continuance of these disorders. To believe that both Adler and Freud have over-stated their cases is compatible with the opinion that a comparison of such views, too sharply focussed as they may be, will add to the physician's power for helping that unfortunate, all-too-human being, the neurotic.

FOOD AND HEALTH.

(1) *The Art of Health.* By Prof. J. Long. Pp. xi+192. (London: Chapman and Hall, Ltd., 1918.) Price 5*s.* net.

(2) *Cookery under Rations. Over* 200 *War-time Recipes.* By M. M. Mitchell. Pp. 65. (London: Longmans, Green, and Co., 1918.) Price 2*s.* net.

(1) THE author of this book is "persuaded that most of our bodily troubles and the diseases of the vital organs are the result of impurities which are produced or deposited in the system from the foods we consume." It is not surprising, therefore, that his advice to those who wish to maintain or recover health deals largely with matters of diet. In the fifteen chapters of which the work consists only three are devoted to matters other than food—namely, No. 10 on "Water," No. 11 on "Air," and No. 12 on "Climate and Temperature." Even water and air are claimed to be foods.

Two reasons are given for undertaking the work—namely, that the author has been a life student of the breeding and feeding of domestic animals, and that he has been led to study the nutrition of the human body by having suffered for a period of four years from a disorder of his own digestive organs, whereby he was reduced to a mental and physical wreck. In consequence, the public is treated to a dissertation on foods containing some useful maxims of a general nature, for the most part repeated several times throughout its pages. The chief points made are that insufficient attention is paid to the minerals and life in plants, also that too much meat is consumed. The author therefore recommends a diet almost entirely vegetarian, and lays special stress on the use of salads and raw fruits. For this a quaint reason reiterated many times is assigned—namely, that "they maintain a clean digestive track [*sic*] throughout the entire system." Nevertheless, the best section of the book is that which deals with salads. It would be even more useful if detailed recipes had been given. Prof. Long would in no circumstances allow entrails to be eaten, and believes that all kinds of meat cause a craving for drink, both non-intoxicating and intoxicating, whereas vegetables have not this effect. He recommends a vegetable and fruit diet for the cure of inebriates, also for cancer and tuberculosis. Cane-sugar is likewise strongly condemned owing to its "high property of fermentation." Nevertheless, the ration of this sugar which he allows would nowadays be considered very liberal—namely, 2 to 5 oz. per day, according to age and constitution.

It is admitted that there are possible objections to vegetarianism—namely, bulkiness of the food, possible irritation caused by a high proportion of indigestible residue, and the difficulty of obtaining sufficient nitrogen to cover wear-and-tear.

A considerable number of mis-statements are to be found, some of which appear to be based on misconceptions. Thus "heat and energy" is an expression which frequently occurs. It is stated on p. 67 that "the liver, kidneys, lungs, pancreas, stomach, and intestines consist of muscular tissue to which more or less fat is attached." The word "ilium" is used instead of "ileum" for the third section of the small intestine. Fat is said to produce heat at more than twice the *rate* of the carbohydrates. The loss entailed by boiling vegetables is, as a rule, placed too high. Parsnips (p. 35) are said to lose more than one-half of the total digestible food they contain; and in a more detailed statement (p. 40) the nutritive matter is said to be reduced by boiling: in the parsnip from 15 to $3\frac{1}{2}$ per cent.; in the carrot from 10 to 4 per cent.; in the turnip from 6 to $1\frac{1}{2}$ per cent.; in the beet from 11 to $3\frac{1}{2}$ per cent.; and in the potato 20 per cent. Probably the author means that a reduction of the nutritive matter takes place, varying in the parsnip from 15 to $3\frac{1}{2}$ per cent., and

so with the others. But the statement is not clear, and, taken with that on p. 35, is calculated to give a wrong impression.

The whole of the useful information in the book could without difficulty be given in a pamphlet one-tenth its size. No index is provided; had it been, the amount of needless repetition would have been made evident at a glance.

(2) For some time after the introduction of rations housewives found it difficult to adapt their cookery to the new conditions. The recipes compiled by Miss Mitchell are intended to help in this matter, and are well adapted to do so. After some useful points on economy in the use of fuel and in making the most of fat in cooking, the recipes proper are given in detail. These are grouped into recipes for (1) meat dishes, more than forty in number; (2) vegetables and sundries, seventeen in number; (3) other meatless dishes, numbering no fewer than sixty; (4) soups, ten; (5) fish, eighteen; (6) sauces, eight; (7) salads, seven; (8) pastry and batters, eleven; (9) puddings and sweets, thirteen; (10) bread and cakes, thirteen; (11) preserves, fifteen.

A mere list does not, however, convey an adequate idea of the value of the book. The recipes are all carefully selected by a writer having practical experience of her subject, and are in most cases excellent.

OUR BOOKSHELF.

Applied Bacteriology: Studies and Reviews of some Present-day Problems for the Laboratory Worker, the Clinician, and the Administrator. Edited by Dr. C. H. Browning. Pp. xvi+291. (London: H. Frowde and Hodder and Stoughton, 1918.) Price 7*s.* 6*d.* net.

THIS book comprises an account of research work on bacteriological subjects by Dr. Browning and co-workers, carried out partly in the Pathological Department of the University and Western Infirmary, Glasgow, and partly in the Bland Sutton Institute of Pathology of the Middlesex Hospital. Much of the matter included has already appeared in the form of separate published papers, but these have been added to and extended.

Dr. Browning contributes an introduction on the scope of applied bacteriology, in which he emphasises that the best results can be attained only by highly trained and experienced workers who have a large part of their time free for original research. Then follow the series of papers the subjects of which include the diagnosis of "enterica" infections (typhoid and paratyphoid fevers and dysentery) by bacteriological and serological methods, by Drs. Browning, Mackie, and Thornton; the use of calibrated pipettes in serological work, by Dr. Browning; observations on the diphtheria group of organisms and on the isolation of *B. diphtheriae* by means of a medium containing telluric acid, by Dr. J. F. Smith; studies on antiseptics, with special reference to selective inhibitory action, by Drs. Browning, Gilmour, and Gulbrausen, in which the action of the flavines and other aniline dyes is considered; and the use of ultra-violet radiations as a means of discriminating between, and of isolating, certain micro-organisms, by Drs. Browning and Russ. The final paper is a summary of what is known about tetanus, by Dr. Browning. This subject is of so much importance in connection with the war that this epitome is very welcome.

Being largely a reprint of research work, the value of this volume can scarcely be appraised at present, but it may be said that much of the matter forms a notable contribution to the advancement of bacteriological science. R. T. H.

Veterinary Post-Mortem Technic. By Prof. W. J. Crocker. Pp. xiv+233. (Philadelphia and London: J. B. Lippincott Co., 1918.) Price 16*s.* net.

A BOOK of this type has long been needed to fill a gap in veterinary literature. So far as we are aware, there has previously been no work detailing in a systematic manner the making of post-mortem examinations on the lower animals, and, consequently, reports of autopsies have been lacking in uniformity, and often the most important features have been omitted or insufficiently emphasised owing to the lack of system. Prof. Crocker's book will go far to remedy that state of affairs, and should be in the hands of all students and most practitioners of veterinary pathology. As might be expected, there are several minor points with which we are not in entire agreement. For example, it is suggested that in the case of a small animal suspected of rabies the head severed from the body as close to the trunk as possible should be dispatched to the laboratory for examination. In our opinion it would be far better to send the whole body without mutilation—the extra weight of a small animal is of no importance. The author recommends the use of Müller's fluid for preserving tissues; it would have been better if the formula had been included. He also recommends the use of slat platforms to be used on the floor of the autopsy room. Wood, however, is not an ideal material for use under these conditions, owing to the difficulty of disinfection, which can be properly carried out only by burning, thus causing continual expense. With regard to the examination of the various organs, we are of opinion that insufficient attention is paid to the examination of the various lymphatic glands, which are of paramount importance in post-mortem examinations in numerous affections.

As a whole the book has been written in a very clear and lucid manner, and there is little fault to find with it. The photographic illustrations of the various methods of procedure are excellent.

Common Beetles and Spiders, and How to Identify Them. By S. N. Sedgwick. Pp. 62. (London: Charles H. Kelly, n.d.) Price 1*s.* 6*d.* net.

IN this little volume the author treats, in a style necessarily sketchy and incomplete, of some com-

mon British beetles and spiders. In dealing with either group he gives first a short general account of structure and habits, next an outline classification of tribes or families, and then a list of some common species with characteristics so superficially described that the promise "How to Identify Them" contained in the title cannot be considered as fulfilled. The 228 beetles chosen for listing are illustrated by natural-size photographs, most of which are too obscure to be of use. The larger photographs of some selected spiders, supplemented by four plates of outline drawings, are less unsatisfactory, but the front-view portrait on p. 50 lettered "Wolf-spider" is evidently taken from a jumping-spider (Salticid). The classification and nomenclature adopted for both spiders and beetles are those of the naturalists of fifty years ago.

Canning and Bottling, with Notes on other Simple Methods of Preserving Fruit and Vegetables. By Dr. H. P. Goodrich. With an Introduction by Prof. Frederick Keeble. Pp. x+70. (London: Longmans, Green, and Co., 1918.) Price 2*s*.

IN spite of its modest size, this book contains a great deal of valuable information on bottling, canning, pulping, drying, and salting vegetables and fruit. In the first part of the book the author describes fully practical methods, while in the second part a brief account of the behaviour of bacteria and fungi, the micro-organisms which have to be fought by the preserver of fruit and vegetables, is given. The canning of fruit, which is extremely popular in America, but comparatively little used by amateurs in this country, is warmly recommended in regard both to the flavour and quality of the products and to the rapidity and simplicity with which the work can be carried out. The fear of tin and of ptomaine poisoning, which has prevented some people from canning vegetables, is shown to be entirely groundless.

The Stars, and How to Identify Them. By E. Walter Maunder. Pp. 64. (London: Charles H. Kelly, n.d.)

THE war has renewed interest in the constellations as guides for night-marching, etc., and several handbooks have been published for this purpose. Mr. Maunder gives here in a condensed form much of the information contained in his "Astronomy of the Bible" and his numerous papers on early Babylonian astronomy.

The constellations of the entire celestial sphere are shown in twenty-six clearly printed maps; the constellation figures are not drawn, but the stars of each group are connected by thin lines, which in many cases give some rough idea of the object the name of which it bears. A summary of the ancient myths relating to the grouping of the constellations is given, as affording a useful aid to the memory regarding their mutual configuration. Four northern and one southern key maps indicate the positions of the constellations at the various seasons. ANDREW C. D. CROMMELIN.

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.*]

Observations of Nova Aquilæ in India.

IN NATURE of June 13 I note that the earliest observation of Nova Aquilæ in England was made by Miss Grace Cook at 9.30 G.M.T. on June 8, and the magnitude was estimated as equal to Altair. In India the star was seen and recognised as a nova about five hours earlier by Mr. G. N. Bower in Madras, who has sent me his original notes made at 10 p.m. Indian Standard Time on June 8 (corresponding with 4.30 p.m. G.M.T.). Mr. Bower was occupied in pointing out the principal stars and constellations to a friend, and identifying them with the aid of Mrs. Evershed's "Guide to the Southern Stars." Turning to the eastern sky, he at once saw a star on the borders of Aquila and Serpens which he could not place. It appeared to be as bright as Altair, or possibly brighter, but not so bright or white as Vega. Altair was, however, unfavourably placed for the comparison.

At Jhelum, North India, the star was independently discovered on June 9, 3.30 a.m. I.S.T. (10 p.m., June 8, G.M.T.), by Mr. C. L. Dundas, I.C.S., who kindly advised me by telegram of his observation. He also estimated it as equal to Altair, but at the same time on the following night "it was apparently equal to Vega."

At Kodaikanal I was photographing the spectrum of Venus on the morning of June 8, and can state with some confidence that the nova had not then appeared, or perhaps it would be safer to say that it had not risen above the second magnitude. The sky was exceptionally clear that morning, and the brilliance of the Milky Way attracted special attention between 4 a.m. and dawn, about an hour later. Mrs. Evershed and myself were both observing the Milky Way, and both had the possibility of detecting novæ at the back of our minds. This narrows down the time of the outburst to between 11 p.m. G.M.T. on June 7 and 4 p.m. G.M.T. June 8.

The spectrum of the nova has been studied here in some detail, thanks to the partial failure of the monsoon in Southern India, which resulted in a good number of fairly clear nights from early in June to the middle of July. Two series of spectrum photographs were obtained simultaneously—a large-scale series with a 6-in. prismatic camera, and a small-scale series with a 2-in. prismatic camera, the latter showing considerable extension in the ultra-violet. By a special arrangement of the apparatus I was able to photograph a comparison spectrum of Arcturus accurately aligned with the nova, so that the wave-lengths in the nova spectrum have been determined by reference to the lines in Arcturus.

On the nights of June 12–13 and 13–14 many of the absorption lines in the nova appeared to be in duplicate, and there are two series of hydrogen absorption lines, both enormously displaced towards violet; the wider, more refrangible series in $H\beta$, $H\gamma$, and $H\delta$ gives a mean displacement corresponding with 2700 km./sec., whilst the comparatively narrow, less refrangible series gives 1720 km./sec., both in the direction of approach. This is with reference to Arcturus, and uncorrected for the component of the earth's motion, which is very small. In later plates the more refrangible set

of lines has vanished, whilst the less refrangible set shows a slightly increased velocity, which on the night of June 19–20 was estimated at 1860 km./sec. This accelerating motion reminds one of eruptive prominences ejected from the sun, and, if confirmed, would indicate the action of a repulsive force.

The hydrogen emission bands are very intense and well defined in all the photographs, especially $H\alpha$ and $H\beta$, but in the ultra-violet beyond $H\delta$ they become feeble and difficult to distinguish, whilst the absorption lines are strongest and persist longest in the ultra-violet, where they have been photographed up to $H\pi$ on June 18–19. The $H\alpha$ line stands cut isolated and without absorption in all the plates except the earliest one exposed on June 13–14. On this plate the continuous spectrum is faintly visible near it, and the two displaced absorption lines corresponding with the two velocities mentioned above are clearly shown. The $H\beta$ emission band on June 20 extends from λ 4834 to λ 4885, and within it are three maxima at 4857, 4864, and 4880.

The last plate secured was exposed on July 11, the star being then of magnitude 3·6. This photograph shows emission bands only, extending to $H\eta$, and there is no appreciable absorption, even in the ultra-violet. The nebula emission band at 5007 has greatly increased in relative brightness, in accordance with precedent.

Kodaikanal, August 6. J. EVERSHED.

THE "TAYLOR" SYSTEM OF "SCIENTIFIC MANAGEMENT."

DURING the last year or two much attention has been given to the results of analyses of industrial operations obtained by Dr. F. W. Taylor in the United States, and a system of scientific management has been based upon them. Advocates of the "Taylor" system claim that, by the thorough analysis and investigation of the actual practice of manufacture, it has been possible to deduce certain principles applicable to all industry. These principles are not so co-ordinated and developed as the laws of physical science, because, although the result of industry —the production of concrete material things—is physical, the actual process of production by human brains and hands is not a physical, but a social, process. Only those who maintain that social laws cannot be discovered which will explain and govern the actions of society can consistently argue that the "Taylor" principles applied to industry are not scientific.

In the early days of mechanical invention progress was entirely by trial and error. At the present day almost all invention is the result of laborious investigation and research, and the development of invention and design has been greatly accelerated by the application of scientific method. The complexity and minuteness of detail shown in the complete working drawings of a modern engineering firm would have been beyond the comprehensions of our forefathers, who could not decide such things on paper, but had to work by rule-of-thumb methods. The application of science to engineering design has made all this development a matter of course to the present generation. Science has made most headway in design, because a knowledge of the laws of the strength of materials, and of magnetism and electricity, are essential to the design of steam and electric machines; and once a man is forced to use science as the basis of his work, he is more likely to evolve scientific methods in connection with the numerous details and routine of actual production. In this direction, however, there is still much that can be done, but the fact to realise is that in this field of human effort scientific method is accepted by practically all.

When we come to the actual purchase, storing, and handling of materials required for production, we find no equivalent to the modern scientific designer and draughtsman. We find a varied collection of buyers, storekeepers, and clerks. It is safe to say that very few of these types of workers have the haziest notion of what scientific methods are, or how they could be applied to their work. It is probably unfair to expect this, as they are all highly trained by rule of thumb. Planning and co-operation, which are among the basic principles of scientific management, are usually glaringly absent, and where production is not held up by lack of material, this is accomplished by prodigal expenditure and, consequently, inefficiency in the use of material. Nevertheless, method is accepted in this direction also, without much controversy. It is agreed that works should be built so that they can be easily expanded without mixing up all the departments, and laid out so that material can travel as continuously as possible from one process to another, until completed, with the minimum amount of cross or backward travel. It is agreed that materials should be purchased with some relation to the output, the time required to deliver, and the number of times to be repurchased in the year, so as to guarantee material when required, without at the same time locking up more capital in stocks than is necessary. It is agreed that stores should be large, roomy, and completely closed in, and nothing issued without proper requisition; and that men from the store should move material to the shops so that the time of the skilled men is not wasted seeking after material.

There are hundreds of systems for doing these things—in fact, each firm must evolve the one most suitable for itself; but the principles underlying all these varied systems are the same; and once a manager has a grasp of these principles he can quickly plan a system, and with time and continual care will get it to work. Buyers, storekeepers, and clerks have no scientific training, and, consequently, they seldom see the principles involved. To unscientific minds there is little or no co-ordination or correlation; everything is more or less in watertight compartments; they cannot see the extraordinary interdependence of all sections of industry. As, however, this type of labour is not numerous, and has no organised objection to improved methods, it is possible to improve matters comparatively quickly with a reasonable expenditure of will and mental energy on the part of the management.

The efficient buying, storing, and handling of the raw material of an industry, while they are very important, and will reduce the cost of manufacture, are at best a saving effected on a very small percentage of the total human effort expended in industry. If we realise that everything that man makes is consumed, sooner or later, then we may consider all the products of each industry to be the raw material of another industry. Production we can conceive as the evolution of raw material from a simple to a more and more complex product. Each time it is sold, bought, and stored in the process, we may consider its growth temporarily stopped. It is during this time of lack of change, when the very minimum of human effort is expended on it, that we try to save human effort. During all the numerous definite changes of the product, when the maximum of human effort is expended, we refuse to apply scientific principles. Considering that this is the application of science which affects by far the greatest number of workers, it is very easy to comprehend their opposition to being "Taylorised," as they say.

The "Taylor" method accepts no preconceived ideas of how a job should be done. As a chemist splits up a compound into its elements, so Dr. Taylor says that all jobs should be split up into their elemental operations. These elemental operations are carefully studied and timed by engineer experts, and the useless ones, which we may consider as impurities, are eliminated. The best machine tools and equipment are used, and, therefore, standard minimum times can be found for all standard operations. When data are accumulated giving the time required for standard specified machine work, fitting, etc., then standard operation times can be fixed from the drawings without any timing in the shops, just as the designs themselves may be made without shop experiments. "Time" or "motion" study is scientific in its method, and the accuracy of the result will, like all experimental data, depend on the accuracy of the observer. There are definite principles in this "Taylor" method which, when grasped by experts, can be used by them to arrive at accurate results. All other methods of "rate-setting" are non-scientific. Some are pure guesswork, some are more or less so.

The "fatigue factor," which is the time to be allowed in addition to the "standard" time, so that the worker may not be "fatigued," is most difficult to discover accurately; but for this, science is as much at fault as industry. Medical science formerly concerned itself almost entirely with the cure of disease, but it now devotes itself largely to cause and prevention. When we all realise that disease must be prevented, we shall soon begin to realise that industrial fatigue must also be prevented. The "Taylor" system is the only one that separates out the work and fatigue of production, like the analysis of useful work and losses in a machine. It remains for the scientific experts, the engineers, the doctors, and the psychologists to co-operate and co-ordinate their efforts so as to produce as scientifically accurate a result as their combined efforts make possible, and to keep it continually up-to-date as methods improve and knowledge extends.

Dr. Taylor says that the workers must be instructed in the principles of their art by the management, and not left to learn it from others as they see fit. This necessitates that the management should be organised on a functional basis. Brains must be specialised and trained just the same as manual labour, and, therefore, the system does away with the old orthodox foreman and his assistants and under-assistants, and he creates many foremen, each of whom has one specific function, in which he is an expert. The "Taylor" system separates the functions of planning, instruction, and execution. It increases the cost and the size of the management, and greatly increases its responsibility. That is why so few employers will adopt it. It requires much more care, study, and thought than any arbitrary, non-scientific system.

The trade-unions and the men oppose the system because it will not use individual and trade habits and prejudices unless they happen to be scientifically sound. While this attitude excuses the workers, it betrays a lack of vision on the part of the "intellectuals" in the Labour movement, who, so far, are unable to see that the elimination of the enormous amount of useless effort put forth by the working classes must be to the benefit of that class more than any other.

It is the same old battle of knowledge against ignorance and prejudice. Patience, sympathy, and much more education are required. Not education which will give to more and more little uncorrelated scraps of chemistry, physics, and electricity, but an education which will train the mind to think in a scientific manner and grasp the significance of the interdependence of all things, and most especially human effort. If we are to maintain our position as one of the greatest of the world-States, intelligently directed effort on the part of everyone will be obligatory. The same energy put into useful work as is now wasted in useless effort will not only double and treble our production of material wealth, but it will also ease the burden on the workers and enable them to live freer, higher, and happier lives.

J. M. SCOTT-MAXWELL.

GERMAN INDUSTRY AFTER THE WAR.

III.

MM. JAUREGUY, FROMENT, AND STEPHEN conclude their series of communications to the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale* (see NATURE for September 26 and October 3) on the influence of the war on German industry with some interesting reflections on its after-effects, temporary and permanent. There can be no doubt that the isolation of Germany for so long a period has occasioned profound modifications in her industrial and commercial position. Whatever may be the ultimate result

of the struggle, she no longer hopes for the victory on which, at the outset, she confidently reckoned. All her energies are now directed to avert or to minimise the disastrous consequences which await her. The era of peaceful penetration is at an end. She realises that she has incurred a world-wide hatred, and that the world's markets are no longer open to her on pre-war terms. Moreover, she is face to face with an unlooked-for and astonishing development on the part of her most powerful enemies of those industries in which she was supreme, and which she trusts may still enable her to recover, to some extent, her lost position. These industries, indeed, are the main means by which she hopes to get over her immediate financial difficulties, to retrieve her commercial credit, and so enable her to purchase the enormous supplies of raw materials of which she is in urgent need.

A very few months after the outbreak of hostilities the leaders of German industry realised the seriousness of their position, and during the middle of 1915 they began to take steps in order to meet the difficulties in front of them. Political reasons compelled the State to delay for a time any public recognition of their apprehensions, but in the late summer of 1916 the Government created an Imperial Commission to study and report upon what was termed the "Economics of Transition," or, in other words, the most feasible means of passing from the economic life of war to the economic life of peace. The Commission consisted of certain State functionaries with a technical staff composed of qualified representatives of every important branch of German industry. Its duties were to consider the best means of regulating the purchase of foreign material, and, as a consequence, to study the question of exchange, to regulate the transport of the merchandise thus bought—that is, the question of freight—to regulate the distribution of imported raw material, and, lastly, to decide upon the most effective means of recovering over-sea traffic.

The discussion of these questions greatly agitated commercial and industrial circles during 1916 and 1917, and roused many conflicting interests. The difficulty was to determine which industries should receive preferential treatment, for it was obvious that these regulations would inevitably strike at the root of all freedom of commerce. The main ideas which seemed to guide the Commission, acting in the general interests of the State, were to develop as rapidly as possible the exportation of products for which presumably there would be an urgent demand, and which, therefore, were commercially the most valuable, such as synthetic dyes and pharmaceutical products; to prevent all importation of dispensable material; to manufacture as rapidly as possible raw materials into products that might be re-exported with the shortest possible delay; and to import the largest possible quantities of food and forage.

As may be imagined, particular industries at once began to urge their right to preferential treatment. It was practically impossible to settle their claims on any intelligible or rational basis. Moreover, many economists viewed the interference of the bureaucracy in matters of commerce with considerable distrust. The great purchasing organisation which was contemplated foreboded a State monopoly. The regulation of imports and exports seemed to strike at the prosperity of Hamburg and Bremen, and the shipping interest protested. Commercial freedom, they insisted, could alone save the country.

Concurrently with all this unrest there was a growing feeling of dissatisfaction with the working of the numerous war societies which the Government had called into existence and placed under the direction of various Ministers of State. By the middle of 1917 these numbered about 250, and were directed solely to the interests of the Army and the war. They proved exceedingly irksome to the commercial classes as a whole, and were at times of great inconvenience and even hardship to the workers, who were moved about from place to place, like so many pawns in a game, as the necessities of the war seemed to demand. By the end of 1916 the Imperial Chancellor had decreed what was, in fact, a civil mobilisation. Certain industries were forcibly taken over by the State, such as the manufacture of soap and of boots and shoes. In the latter case the tanning and leather industries raised a violent protest, and the reaction—it was virtually a revolution—spread throughout Germany. A syndicate such as was contemplated by the Government would mean the eventual ruin of their export trade. One manufacturer thus expressed himself: "The war has shown how much we as a nation are detested by the foreigner and regarded as barbarians. Merchandise launched upon the world's markets after the war by a State syndicate would meet with the greatest opposition, whereas goods offered by old commercial friends who are known personally, through commercial relations established for years, and are not looked upon as barbarians, would be received in a very different spirit."

The arguments of the traders met with an echo in the Reichstag. The syndicates were warmly defended as provisional measures by ex-Vice-Chancellor Helfferich, and supported by State-Secretary Schwander. Ex-Chancellor Michaelis went even further: they were, he said, a fiscal necessity, and must exist after the war as State monopolies, in view of the enormous financial needs of the Empire. In this declaration the industrial community saw the justification of its fears and the necessity for its action. The opposition was thereby strengthened, and in the end the Government capitulated.

There are two great branches of industry on which Germany sets great store, and which she hopes may do much to rehabilitate her commercial position after the war. The one is the synthetic colour trade and the affiliated manufacture of pharmaceutical products; the other is the potash industry, of which she had practically a monopoly.

As regards the first, she is striving by every means to maintain her ascendancy. Not only have the great colour-producing concerns banded themselves together to work in common and pool their profits, they have also taken steps to assure themselves of a continued and, indeed, increased supply of the trained material upon which the ultimate success and development of their industry depend. This they have sought to further by the establishment of scholarships or bursaries, known as the Liebig bursaries, to be awarded to deserving young chemists who have graduated at the polytechnics, on condition that they serve as assistants to the professors and are trained in the work of research. The necessary capital of 2 million marks to found these bursaries has been entirely subscribed by the leading colour-makers. Similar action has been taken by the Technico-scientific Union, which acts as an intermediary between industry and the scientific departments of the universities and the polytechnics, and arranges for the investigation of special problems which the smaller or less wealthy industrial concerns may desire to have solved. There is also an organisation known as the "Society of Friends and Benefactors of the Rhenish University of Bonn," which seeks to make generally known the knowledge acquired during the war in the domains of agriculture, commerce, and industry, and to further their progress by the active collaboration of science and industry. These instances are remarkable as indicating that Germany is at length seeking to emancipate itself in educational matters from official thraldom. Hitherto efforts of this kind have been largely initiated or controlled by State authority. It is curious that whilst that country as the result of war-experience is moving towards a more democratic control in this matter, our own action in national educational effort as the outcome of the same experience tends more and more towards bureaucratic direction.

The Stassfurt potash deposits are, no doubt, a great German asset. Prof. Ostwald, indeed, has declared that it rests with Germany to decide if in the future the world is to be nourished or starved. Four years' experience will, however, convince most people that the learned professor's assertion is on a par with much of the rodomontade to which he has accustomed us. There are many signs that the German potash monopoly will be broken, and, as Mr. Kenneth Chance has shown in the paper which he read at the recent annual meeting of the Society of Chemical Industry, the production of potash in this country is far from being an insoluble problem. With the passing of Alsace to France, Germany's control of the main supply will be jeopardised. Moreover, there are other untapped sources throughout the world. It has been asserted that the chance of finding soluble potash in British geological deposits is at least as great as that of discovering mineral oil. What is wanted is a systematic scheme of exploration which has never yet been attempted. There is no *a priori* reason why the conditions which have led to the creation of the German deposits should be confined to that country. It seems only yesterday that such deposits were discovered in Alsace, and what has happened in Alsace may well be found to have occurred elsewhere.

DR. HENRY DYER.

WITH the death of Dr. Henry Dyer on September 25, there passes from our midst, at the age of seventy, one whose name will ever be associated with the rise of Japan as an industrial Power. He had barely finished his distinguished student career in the University of Glasgow when, on the recommendation of Prof. Macquorn Rankine, he was appointed principal of the newly constituted Kobu Daigakko or College of Engineering in Tokyo. This was in 1872, when he was only twenty-four years of age. An account of the college in these early days will be found in NATURE, vol. xvi., p. 44 (May, 1877), and its marked success as an educational institution up to the date of its amalgamation in 1886 with the Teikoku Daigaku or Imperial University of Tokyo was an eloquent tribute to the clearness of purpose and the organising skill of its first principal.

In considering the part Dyer played in this great venture we should bear in mind not only his own direct work, but also the remarkable staff of young professors he gathered round him. Most of these he outlived, such as Ayrton, the electrician; Edward Divers, the chemist; John Milne, the seismologist; and C. D. West, the engineer, a man of the wide culture so characteristic of the graduates of Trinity College, Dublin. Prof. John Perry and Prof. Thomas Alexander are still with us, as are also two of the professors of English, the Rev. W. G. Dixon, now of Dunedin, and Prof. J. M. Dixon, of the University of South California, Los Angeles. The inclusion of English as an essential subject of study in the engineering curriculum showed the far-sighted policy of the early organisers of the college. From within its walls there went forth a great body of graduates to whom English was almost a second mother tongue, so well were they trained in the use of our idiom and in the knowledge of our best books. Many of these graduates held important Government posts, and their influence must have been considerable in shaping Japan's destinies.

After ten years of strenuous work Henry Dyer retired from the principalship and settled in Glasgow, where he soon identified himself with progressive educational developments. He threw himself with characteristic ardour into the organisation of what is now the Royal Technical College, of which he was a life governor. He became a member of the Glasgow School Board in 1891, and had acted as chairman since 1914. He was particularly interested in the work of the continuation classes and in the difficult problems of industrial reconstruction and education. As deputy-chairman of the Board of Conciliation and Arbitration of the Manufactured

Steel Trades of the West of Scotland, he enjoyed the confidence of both masters and men. He also took an active interest in the West of Scotland branch of the British Astronomical Association, of which he was honorary vice-president at the time of his death.

In 1910 Dr. Dyer received the honorary degree of LL.D. from the University of Glasgow, and in 1915 the degree of Doctor of Engineering from Japan. In 1882 he was decorated with the Japanese Order of the Rising Sun (Class III.), and a few years later with the Order of the Sacred Treasure (Class II.).

In addition to many contributions to periodical literature, Dr. Dyer wrote a number of important books, of which the best known is "Dai Nippon, the Britain of the East." In this volume he traces the rise and progress of Japan in economics, industries, and education, very naturally devoting considerable attention to the work of his own College of Engineering.

His other published works deal with such questions as science teaching in schools, education and national life, the evolution of history, and the like.

Dr. Dyer's many friends and associates can look back upon the record of a life well spent in the highest educational activities and in furthering the interests of the community among whom he lived. His was a strong personality actuated by a single-hearted enthusiasm in the cause of scientific training. C. G. K.

NOTES.

We learn with much satisfaction that the report of the death of the distinguished philosopher, M. Emile Boutroux, member of the Institute of France and of the French Academy, is incorrect.

In the *Times* for October 5 there appears a short notice concerning the latest Halberstadt biplane, quoting a report on this machine prepared by the Technical Department of the Air Ministry. It is exceedingly gratifying to read that the performance of the above machine is poor when compared with our own machines of a similar class, especially when it is remembered that the particular aeroplane on which the report is based was captured so late as last June, and bears the date April 14, 1918, stamped on various parts. Some figures relating to speed and climb are given in the *Times*, but, unfortunately, the weight of the machine is not stated, so that their full significance is not apparent. The speed is given as ninety-seven miles an hour at 10,000 ft. with the 180-h.p. Mercédès engine, and the times given for climbs to various heights indicate a climbing speed of about 600 ft. per minute at ground-level. If the weight of the machine were 2700 lb., a likely figure for such an aeroplane, one would expect a climb in the neighbourhood of 1000 ft. per minute at ground-level with the above horse-power, and this rough figure gives some idea of the relative merits of our own two-seater fighters and this recent German machine. The Halberstadt is considered easy to fly and quick in manœuvrability, but these qualities cannot be used to the best advantage in a machine the speed and climb of which are low. The report in question is of great interest, since it establishes in a very direct manner the superiority of our machines over those of the enemy, and there seems little doubt that this superiority, once definitely gained, will be easily maintained in the future.

The Right Hon. H. A. L. Fisher, President of the Board of Education, will preside at a meeting to be held at the Royal Society of Arts on Monday, October 28, at 3 p.m., when a scheme for the promotion of industrial art will be submitted for consideration. Amongst those who have consented to speak are Lord Leverhulme, Sir Charles Allom, Sir Woodman Burbidge, Mr. Kenneth Lee, Sir William McCormick, Mr. Gordon Selfridge, and Sir Frank Warner. The prime objects of the scheme are:—(1) To encourage and co-ordinate movements towards the development and improvement of industrial art, with the view of maintaining for the trade of the British Empire its position in the markets of the world; (2) to co-operate with Government Departments and other bodies in promoting exhibitions, and in particular with the Government scheme for a British Institute of Industrial Art; and (3) to initiate and encourage research, experimental and other work germane to the objects above indicated, to award grants for conducting such work, and to co-operate, whenever possible, with Government and other institutions founded for such purposes.

An Exhibition of New British and "Key" Industries, organised by the Industrial Section of the Tariff Reform League, was opened at the Central Hall, Westminster, on October 7, and will remain open until October 22, when the intention is to take it to Manchester and other large provincial centres of population. The exhibition is on a smaller scale than that recently organised at King's College by the British Science Guild, to which appreciative reference is made by Mr. H. J. Mackinder in his introduction to the official handbook, and little is included which was not represented in that exhibition. On the scientific side, therefore, there is nothing to record which has not been described already in these columns. Among the exhibits of new or revived British industries are flags, Christmas cards, dolls, toys, puzzles, indoor games, and picture-frame mouldings, which were outside the field of the British Scientific Products Exhibition. The handbook, price 1s. net, contains instructive articles upon the occurrence and uses of metals and other substances essential to the existence of many great industries, and controlled by enemy influence before the outbreak of the war. The fact that we were dependent upon Germany for many products and appliances which we were fully capable of manufacturing ourselves is beyond dispute, but it must remain a matter of opinion as to whether the conclusions of the Tariff Reform League as to its chief cause are correct. The exhibition is, however, an enlightening display of national scientific and industrial effort, and as admission is free there will no doubt be many visitors to it.

Dr. Addison, Minister of Reconstruction, in his inaugural address at the opening of the Pharmaceutical Society's School of Pharmacy on Wednesday of last week, laid stress upon the need for co-ordination of scientific knowledge and for a thorough and scientific treatment of facts and inquiries. The greatest danger before and during the war were German organisation, training, and method, especially in the application of physical science; to safeguard ourselves in the future it was necessary to provide better training and better conditions of life. At the outbreak of war we were faced with difficulties consequent upon our dependence on Germany for the supply of a large number of medicinal chemicals, as

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well as of certain medicinal herbs, and Dr. Addison described the methods by which these difficulties were overcome, with the result that not only did we succeed in satisfying ourselves, but we were also in a position to supply our Allies and to export to certain neutral countries. The particular lesson to be learnt was that we must have a much better supply of trained chemists, and to get this supply and maintain it a sufficient number of well-paid and suitable posts must be assured. Chemical science and industry must be completely reorganised. Science must not be bottled up in laboratories, but given a wider range and more freedom. However, with all that we plan and arrange, we must never forget that our national strength ultimately resides in the vitality, independence, initiative, and character of individual citizens.

THE announcement that within the last few days there has been direct wireless communication between Great Britain and Australia must not be exaggerated into an achievement heralding the immediate approach of direct wireless communication between the two countries. It is unnecessary to point out here that, under certain abnormally favourable conditions combined with an element of luck, signals can be heard over remarkably long distances. On more than one occasion, when such signals have been heard over long distances, the feat has been allowed to become unconsciously exaggerated in the public mind, and the science of wireless telegraphy has not thereby been advanced. It is not the first time that reports have been issued of wireless communication with the Antipodes. During 1917 a wireless operator at Invercargill, New Zealand, is said to have found no difficulty in reading messages transmitted from the Eiffel Tower, in Paris, and Coltano, near the Italian Riviera. Possibly developments have taken place during the war (about which nothing has been said, and very properly too) which are bringing us nearer satisfactory and trustworthy commercial long-distance wireless working over ranges indicated in recent Press announcements. It appears that in Germany, too, the problem of long-range working has been receiving attention. In a recent description of the Nauen station it was stated that the equipment had been so enormously developed during the war that it was now capable of working over a range of 6200 miles. The quiet scientific work essential to the solution of problems that have hitherto made commercial working over very long ranges an impossibility has been practically in abeyance during the war, and until we know what has been accomplished under the veil of secrecy it is wiser not to assume too much from the announcements appearing in the Press.

THE June issue of *The Central*, the journal of the Old Students' Association of the City and Guilds College, contains an article on the organisation of the technical worker. Since, first, the manual workers and, later, the employers have formed unions or associations for their mutual protection, there is a rapidly increasing sentiment amongst technical workers that their interests would be best advanced by the formation of some protective association. The older technical societies do not concern themselves with the material advance of their members, and they have been, on the whole, somewhat slow to act in the interests of the professions they represent during the many changes of the last few years. The question whether scientific and technical workers should form a union is a vexed one, the more so since involved in it is the very difficult subject of the definition of a chemist or an engineer. The chemists have been the first in the field to form a professional union, and two rival bodies are already constituted, the British Association of Chemists and the National Association of Industrial Chemists. In addition, the Institute of Chemistry has increased its activities and made a very proper attempt to open its membership to all genuine chemists—using the term to indicate the fully qualified chemist comparable with the lawyer or the doctor of medicine. Unfortunately, this has failed, and the founders of new organisations have persisted in their formation, although they will not be representative of the properly qualified chemists. The proposed National Union of Scientific Workers has less trouble in deciding the qualifications of candidates for membership, and if it is successful in any way in obtaining recognition of the proper place of scientific work in the national life, it certainly merits support. It is, at any rate, clear that the days of aloofness and isolation, which have been a characteristic of our scientific societies in the past, will have to give way to a spirit of helpful co-operation if the societies are to make their valuable influence felt by the nation.

THE death is announced, on October 2, in his fifty-fifth year, of Mr. John Briggs, principal of University Tutorial College, London.

DR. PERCY KIDD will deliver the Harveian oration at the Royal College of Physicians of London on Friday, October 18, at 4 p.m.

THE first annual Streatfeild memorial lecture will be delivered on Thursday, October 17, at 4 o'clock, at the City and Guilds Technical College, Finsbury, by Prof. W. J. Pope, who will take as his subject "The Future of Chemistry." No charge will be made for admission.

DR. C. ADDISON, Minister of Reconstruction, will give an address on "Principles of Reconstruction" at 4.30 on Wednesday, October 16, in the Saddlers' Hall, Cheapside. The lecture will be the second of the series arranged for by the Industrial Reconstruction Council.

A WAR relief fund for the purpose of restoring the gardens and orchards in France, Belgium, and Serbia which have been destroyed by the enemy has been opened by the Royal Horticultural Society. Sir H. Veitch, the honorary treasurer, will be glad to receive contributions to the fund. They should be sent to him at Room 39, 17 Victoria Street, S.W.1.

CAPT. SIR CHARLES BATHURST, K.B.E., who has been Parliamentary Secretary to the Ministry of Food since the beginning of last year, and has done very valuable service for the promotion of agriculture for many years, has had a peerage of the United Kingdom conferred upon him by the King. It is understood that he will represent the Ministry of Food in the House of Lords.

THE Commitee of the Ramsay Memorial Fund (to which the Italian Government has granted 300*l.* a year for ten years to establish Ramsay memorial fellowships in chemical science, tenable in the United Kingdom by chemists from Italy) announces that H.R.H. the Prince of Wales has consented to accept the position of patron of the fund, which was inaugurated in 1916 to raise the sum of 100,000*l.*, and that it is proposed to raise 50,000*l.* of the amount by a Million Shilling Fund, which will be devoted to (1) the provision of Ramsay research fellowships, tenable wherever the necessary equipment may be found; and (2) the establishment of a Ramsay memorial laboratory of engineering chemistry in connection with University College, London.

Donations should be sent to Lord Glenconner, the honorary treasurer of the fund, at University College, Gower Street, W.C.1.

WE regret to record the death of the Rev. Edward Frank Sampson, student of Christ Church, Oxford, which took place at Clifton on October 1. Mr. Sampson was born at Bristol in 1848, and educated, under the late Dr. Caldecott, at the Bristol Grammar School, whence he proceeded in 1865 to St. John's College, Oxford, having been elected to a Bristol scholarship in mathematics. He had a very successful career as an undergraduate, taking first classes in Mathematical Moderations and the two Final Schools of Mathematics and Natural Science; and in 1869 he was elected to a clerical senior studentship at Christ Church, being appointed lecturer in mathematics in 1870 and a tutor of the house in 1874. He was a good and sound, though not a brilliant, mathematician, and a painstaking, conscientious, and efficient teacher, many of his pupils owing him deep gratitude for the unstinted help, pecuniary and other, that he gave them. But his chief interest did not lie in mathematics and its developments. He was an administrator and reformer, with a very deep sense of the duty he owed to undergraduates both as tutor and cleric. He was a man of great energy and tenacity, and his position as one of the censors of the house, to which office he was appointed in 1877, greatly helped in the promotion of necessary reforms. Ill-health caused Mr. Sampson to resign the censorship in 1894, and in 1900 he retired from active college work.

THE University of Pennsylvania is devoting special attention to a scientific analysis of North American Indian dialects. The last contribution on this subject is an elaborate monograph by Dr. Franz Boas on the language of the Tlingit Indians, published in vol. viii., No. 1, of the University Anthropological Publications. The material has been collected by Mr. Louis Shotridge, a full-blood Chilkat Indian, and it has been arranged by Dr. Boas, the leading expert in this branch of philology. The difficulty of reproducing in type the complicated system of transliteration necessary to represent the sound-forms has been skilfully surmounted.

A VERY able account of the habits of the sparrow-hawk during the nesting period, by Mr. J. H. Owen, appears in *British Birds* for September. Among other things, Mr. Owen comments upon the very long time an egg takes to hatch after the embryo has chipped the shell. Out of eleven eggs kept under observation, six took two days to hatch. In another case the hen was seen to assist the chick to emerge by breaking away the shell. Though the author believes that the cock determines the site of the nest, he seems never to take any part in incubation, but during this time he hunts for the hen, bringing her food to the vicinity of the nest. Though more than three hundred victims have been more or less certainly identified at such nests, only two were game-birds; one of these was a nestling red-legged partridge, the other a pheasant, also in down. Although farmyard chicks were abundant in the neighbourhood of the nests under observation, none were ever taken by these birds, and this is a point worth noting. Finally, Mr. Owen remarks striking differences in the behaviour of sparrow-hawks when disturbed at the nest, some stealing off silently, others leaving with much screaming, the male also taking part in such protests.

IN the current issue of the *Quarterly Journal of Microscopical Science* (vol. lxiii., part 2) Mr. J. Bronté Gatenby gives a very useful summary of our knowledge of the remarkable phenomenon of polyembryony as met with in the parasitic Hymenoptera. Many of these insects, as is well known, deposit their eggs within the eggs of other insects, the young parasite following out its own development in the body of the larval host. This development is often of a very singular character, for from a single egg a large number of individuals may be formed by a process of embryonic budding. Not less interesting is the manner in which enveloping membranes are formed around the developing mass. In the first place, a nutrient envelope, the tropho-amnion, is derived from the polar bodies of the parasitic egg, the nuclei of which divide for the purpose, while an outer covering, of an epithelial character, is formed from certain cells of the host. The larval parasites feed upon the internal organs of the larval host, apparently taking care not to injure it vitally until they no longer require it, when they pupate, either inside or outside the dead larva.

IN the Proceedings of the Geologists' Association (vol. xxix., p. 46, 1918), Mr. Arthur L. Leach brings forward very interesting evidence of the occupation of the submerged forest-lands off the coast of Pembrokeshire by flint-chipping man before the full growth of the forest-trees. This occupation may date from early Neolithic times, and a minimum coastal subsidence of 30 ft. has since occurred.

MR. EDWIN KIRK (*Amer. Journ. Sci.*, vol. xlvi., p. 511, 1918) records successive epochs of glaciation in Alaska in past geological times, including what is believed to be the first record of Silurian "tillite." The conglomerates on the Alaskan border, previously described by Cairnes (1914) as probably of Permo-Carboniferous age, are shown to be paralleled by others that lie between high Carboniferous and Triassic horizons.

AN important contribution to our knowledge of the Cretaceous strata of the southern hemisphere is made by Sr. Anselmo Windhausen in the *Boletin de la Academia Nacional de Ciencias en Cordoba (Argentina)* (vol. xxiii., p. 97, 1918). Under the name "Neocomiano" the whole Lower Cretaceous sequence in the Argentine Cordillera is reviewed, and the free interchange of marine forms between this region and the Himalayas is pointed out in its geographical significance.

DURING the summer Dr. Arnold Romberg has made some interesting seismometric experiments at the Hawaiian Volcano Observatory (Weekly Bulletin, vol. vi., 1918, pp. 87-92). A new upright pendulum has been built for determining the direction from which local earth-waves proceed. A short-period, highly damped horizontal pendulum with heavy mass has been arranged, recording optically on bromide paper running at high speed. By closing up the lines on the drum, this can be done without much additional expense. This instrument has already given a clear, open record of a local earthquake. Another change promises to reduce the friction of the pointer in the smoked-paper mode of registration. A new stylus has been made, consisting of a lever of an extremely light and fine glass tube with a minute sharp-edged watchwork wheel rotating at the end in a glass bearing, the wheel itself being the writing-pen.

THE report on the mineral resources of the Philippine Islands for the year 1916 has just been issued by the Division of Mines of the Government of the Philippine Islands. The only product of any importance is gold, the output of which is valued at 307,450*l*., the highest figure yet reached. It is in-

teresting to note that a small quantity of manganese ore, namely, 3000 tons, has been produced and shipped to Japan. It is also noteworthy that a small cement plant, with a capacity of 500 barrels per day, has been installed, and has been at work at Rizal since 1915; the cement made is said to be of highly satisfactory quality. A good deal of prospecting and exploratory work is being done, and the coal outlook in particular is well spoken of. It is stated that the Batan coalfield is to be reopened, and that it is possible that this will become the main centre of production; the Cebu and Danao fields are also attracting attention.

WE have received a copy of the first number of the *Decimal Educator*, a quarterly publication of the Decimal Association. The principal objects of this new periodical will be to secure the adoption of a decimal system of coinage and the compulsory introduction of the metric system of weights and measures, and also to advocate improved decimal methods in education and business. The first article is an historical sketch of the Decimal Association, in which attention is directed to the important part played by the association in securing the appointment of the Select Committee of 1895, charged with inquiring into the question of metric weights and measures, and to the vigorous campaign waged by the association in the early years of the present century, which resulted in the Metric Bill of 1906. The Act of 1897, which legalised the use of metric weights and measures in trade, was also to a large extent due to the exertions of the association. Another article, on teaching the metric system, protests against the unreasonable stress which many text-book writers lay upon tedious and unpractical conversions from one system of weights and measures to another, and calls for a revision of the present methods of teaching the metric system. On the whole, this new publication promises to be a useful auxiliary to the metric and decimal cause.

VOL. IX. of *Technology*, the journal of the Manchester Municipal College of Technology, is a quarto volume of nearly 260 pages, and consists mainly of reprints of nineteen scientific and technical papers by members of the staff which appeared in journals and proceedings during the year 1915. The papers cover a wide field, from education and the labour problem to the construction of sewers and the abolition of smoke. They all bear more or less on the industries of the district, and show what an important asset the country possesses in an institution of this kind. As a typical paper, that of Mr. S. Evans may be mentioned. It deals with a score of cases in which some metal portion of a manufacturing plant had failed owing to causes not at once apparent. In each case the steps taken to investigate the cause of the trouble are described and the remedy found. The saving in money and time effected by investigations of this kind is enormous; it could safely be put down as several hundred times the salaries of the whole of the staff of the college. The greater the number of colleges in the country capable of turning out so creditable a year's work as this volume represents, the better.

SOUTHPORT stands in the forefront for borough meteorological observations under the superintendence of Mr. Joseph Baxendell. The report of the Fernley Observatory for 1917, just issued, gives detailed observations which are very suggestive to other borough councils which are aiming to be of service in the varied interests of meteorology. Many of the matters discussed are obtainable only by steadily observing the different elements for a number of years. A useful and valuable table is given showing for practically all the health resorts in the British Isles the "comparative statistics for the year 1917." Some of the special features of interest at Southport in 1917 are the unprecedented low mean and extreme barometric pressures in August, the unusually dry period for nine weeks from June 7 to August 7, and the warm summer following a cold winter, which is mentioned as exemplifying the statement made by old writers. December had the highest mean barometric pressure of any corresponding month since the year 1879. In addition to tables of all ordinary elements, tables are given showing the amount and frequency of rainfall with different wind directions, and there are now added hourly averages of rainfall and sunshine for a term of years. Observations are supplied to the Meteorological Office and to the British Rainfall Organisation. Both the old and the new units of measurement are used in the tables, and if any criticism can be made it is that in such cases as the air temperature the use of both Fahrenheit and Absolute temperatures leads somewhat to confusion. The remarkable "discontinuity" in the seasonal rainfall records shown in the preceding report for 1916 has been interrupted in 1917 by the exceptionally heavy rains of August, with an excess of 2·55 in., and October, with an excess of 2·97 in., but the decreased rainfall in July and September is well maintained.

SEVEN years' experience in the Austrian Government Telegraph Department has led a writer in *Chemiker Zeitung* for August 3 to recommend zinc fluorides as a preservative of wooden poles. It compares favourably with copper sulphate. When complete impregnation of the wood is unnecessary, a partial application of sodium fluoride will be found to exhibit great preservative action.

L'Industria for July 15 describes a new method for the electrolytic extraction of copper from pyritic ashes. The method is based on the electrolytic conversion of sulphide or sulphate of copper into cupric or cuprous chloride by the action of chlorine at the anode. If in an electrolytic bath containing hydrochloric acid in solution the anode is surrounded by a mass of pyritic scoria, the chlorine liberated by the hydrogen attacks the oxides, sulphates, or sulphides of copper more rapidly than the oxides of iron, and combines with them to form cupric chloride. This reaction extends to the entire mass of scoria, so that the latter acts as an electrode. The copper loss by this method is only 0·1 per cent. A simple type of apparatus for applying the process industrially is described.

THE permeameter devised by Mr. F. P. Fahy, of the Pennsylvania Railway Co., and described in the *Electrical World* a year ago, has been subjected to severe tests at the U.S. Bureau of Standards, and the report on it appears in the Bulletin of the Bureau for June. The instrument consists of an **H**-shaped iron core, on the cross-bar of which the main magnetising coil is wound. The magnetomotive forces between the top or bottom ends of the two upright limbs can be measured by two uniformly wound solenoids with their ends close up to the ends of the limbs. If one pair of core-ends is joined by a bar of magnetisable material, the magnetomotive force between the two ends is reduced. By means of compensating coils wound round the vertical limbs of the yoke near their ends, it may be brought up to its normal value. The magnetising force and the magnetic induction are then determined from the electromotive forces induced in the top and bottom solenoids on reversal of the magnetising current. For accuracy and consistency the Bureau regards the instrument as a distinct advance on previous permeameters.

MESSRS. ILFORD, LTD., referring to the article by Mr. Chapman Jones, in NATURE of October 3, on colour sensitised plates, write to say that the filter used for the photographs mentioned in the article was not a yellow filter, but their pale green filter No. 240, specially introduced for use with their special rapid panchromatic plate. Mr. Chapman Jones did not for a moment wish to suggest that Messrs. Ilford were not familiar with the proper use of certain light-filters, and regrets that his article should have given that impression. It is very satisfactory to have their assurance that the lack of perfection in the one example examined is due to the printing and reproduction processes rather than to the photography, owing chiefly to the difficulties in obtaining suitable inks. A reference to Mr. Chapman Jones's article will show that he did not credit anyone with having produced a plate of even sensitiveness throughout the visible normal solar spectrum, or, indeed, the spectrum of any other of the usual light sources. Those who use Ilford X-ray plates will find a pamphlet just issued by the company of considerable service, especially if they have difficulty in getting contrast, or are uncertain as to the best method of treating them. The "Notes" also contain advice as to printing from the plates, and the application of films for dental purposes which are put up in a special manner ready for use. Half a dozen excellent reproductions are included.

THE latest catalogue of Messrs. J. Wheldon and Co., 38 Great Queen Street, W.C.2 (New Series, No. 85), deals with ornithology, and should be of interest and service to many readers of NATURE. It contains many first and rare editions, and is conveniently arranged under the headings of British Islands, Cage Birds, Game Birds, etc., Pigeons and Poultry, Europe, Asia, Africa, North America, South America, Australasia, General Systems, etc., Miscellanea, and Morphology. We notice that Messrs. Wheldon have for disposal many sets and long runs of scientific serials, *e.g.* the *Ibis*, "British Birds," "Novitates Zoologicæ," "Proceedings of the Zoological Society of London," the *Zoologist*, etc. The catalogue is sent post free on receipt of 2*d*.

OUR ASTRONOMICAL COLUMN.

ELECTRIC-FURNACE SPECTRA.—An important study of the spectra of calcium, strontium, barium, and magnesium, as produced in the electric furnace at temperatures of 1650°, 2000°, and 2350° C., has been made by Dr. A. S. King at the Mount Wilson laboratory (*Astrophys. Journ.*, vol. xlviii., p. 13). The extension of the observations into the ultra-violet has shown that there is a limit beyond which no lines are emitted at a given temperature, and that the limit advances towards shorter wave-lengths with increase of temperature, as in the case of the continuous spectrum of an incandescent solid. The observations bring out very clearly the characteristics of the various lines, and permit their classification in relation to temperature. The line at λ 6573 is unique among the calcium lines, being faint in the arc and much weaker at high than at low temperatures in the furnace; it is much strengthened in the spectra of sun-spots, and may be used with confidence as a low-temperature indicator. In agreement with previous work, the magnesium line λ 4571 was also found to be a low-temperature line of extreme type. In the case of barium, there is not merely a sharpening of the lines as compared with the arc, but in several cases there is also a resolution of diffuse arc lines into two or three components; the resolved lines possibly occur among the faint absorption lines of the solar spectrum, suggesting that the solar conditions in the region where these lines are produced involve a moderately high temperature combined with low pressure.

THE NEBULAR HYPOTHESIS.—The present position of the nebular hypothesis is discussed by Prof. J. H. Jeans in an interesting article which appears in the October issue of *Scientia*. The absence of adequate observational evidence of successive stages in the process conceived by Laplace being possibly due to instrumental limitations, the hypothesis can only be tested by mathematical research on the sequence of configurations of a rotating and condensing mass of gas. On the assumption that the mass is homogeneous and incompressible, it has been shown that systems corresponding closely with binary and multiple stars would be produced. When account is taken of the increase of density towards the centre, only approximate solutions of the problem are available. It appears, however, that for densities greater than one-quarter that of water the result would be very similar to that for an incompressible mass, while for lower densities the form assumed would be that of the lens-shaped figure deduced by Roche. In the latter case, after the attainment of a certain critical velocity, no further change of shape would be produced, but matter would be ejected from the periphery, and, as a result of tidal forces, the ejected matter would take the form of two spiral arms. It can be further shown that these filaments will only break up when they are on a sufficiently massive scale, and that when a reasonable value is assumed for the density of the primitive nebula, the condensation nuclei would be comparable in mass with the sun. It is thus suggested that, while the process imagined by Laplace is quite inapplicable to the solar system, its action is exhibited on a far grander scale in the giant masses of the spiral nebulæ; the products of disintegration are not planets and satellites, but streams of stars.

THE PROBLEM OF ADULT EDUCATION.

DURING the Session of 1917 the Minister of Reconstruction, the Rt. Hon. Christopher Addison, appointed a Committee, of which the Master of Balliol is the chairman, "to consider the provision for, and possibilities of, adult education (other than technical or vocational) in Great Britain, and to make recommendations."

The Committee has recently issued a most important interim report (Cd. 9107, price 3*d*.), which demands the earnest consideration of all who are interested in the industrial, social, intellectual, and moral well-being of the nation.

As a result of its inquiries and of the evidence offered the Committee has come to the conclusion that before the just claims of adult education can be considered and adequately met, it is indispensable to have regard to the industrial and social conditions under which the nation exists. There is unquestionably a wide and growing demand for education for adults of a non-vocational character, with a view to fuller personal development and with the object of promoting a healthier social intercourse and generally of equipping the workers, both men and women, for wider industrial, social, and political responsibilities, so that they may take their full and rightful share in the national life and well-being. It is fully recognised in the report that the development of the education of the child and of the adolescent, foreshadowed by Mr. Fisher's measure, now happily become law, is essential to further opportunities for the continued education of the adult, who will thereby be the better fitted to avail himself of the experiences of life, and to seek and find a wise solution of the

problems to which they continue to give rise. The recent enfranchisement of large numbers of women lends additional impetus to the demand for means of more extended facilities of adult education, which is, after all, to be regarded as essential for men and women alike, however great may be the development in the education of children and adolescents.

An interesting review is given of the present facilities of adult education as exemplified in the University Extension system, that of the Adult Sunday School, the Workers' Educational Association, Ruskin College, the Working Men's Colleges, and other bodies, including the work of the local education authorities, but the conclusion is rapidly reached that so long as the present economic conditions prevail these and other means of educational progress must remain short of their full harvest, and the nation be left vastly poorer thereby. The evil conditions which beset the worker and hinder his full educational and social development are the subject of careful review. They are found in the abnormal length of the working-day in most industries. in the heavy and exhausting work in others, in the demands of excessive overtime, in the shift system and that of "split turns," in night-work, continuous or periodic, in the evil effects of continuous, monotonous labour, and, finally, in the insecurity of employment which besets many workers in industrial and rural occupations.

Proposals are made to shorten by law the working-day, so that it shall not exceed, with some qualifications, eight hours in any industry; that in heavy, exhausting kinds of work the legal working-day shall be shorter than the normal, and, where possible, mechanical devices introduced, such occupations to be specially regulated; that overtime and "shift-work" shall be the subject of legal regulation and reduced to a minimum; and that regular night-work shall be prohibited, whether periodic or continuous, except where it is absolutely necessary. With the view of meeting the evils of continuous, monotonous labour, alternating forms of employment are suggested, and the establishment of works committees for the consideration of matters affecting workshop life. Measures should also be taken to minimise the ruinous effects of unemployment by the reorganisation of industry or the extension of the principle of insurance. Other measures of reform are also suggested with respect to schemes of housing and town-planning, in order to secure better domestic conditions and pleasanter surroundings for the worker, and there should be established in every village an institute or hall under public control. An eloquent testimony is offered at the conclusion of the report to the splendid qualities and potentialities latent in our people, as shown by their sacrifices in the present disastrous war, which render them worthy of any effort to improve and make worthy their conditions of life.

The suggestions in the report are made by men and women experienced not only in education, but also in the actual conditions of industrial life, and may be commended to the earnest consideration of all who are responsible for the future well-being of the nation. They are the pre-conditions of any form of effective adult education.

A MONOGRAPH ON COW-WHEAT.

M. G. BEAUVERD'S "Monographie du genre Melampyrum," which has recently appeared (*Mémoires de la Société de Physique et d'Histoire naturelle de Genève*, vol. xxxviii., fascicule 6), is an intensive study of a genus carried out under the serious limitations imposed by the present war conditions. Melampyrum, the British cow-wheat, which is represented in our flora by four species, is one of a small group of genera of the family Scrophulariaceæ, which are characterised by a hemiparasitic habit. They are small herbaceous plants which draw part of their nourishment from other plants, to the roots of which they become attached by suckers developed upon their own roots. Many of them have the peculiarity of turning black on drying.

The genus, fourteen species of which are recognised by M. Beauverd, is widely distributed in the northern hemisphere. There are four areas of distribution: a North American, extending right across the continent; an Eurasiatic, comprising the greater part of Europe with Central Asia; an eastern Mediterranean area; and a Far East or Chinese and Japanese area. M. Beauverd's work, so far as the systematic study of the species is concerned, is very largely based on the material in the various public and private Swiss collections, which, though rich in a representation of Central European forms, would naturally contain a less extensive series from other areas. His knowledge of British forms is derived almost exclusively from Mr. G. C. Druce's collection, which he has had the opportunity of studying. The author has not consulted the great British and Russian herbaria, apart from which the study of the central and eastern Asiatic forms must be far from complete. Further, in the systematic study of a genus it is of importance to examine the original specimens on which previously described species and varieties are based, and a large proportion of these are to be found only outside the circumscribed area of M. Beauverd's studies. The limitations under which the work has been carried out must, therefore, necessarily lead to a want of balance between the treatment of the Central European forms and of those occurring outside that area and to a lack of completeness in the systematic scheme.

Within the limits imposed M. Beauverd has made good use of the material available. He has studied in the field the range of variation of species and forms, and by a careful microscopic study of the details of the flower, the technique of which he describes at some length, he has convinced himself of the relative value of fixed qualitative and variable quantitative characters in the discrimination of species and of inferior grades of relationship. Thus M. Beauverd regards the two different methods of dehiscence of the fruit, to which he had previously directed attention, as affording criteria for the two main divisions of the genus. The author has also noted in some species the presence of a ring of hairs on the inside of the corolla-tube above the base, in such a position as to protect the nectar beneath it from being pillaged by an insect biting through the lower part of the tube; the presence or absence of this "nectarostegium," the minute structure of the hairs associated with the anthers or occurring elsewhere in the flower, and the form of the bracts at the top of the inflorescence, afford constant characters for the differentiation of sections or aid in the diagnosis of the species.

On the other hand, variable quantitative characters such as the number of joints in hairs of the same plan of structure, the relative size of flowers or leaves, the number of sterile bracts or of stem-nodes between the root and the inflorescence, the size and frequency of the marginal teeth of the bracts, the size of the calyx-teeth, and the degree of opening of the mouth of the corolla, are of value in assigning limits to subspecies and varieties. The author's discussion of these points and their application in the systematic scheme adopted by him afford the most interesting chapter in the memoir.

Apart from its value as a contribution to the systematic study of the genus, the monograph supplies a useful *résumé* of previous work. The first chapter,

occupying fifty pages, is a chronological précis of this nature. The morphology of the vegetative or reproductive organs is treated in detail in another chapter, while a chapter entitled "Biological Notes" deals with pollination, the distribution of the seeds by the aid of ants, and some ecological notes based on the author's own observations.

LACUSTRINE FAUNA IN THE FAR EAST.[1]

THE two memoirs before us contain the first five of a series of reports upon material collected, for purposes of comparison with a corresponding ecology in the Indian fauna, by Dr. Annandale in certain lakes of the Far East, namely, in Lake Biwa in Japan, in Tai Hu Lake in the Yangtse Delta, and in Talé Sap, a lagoon on the eastern coast of the Malay Peninsula; with them is incorporated a short critical dissertation on Oriental Batrachia in general.

Lake Biwa, with an area of 269 square miles, lies among hills about forty miles distant from the sea; as it is more than 200 ft. deep in many parts and reaches a depth of 320 ft. in some places, and as there is considerable difference in summer temperature between the open surface and the depths, there is some variety in its biological conditions. Tai Hu, about sixty miles in length and in breadth, is a muddy lake of uniform conditions, nowhere exceeding 12 ft. in depth; though it is forty miles from the sea and its water is quite fresh, its fauna contains a distinct marine or estuarine element. Talé Sap differs from the other two lakes in lying on the seaboard and having a narrow sea-inlet; like the Chilka Lake in Orissa, it consists of two distinct basins of unequal density—though the inner basin is fresh, or practically so, throughout the year—and so presents variable conditions; the greatest depth of the main fresh-water portion is about 16 ft.

The collections described in the present instalments are the Polyzoa in part (Entoprocta and Ctenosomatous Ectoprocta), the Mollusca of Lake Biwa, and the Hydrozoa and Ctenophora, all by Dr. Annandale himself, the aquatic Oligochæta by Col. J. Stephenson, I.M.S., and the aquatic Hemiptera by Mr. C. A. Paiva. Most of the reports are distinguished by attention to anatomical details and to biological interpretations of fact.

The Polyzoa comprise five species from Talé Sap and two from Tai Hu. Two of them (*Triticella pedicellata* and *Paludicella elongata*) have not before been recorded from tropical latitudes. A third noteworthy form, closely akin to Loxosomatides, but differing in the arrangement of the muscles of the stalk, is distinguished as a new genus, Chitaspis.

The Mollusca of Lake Biwa include twenty-nine species, of which eleven are restricted to this lake and eleven others are peculiar to Japan. Most of the genera (*e.g.* Limnæa, Planorbis, Vivipara, Bithynia) are cosmopolitan, or (*e.g.* Anodonta, Valvata) palæarctic, or, like Melania and Corbicula, of common occurrence in tropical and subtropical latitudes. The author distinguishes a rupicolous community of species quite distinct from that inhabiting the mud and sand in shallow water, and a congeries of species restricted to the depths, among the latter being the only representatives of Pisidium and Valvata occurring in the lake.

Among the Hydrozoa identified are *Cordylophora lacustris*, from Tai Hu, and five species from the brackish parts of Talé Sap. A description of a new genus of Hydromedusæ, Asenathia, from the Gangetic Delta, is also included; this the author suspects to be the sexual generation of the curious hydroid Annulella recently described by Ritchie from that part of Bengal.

Among the aquatic Oligochæta, *Branchiura sowerbyi* and *Limnodrilus socialis* were found in association here as in India; a new species of Chætogaster commensal in sponges is described, and a new genus Kawamuria—a Branchiura without gills and having the penis-sac provided with a penis—from the depths of Lake Biwa. Col. Stephenson also describes a new species of Criodrilus, found at the remarkable depth of 180 ft. in this lake.

The aquatic Hemiptera are for the most part common Oriental forms; but *Microvelia sexualis*, from Talé Sap, is a new species of Hydrometrid representing a genus hitherto known only from North America.

[1] "Zoological Results of a Tour in the Far East." Edited by Dr. N. Annandale. Memoirs of the Asiatic Society of Bengal, vol. vi., pp. 1–74 and pp. 75–155.

CARBONISATION REACTIONS.[1]

IT is difficult to obtain clear information about the reactions in carbonisation by the direct distillation of coal in the laboratory, especially about minor, though important, products such as toluene, benzene, etc., of which the quantities available become excessively small. Therefore the author, in conjunction with Dr. S. F. Dufton, chose to investigate the stability of individual compounds in different atmospheres when passed over heated coke, with a time of contact of the same order as met with in carbonising practice. The behaviour of the compounds was dependent on conditions of temperature and concentration, apparently in accordance with the laws of chemical dynamics. Benzene, at varying partial pressures in an atmosphere of nitrogen, which was assumed to be inert, showed signs of incipient decomposition at 550° C., leading to the production of diphenyl. At higher temperatures this was more extensive, and *p*-diphenylbenzene also appeared. The former condensation at least is reversible. Benzene in an atmosphere of hydrogen yielded much less diphenyl under otherwise similar conditions, and at 800° C. is scarcely decomposed at a concentration of 5 per cent. by volume, while diphenyl in an atmosphere of hydrogen is reduced to benzene. This doubtless accounts for the practical non-occurrence of diphenyl in coal-tar, although this substance is readily formed from benzene in the absence of hydrogen. Benzene did not yield naphthalene or unsaturated compounds. At 900° C., even in hydrogen, benzene was extensively broken down with the formation of carbon. Toluene in nitrogen shows signs of decomposition at 550° C., but there are now two possibilities—reactions through the nucleus and also through the side chain. The product is more complex, a solid being formed, which was identified as stilbene $(CH.C_6H_5)_2$, and also an oil. At 750° C. decomposition was more extensive, naphthalene and anthracene being identified among a number of other products. On substituting hydrogen for nitrogen the decomposition was much accelerated, but with the production of benzene and methane and smaller quantities of solids. The formation of stilbene, which occurs with the liberation of hydrogen, is inhibited. Methane and benzene react in the reverse direction to form toluene, but only very slowly. Thus hydrogen protects benzene from decomposition, whereas it decomposes toluene, but in the sense of breaking off the side chain while hindering molecular condensations with elimination of hydrogen, which are a characteristic effect of heat on the lower aromatic hydrocarbons. The xylenes resemble toluene in behaviour, while cresol is reduced by hydrogen at 750° C. to toluene, and necessarily to benzene also. The importance of atmosphere

[1] Abstract of the William Young Memorial Lecture of the North British Association of Gas Managers, Glasgow, September 6, 1918, by Prof. John W. Cobb.

in carbonisation is therefore great, and can influence the course of the process. This is seen in practice in the results of steaming charges in vertical retorts. The hydrogen of the water-gas formed doubtless operates in the sense shown above, as well as physically in sweeping out the vapours before decomposition can have gone too far. The lightness of the hydrogen molecules and consequent high diffusivity doubtless promote this physical effect, but the predominant influence is chemical. Whether it is better to introduce the water-gas from the outside or to generate it *in situ* by steaming remains to be shown. In any case, there is an advantage to be gained by the admixture of water-gas in that the proportion of the heat of the coal in the gas is increased. When steam is introduced into the retort, reactions which lead to the formation of ammonia, as in the Mond gas producer, are called into operation. It is steam which promotes the formation of ammonia, and not hydrogen, on which undue stress has been laid since the time of Tervet. Experiments made in conjunction with C. A. King show that steam alone among a number of gases tried had any marked effect in the production of ammonia from coke at 800° C. Characteristic of the results of steaming charges in recent experience is the much increased yield of ammonia, and also of tar, which contains less of the heavy complex condensation products than ordinary horizontal-retort tars. This is important in connection with the carbonisation of coal as a possible source of fuel-oil. In considering the effect of heat on hydrocarbons, there is evident a tendency for molecules to coalesce with the production of more and more complex six-atom carbon-ring compounds, with the elimination of hydrogen, which operates in the reverse sense. The stability of the six-atom ring structure seems characteristic of carbon even under the most drastic treatment, and it is interesting to note that the investigations of the Braggs show that the same orientation can still be detected in the diamond and graphite.

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UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

BIRMINGHAM.—Miss S. Margery Fry has resigned the seat on the University Council which she has occupied for nine years.

Mrs. Osler, on behalf of her family and friends, has endowed a scholarship of about 25*l.* per annum to be tenable by a woman student who, having taken the B.A. degree, undertakes to remain at the University for an additional year to prepare for the M.A. degree.

Miss E. H. B. Coghill has succeeded Dr. Mary Clarke as lecturer in hygiene in the Women's Training College.

CAMBRIDGE.—Mr. J. Gray, of King's College, has been appointed demonstrator of comparative anatomy for two years. The election of a Quick professor of biology is to take place on November 1. Prof. Nuttall, the present holder of the chair, is eligible for re-election.

LONDON.—Mr. A. H. Barker will deliver two further public lectures on "The Principles of Fuel Economy in the Home" at University College, Gower Street, W.C.1, on Wednesdays, October 16 and 23, at 7 p.m. The lectures are designed to meet the needs of householders now faced with the problem of fuel economy. A syllabus of the lectures can be obtained from the Publications Secretary of the college by sending a stamped addressed envelope to him.

THE sum of 20,000*l.* has been bequeathed by Mrs. C. H. Colburn to the Harvard University Medical School to establish a fund for research in tuberculosis.

THE Barrow Steel Co. has offered 100*l.* per annum for the foundation of a scholarship at the Barrow Technical School, preferably for the benefit of children whose parents are in the employ of the donors.

MR. A. SERENA has given 20,000*l.* for the foundation of chairs of Italian in the Universities of Oxford and Cambridge. The Vice-Chancellors of the two Universities and the Minister of Education are to be consulted, and, with Mr. E. Hutton, the editor of the *Anglo-Italian Review*, requested to draw up the conditions on which the chairs should be established.

A MEETING of the Textile Institute was held at Bradford on Friday last, when it was announced that nearly 7000*l.* had been received of the 50,000*l.* aimed at for the extension of the scope of the technology of the textile trades, to establish and maintain lectureships, to encourage invention and discovery, to promote the standardisation of tests, and to provide the necessary connection between the business and the scientific mind.

A MEETING of business men was held at the Huddersfield Chamber of Commerce on September 24 to consider the scheme for the extension of the textile department of the Huddersfield Technical College. The scheme provides for the raising of at least 25,000*l.* for the purchase of a building and its equipment with up-to-date machinery. The following resolution was passed:—"That this meeting of employers engaged in the textile industry in the Huddersfield district approves of the scheme for the extension of the textile department of the Huddersfield Technical College, as outlined by the members of the sub-committee." We understand that the premises have now been acquired, and that the transfer of the existing technical department to the new building will begin immediately. Any sum not required for the equipping of the new premises will be used to found scholarships for textile students.

THE memorial tablet and medallion of the late Mr. F. W. Rudler, which have been placed in the quadrangle of the University College of Wales, Aberystwyth (in which Mr. Rudler was one of the earliest professors, 1876–79), will be unveiled by Prof. J. Mortimer Angus in the presence of the court of governors and others on Friday, October 18. Mr. Rudler attached great value to students' geological excursions, in regard to which he himself rendered devoted service during his membership of the Geologists' Association. A few of his friends are, therefore, desirous of creating a fund to be capitalised, the annual income from which is to be devoted, on the recommendation of the professor of geology, towards the defrayment, where necessary, of the expenses of students during such excursions. Contributions to the suggested fund may be sent to the Registrar, University College, Aberystwyth.

FOR some time the Y.M.C.A. and other agencies have, with the approval of the military authorities, been carrying on valuable educational work among the troops on the lines of communication in France and at home. A new branch of the Directorate of Staff Duties has now been constituted at the War Office to direct and co-ordinate the educational training scheme of the Army, which was issued as a special Army Order on September 24. The deputy director of the new branch is Col. Lord Gorell, and the assistant director Sir W. H. Hadow, principal of Armstrong College, Newcastle. The new branch will be advised on matters of general policy by an Inter-Departmental Committee, which includes Mr. E. K.

Chambers (Board of Education), Sir John Struthers, K.C.B. (Scotch Education Department), and Major R. Mitchell (Ministry of Pensions). In addition, the following, among others, have been asked by the President of the Board of Education and the Secretary for Scotland to act as expert advisers on special questions as they arise:—Sir Graham Balfour, Director of Education, Staffordshire; Sir Robert Blair, Education Officer, L.C.C.; the Hon. W. Pember Reeves, director, London School of Economics; Dr. G. MacDonald, Assistant Secretary, Scotch Education Department; Dr. E. Salter Davies, Director of Education, Kent; Mr. Albert Mansbridge, vice-president, Workers' Educational Association; Prof. Gilbert Murray, Regius professor of Greek, Oxford University; and Prof. John Adams, principal, London Day Training College. We do not recognise a single representative of scientific or practical education in the list of the new branch and its advisory committee and individual experts, though we should have supposed that an educational scheme for the Army would necessarily be concerned largely with scientific and technical subjects. The special questions which will arise will certainly involve the consideration of scientific and technological training not entirely within the field of the educational administrators and expert advisers whose names are announced. The War Office should remedy what is a manifest deficiency in the constitution of its new branch.

SOCIETIES AND ACADEMIES.

CAPE TOWN.

Royal Society of South Africa, August 21.—Dr. J. D. F. Gilchrist, president, in the chair.—L. **Simons**: The velocities of two distinct groups of secondary corpuscular rays produced by a homogeneous Röntgen radiation, and their absorption coefficients in gases. The absorption coefficients in gases of the secondary corpuscular rays produced by the incidence of silver X-rays on a single gold leaf were found by calculation from the pressure at which the cathode ionisation falls to half its maximum value. They are probably too high for the fastest corpuscles produced. The log. cathode ionisation curves could be analysed into two distinct portions when the particles emerge from a very thin screen, giving two absorption coefficients in a gas, their ratio being 1 : 4·76. The maximum velocity of emergence of the slower corpuscle was found to be 65×10^8 cm./sec., and the velocity of the faster corpuscle was 96×10^8 cm./sec.—G. A. **Boulenger**: (1) A new lizard of the genus Latastia from Southern Rhodesia. (2) *Rana ornatissima* and *R. ruddi*.—Sir A. **Theiler**: A nematode of fowls having a termite as an intermediate host. Some time ago a farmer forwarded a species of termite infected with a nematode, inquiring whether these worms were a stage in the life-cycle of the wireworm of sheep (*Haemonchus contortus*). This possibility, of course, had to be excluded, but since they were larvæ it was concluded that they represented a stage in the life-cycle of a nematode, which had its habitat in a host that would consume termites. Many birds are known to eat termites; fowls are particularly fond of them. It was decided to feed infected termites as well as the larvæ extracted from them. For this purpose eggs were hatched in an incubator and the chickens reared under conditions excluding accidental infection. Infected termites were found on red soil in the neighbourhood of a Kaffir kraal. A series of experiments was carried out, and in every instance an imago was so obtained in the small intestines of the fowls. The control fowls were free of it, as well as controls running in an area not inhabited by the species of termite. The imago was identified as a Filaria, and since it turned out to be a new species the name *Filaria gallinarum* is proposed.—Sir Thomas **Muir**: Note on recurrents resolvable into a sequence of odd integers.—Miss E. M. **Doidge**: Meliolaster: a new genus of the Microthyriaceæ. A fungus occurring on *Piper capensis* is described, which combines certain characters of the genera Meliola and Asterina.

BOOKS RECEIVED.

The Applications of Electrolysis in Chemical Industry. By A. J. Hale. Pp. ix+148. (London: Longmans and Co.) 7*s*. 6*d*. net.

The Correlation between Relatives on the Supposition of Mendelian Inheritance. By R. A. Fisher. (Transactions of the Royal Society of Edinburgh. Vol. lii. Part ii. No. 15.) (Edinburgh: R. Grant and Son.)

British Antarctica (*Terra Nova*) Expedition, 1910. Natural History Report. Zoology. Vol. ii. No. 8. Brachiopoda. By J. W. Jackson. Pp. 177–202+plate. (London: British Museum (Natural History).) 5*s*.

Solutions of the Examples in a Treatise on Differential Equations. By Prof. A. R. Forsyth. Pp. 249. (London: Macmillan and Co., Ltd.) 10*s*. net.

DIARY OF SOCIETIES.

TUESDAY, OCTOBER 15.

INSTITUTION OF PETROLEUM TECHNOLOGISTS, at 5.30.—Some Notes on the Geology of the Persian Oilfields: H. G. Busk and H. T. Mayo.

WEDNESDAY, OCTOBER 16.

ROYAL MICROSCOPICAL SOCIETY, at 8.—A New Illuminant for Microscopical Work: J. E. Barnard.

FRIDAY, OCTOBER 18.

INSTITUTION OF MECHANICAL ENGINEERS, at 6.

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