THURSDAY, MARCH 8, 1917.

MENTAL ORGANISATION.

Organic to Human: Psychological and Sociological. By Dr. Henry Maudsley. Pp. viii + 386. (London: Macmillan and Co., Ltd., 1916.) Price 12*s.* net.

WE welcome this vigorous expression of a distinguished veteran's convictions in regard to some of the major problems of evolution, both organic and social. Mature reflection does not seem to have made Dr. Maudsley more tolerant of metaphysicians, men of feeling, and others of that clan; he remains, in fact, a consistent unbending type of those whom William James called "tough-minded," and he writes as trenchantly as ever about the folly of man's overweening intellectual conceit. One of the central ideas of his book is that of the unity of the organism, which discharges mental as well as motor functions by a nervous organisation in which every part co-operates.

"The whole body enters into the constitution of every mood, thought, and feeling." The author sees man as solidary with the rest of creation on his mental as well as on his bodily side. We are glad to see that he recognises that "there is obviously plenty of seemingly conscious work in animal nature outside human nature, though not, of course, so complexly reflective intra-mentally." With these conclusions many biologists will agree, but few will now follow Dr. Maudsley in his Lamarckian explanation of man's cerebral organisation as "embodying the cumulative acquisitions of immemorial adaptive experience from age to age."

Dr. Maudsley makes much of "mental organisation," which might well have been the title of his book had not the word been vulgarised in other connections. The idea is a sound one that individual initiatives may somehow become enregistered in the hereditary constitution of the race. The author also uses the vivid phrase "mental capitalisation" for the way in which man secures external registration—in implement and machine, in cultivated plant and written word—of the gains of ages. "The wonderful calculation it would be to estimate the number of mind-powers incorporate in and now represented by the modern battleship evolved step by step from the primitive canoe. . . . It is in like manner that the intelligent instincts of animals represent the silent memories of past habits, of acquired function grafted in structure, and that the innate capacities and aptitudes of human intellect signify the quintessence of immemorial consolidate adaptations transmitted as unconscious mind by heredity." But this is very questionable interpretation. That there is "mental capitalisation" in battleship and brain alike seems indubitable; but the resemblance in process in the two cases is purely formal. That the brain of any organism grew rich in the course of evolution by accumulating the acquisitions of individual thrift is a very hazardous biological hypothesis. Facts are wanted!

We are precluded by limits of space from any appreciation of Dr. Maudsley's stimulating and critical discussions concerning the relation of science to social advance, the conditions of civilisation, the microbe and man, social evolution, and the moralisation of the reproductive instinct; we must pass on to the last chapter, where the view is expounded that "materialism neither can nor ought to be got rid of. To think such riddance possible is to perpetuate pretence and invite unrealities and hypocrisies of thought."

For a man of his experience Dr. Maudsley is surprising in the convincedness with which he continually suggests that all the hard, resolute, sincere, critical thinking is done by tough-minded scientific analysts. This conviction is more grotesque than the "ungainly, contorted, or otherwise ungraceful bodies" which Dr. Maudsley has discovered in the animal kingdom. It is equally fictitious. Another psychologically erroneous view, as it seems to us, is expressed in the copious cold water which the book pours on those who cannot settle down sensibly and give up the adventure of trying to interpret Nature. As if that were not the very last thing man should give up! A German biologist of distinction wrote not long ago:—"So until the opposite can be proved we must accept the proposition that also human intelligence comprises no psychical factor, and that it has arisen phylogenetically through continual transformation and refinement of physico-chemical nerve-processes." If this sort of position is included in the materialism which Dr. Maudsley does not wish to get rid of, we protest, for it seems to us a false simplicity and bad science. That the position cited would be accepted by Dr. Maudsley we do not suggest, for we understand the author of "The Physiology of Mind" to recognise the reality of psychical factors while contending that they are inseparably bound up with physiological factors in the unified life of the creature. But he sails very near the wind when he says: "Consciousness is not itself a power of doing work." For who cares for ideas if they have not hands and feet? J. A. T.

BOOKS ON ANALYTICAL CHEMISTRY.

(1) *Analytical Chemistry.* Based on the German text of Prof. F. P. Treadwell. Translated and revised by W. T. Hall. Vol. i., *Qualitative Analysis.* Pp. xiii + 538. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1916.) Price 12*s.* 6*d.* net.

(2) *A Method for the Identification of Pure Organic Compounds.* By Prof. S. P. Mulliken. Vol. ii. Pp. ix + 327. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1916.) Price 21*s.* net.

(1) THE present volume is the fourth English edition of this well-known analytical chemistry, which was first published at Zürich in German in 1899 by the American chemist, F. P.

Treadwell. According to the translator, W. T. Hall, the original has been so thoroughly revised and so largely rewritten that it is no longer fair to publish the book as a literal translation, and though the general plan has been kept, greater stress has been laid upon the theoretical side of the subject. The introductory chapter deals with such general principles as are usually included in text-books on physical chemistry, viz. electrolytic dissociation, electromotive series, solubility product, mass law, etc., subjects which not only come well within the scope, but are essential to the thorough grasp, of analytical methods.

The book is, in short, not the ordinary type of examination *vade mecum*. It is rather in the nature of a philosophical treatise on analysis in which the subject is treated with the thoroughness demanded by a highly important and dignified branch of chemical science. A special feature of the new edition is the use of ionic equations, which often appear side by side with the more usual form. In this way the student is, without much effort, familiarised with both methods of representing reactions.

(2) The procedure adopted by Dr. Mulliken for the identification of pure organic compounds (in vol. ii.) by means of tables follows very closely that of vol. i. Vol. ii. contains what are termed compounds of Order II., which includes those of the three elements, carbon, hydrogen, and oxygen, of vol. i., with the additional element, nitrogen.

The tables are divided into suborders of colourless and coloured compounds, these again into genera comprising acidic, basic, and neutral compounds, and these again into divisions A and B of solid and liquid species.

An illustrative example of the application of the tables is given, and the author claims that the method of identification is much more rapid than that which would have been required to arrive at an equally certain result by the use of the method of empirical formulæ. This may be true of a substance with no previous history which is thrust into the hands of a chemist for rapid identification. But the writer is by no means convinced that, however valuable the data, the arrangement for research purposes is the most satisfactory that could be devised.

Although it may be true that the scheme of species, genera, suborders, and orders may help one, like a botanical key, to track down an unknown compound more quickly than by means of a combustion, one has to remember that it is rarely that a chemist engaged on research is entirely ignorant of the possible nature of the substance he has obtained. It is not a question of one of a possible 4000 compounds described in these tables, but more probably one of half a dozen.

The molecular formulæ and Richter's lexicon will soon put the chemist on the track of a reference; and if, in addition, he has tables of specific reactions arranged according to molecular formulæ, he will rapidly orient his compound, provided it has been described before.

The present arrangement is too mechanical, and makes too little appeal to the previous sequence of chemical events to be entirely satisfactory. At the same time one would not wish to depreciate the value or trustworthiness of the vast and varied data which Dr. Mulliken has compiled with so much care and discrimination. There are distinct, if restricted, uses for such tables.

It may be added in conclusion that not the least important section in the book is chap. iii., giving a list of reagents, their preparation and uses, which many organic chemists often overlook.

J. B. C.

GARDEN AND FIELD.

(1) *The Standard Cyclopaedia of Horticulture.* By L. H. Bailey. Vol. iii., F—K. Pp. v+1201–1760. Vol. iv., L—O. Pp. v.+1761–2421. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1915–16.) Price 25*s.* net each vol.

(2) *The Small Grains.* By M. A. Carleton. Pp. xxxii+699. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1916.) Price 7*s.* 6*d.* net.

(1) HORTICULTURE has been well served by its encyclopædists. In this country we possess Nicholson's Dictionary and "The Gardener's Assistant," both admirable works of their kind. But unfortunately, and in spite of the ever-increasing popularity of gardening, no new edition of either of these works has appeared in recent years. One, we know, is under revision, and but for the war a new edition would have appeared before now. No less admirable than these indigenous productions is Bailey's "Standard Cyclopædia of Horticulture," now appearing in a greatly enlarged form. This "cyclopædia" is indispensable to horticulturists if only for the fact that it contains descriptions of the many new garden plants which are of recent introduction, particularly from China. Although this country led the way in the systematic horticultural exploration of that wonderful country, America has made notable contributions thereto, and the many introductions due to Wilson, Forrest, Purdom, Ward, and Farrer are now coming into general cultivation both in the States and here. Not a few of these acquisitions are described in the pages of Dr. Bailey's work.

As is to be expected from the provenance of this work, the sections treating of tools and machinery are particularly well done, the article on machinery and implements extending over upwards of twenty closely printed pages, and beginning with the just claim that "the American is known by his tools and machinery."

Of great interest to British horticulturists also is the comprehensive account given of horticulture in the North American States, to which more than 100 pages of vol. iv. are devoted. The exporting British horticulturists—and we are too apt to ignore that there is a large horticultural export trade from this country to the States—will derive much valuable information from a study of this section of the work. We commend the account given of the horticultural experiment stations in the various States to the particular attention of those whose business it is to give State encouragement to horticultural research in this country.

The "Cyclopædia" is well and copiously illustrated; the black-and-white figures are excellent. The coloured plates, however, are, as is so often the case, of unequal merit.

Taken as a whole, this American encyclopædia is a great monument to Dr. Bailey's energy and knowledge, and should find its place on the shelves and in the hands of all British gardeners.

(2) In "Small Grains," by Prof. Mark A. Carleton, a comprehensive account is given of the cereal crops—wheat, oats, rye, and barley—and of buckwheat and rice. A mass of useful information is contained in the 700 pages which constitute the book, and it is no doubt useful to the student of "agronomy" to have access to this information within the covers of one book. Nevertheless, it seems to us that a student who mastered the multifarious contents of this volume would do so at the risk of ruin to his mental digestion. In any case, he would deserve the encomium lavished by Goldsmith on the village schoolmaster:—

> . . . and still the wonder grew
> That one small head could carry all he knew.

The English student, at all events, must look on this book rather as a compendious work of reference than as a text-book, and used in this way it will no doubt prove of considerable value.

Particularly good is the account of the different kinds of wheat—common, club wheat, poulard or rivet, durum, einkorn, emmer, spelt, and Polish, and of the chief varieties grown in America and other parts of the world.

With so vast a subject it is not to be wondered at that the discussion of many of its aspects is brief; but to an English reader it appears strange that the author has not found room for the inclusion of Biffen's work on breeding (for although reference is made to that author's determination of dominant characters, nothing is said of his classical experiments in the combination of characters). Nor, though considerable attention is devoted to manuring, do we find, so far as we have been able to discover, any account of the pioneer and fundamental work of Rothamsted.

Although Prof. Carleton's work is designed primarily for the American agronomist, it is one which the scientific agriculturists of this country will be glad to have if only for the somewhat remarkable manner in which the author contrives to give a bird's-eye view of the vast area and diverse conditions over and under which the "small grains" are cultivated in the United States.

OUR BOOKSHELF.

Fatigue Study: The Elimination of Humanity's Greatest Unnecessary Waste: A First Step in Motion Study. By Frank B. Gilbreth and Dr. Lillian M. Gilbreth. Pp. 159. (London: George Routledge and Sons, Ltd., 1916.) Price 6*s*. net.

THE main thesis of the authors of this book is that much of the fatigue occurring among industrial workers is unnecessary, and is caused by the carrying out of the work under conditions which involve excessive and avoidable expenditure of energy. The methods suggested for the elimination of unnecessary fatigue consist for the most part of various mechanical devices. One of these consists in the provision of high chairs so that the workers can sit to their work instead of having to stand. Another suggestion is the use of chairs provided with springs which exclude vibration from the floors of buildings in which high-speed machinery is used. Considerable attention is directed to the value of organisation in the placing of his material in the most convenient position for handling by the worker, to the importance of suitable lighting, and to the desirability of frequent rest intervals during the day's work. A useful point which is brought out is that the value of rest periods is greatly enhanced by the provision of an adequate supply of rest chairs. The authors find that the application of these methods produces a striking improvement, both in the physical condition of the workers and in the efficiency of their work.

Farm Spies: How the Boys Investigated Field Crop Insects. By Prof. A. F. Conradi and W. A. Thomas. Pp. xi+165. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1916.) Price 3*s*. net.

THIS is a collection of brightly written, well-illustrated "story-articles" on various common injurious insects of North America, designed to catch the attention and enlist the sympathies of "boys and girls and those persons who know nothing about insects and how to fight them." Among the pests described are the cotton boll-weevil and root-louse, chinch-bugs (an American "bug" that is really a bug), grasshoppers, and the black corn weevil. The life-histories and habits of the insects are drawn out by conversations between farmers and entomologists, and the farmers' boys are naturally enlisted in the work of destroying the ravagers of crops. Points in the breeding and feeding habits that bear on farm practice are often cleverly emphasised, and some of our British students might be well occupied in compiling for the Home Country a somewhat similar work. "Nearly every incident mentioned has at some time or other come within the experience of the authors," we are told in the preface. The qualification is satisfying when we read how "Dr. Science, walking across a field, heard a vetch plant and a bacterium talking together," how he asked "Would it be possible for you two to get together and trade?" and how the vetch suggested: "The bacterium can live on my roots and supply me with nitrogen, and I furnish him with phosphoric acid and potash." Happily such passages, which are neither good science nor good fiction, are rare in the handy little volume.

G. H. C.

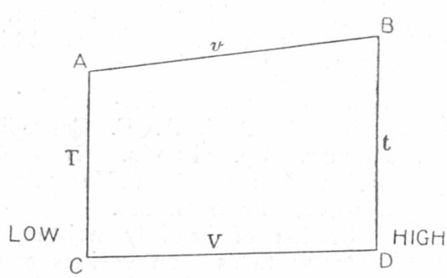
LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

The Horizontal Temperature Gradient and the Increase of Wind with Height.

It has been known for some time past that from heights of about 1 to 9 km. the temperature is higher in the high-pressure than in the low-pressure area, and also that in general the wind, and especially the west wind, increases with height. The following simple proof shows that these two observational facts are not independent of each other, but that, one being given, the other follows as a logical consequence.

A wind in the northern hemisphere exerts an acceleration towards its right-hand side equal to $2\omega v \sin\phi$, where ω is the earth's rotational velocity, v the velocity of the wind, and ϕ the latitude. Also, if the path of the air particles is curved, there is a further acceleration equal to v^2/r, where r is the radius



of curvature, and the acceleration is away from the centre of curvature. The total acceleration to the right is $2\omega v \sin\phi \pm v^2/r$, and the sign of the term involving v^2 is positive in regions where the isobars are concave to the low pressure. However, in these latitudes the v^2 term is not as a rule important, but appears as a correction, generally positive, to the term $2\omega v \sin\phi$.

Let ABCD be a vertical section at right angles to the gradient wind, AB and CD being sections of the isobaric surfaces, and AC and BD vertical straight lines. If v be the gradient wind—*i.e.* the wind at right angles to the paper—then the tangent of the slope of AB is $2\omega v \sin\phi + v^2/r : g$, for $2\omega v \sin\phi + v^2/r$ is the horizontal acceleration and g the vertical. Similarly, the slope of CD is $2\omega V \sin\phi + V^2/r : g$. If, then, v is greater than V, BD must be greater than AC. Now the pressure difference between A and C is equal to the pressure difference between B and D, since AB and CD are isobaric lines; and since the corresponding elements in the two air columns AC and BD are of equal pressure, and the density in BD less, the temperature in BD must be higher than that in AC. That is, if v be greater than V, then t is greater than T.

Thus where the wind is increasing with height without much change in direction, anyone with his back to the wind will, if he follows an isobaric surface from left to right—that is, from cyclone to anticyclone—find an increasing temperature.

If we neglect the curvature it is easy to calculate the numerical values. An increase of 1 metre per second over a horizontal range of 100 km. in latitude 53° makes BD−AC=1·28 m.; therefore, taking AC as 1 km. and CD as 100 km., an increase of 1 m./s. per km. height makes $t-T=0{\cdot}00128t$, or, giving to t a mean value of $250a$, $t-T=0{\cdot}32°$. Thus an increase of 1 m./s. per km. gives in these latitudes an approximate rise of 1° C. per 300 km. along an isobaric line at right angles to the wind. This is fully in accordance with such observations as are available.

As a corollary it follows that the strongest winds have a high temperature on their right-hand side below their own level and a low temperature above, while on their left the converse holds, and it is cold above and warm below, cold and warm being used relatively to the mean for the height. Since the strongest winds are found near the upper limit of the troposphere in regions where the barometric surface gradient is steep, this again agrees with the usual distribution of temperature in cyclones and anticyclones.

The special tendency of west winds rather than east to increase with height agrees with the natural rise of temperature in the lower strata from north to south.

W. H. DINES.

Benson, February 23.

Ten Per Cent. Agar-agar Jelly.

It may be of use to put on record a method of making a jelly containing ten or more parts by weight of agar-agar to 100 parts by volume of solvent.

Agar-agar powder is apt to form lumps when mixed with water or with a mixture of water and glycerine. If this difficulty is obviated by vigorous stirring bubbles are formed. In the case of jellies of 1½ or 2 per cent. strength this does not matter, as the bubbles readily come to the surface. With thicker jellies this is not the case. These difficulties are avoided by the following procedure.

Powdered agar-agar is washed with ether, dried, and passed through a sieve. This treatment removes a fatty acid.

Twenty grams of the purified agar-agar are placed in a round-bottomed flask. The flask is provided with a cork having two holes. Through one of the holes passes a tube leading to a vacuum pump. The other tube accommodates the stem of a separating funnel. The air is exhausted, 140 c.c. of glycerine are placed in the funnel and rapidly run into the flask. The flask is shaken for a few seconds, by which time the agar-agar powder will be found to be completely and uniformly suspended in the glycerine. Sixty c.c. of water that has previously been boiled and completely cooled are now placed in the funnel, run into the flask, and mixed with its contents by a few seconds' shaking. Air is allowed to enter the flask, and the mixture is at once run out into a series of glass syringes from which the pistons have been removed and the nozzles of which are closed with rubber caps. Each syringe is filled about two-thirds full of the mixture, the pistons are replaced, and the syringes are then heated in a water-bath. The jelly is now ready for use. Caps for the nozzles may be made by boring a hole nearly, but not quite, through a rubber cork. A bent strip of tin is required for each syringe to hold the cap in place. The jelly when melted is too stiff to pour out of a test-tube. It can be readily squirted from the nozzle of the syringe.

If the proportion of glycerine is increased the jelly is weaker, but more transparent. With less glycerine and more water the jelly sets more firmly and cuts more easily, but is less transparent.

I have used such jelly in preparing sections of the wings of insects. The wing was first placed in an ordinary silvering solution containing Rochelle salts to which 50 per cent. of alcohol had been added. After it had thereby become blackened from the deposit of metallic silver it was washed with 50 per cent. alcohol and then placed in rectified spirit. To embed the wing after this treatment I formed a cell of plasticine on a sheet of glass. A layer of melted jelly was placed in the cell, which was then filled up with alcohol. The wing was placed in the cell. It dropped through the alcohol on to the surface of the jelly. The alcohol was at once run off by making a cut through the walls of the cell. The latter was then filled up with more of the jelly. By this procedure wings of moths and butterflies, which are not readily wetted by water, could be obtained firmly embedded, free of air-bubbles and without displacement of the scales. To the 60 c.c. of water used in making the jelly I had added 16 grams of hyposulphite of soda. Having cut the lump of jelly containing the wing into ten slices of equal thickness with a Gillette razor-blade, these slices were threaded in order on a wire, and placed all night in a half-saturated solution of tartaric acid in 70 per cent. glycerine. The acid decomposed the hypo., liberating sulphur, with the result that the jelly acquired an ivory-white colour, on which the wing-sections appeared in black. The slices were mounted in a cell containing glycerine jelly. Embedding in celluloid no doubt would be preferable for wings of smaller insects. The method here described is probably more suitable for larger insects, the wings of which would be likely to offer difficulties in an attempt to cut thin sections.

E. H. HANKIN.

Agra, India.

National Service.

THE wording of the enrolment form for National Service having given many the impression that volunteers are wanted only for industrial work, which some men over fifty cannot possibly undertake, I wrote to the Director of National Service for definite information, and my queries were answered as follows:—

"National volunteers are required not only for industrial work, but also for other positions of national importance."

Further: "Mr. Chamberlain wishes it to be clearly understood that brains as well as 'hands' are required, and also that no volunteer will be set to do work for which he is not fitted personally."

These very clear and authoritative replies will, perhaps, relieve the doubts of many who have been hesitating on the very reasonable ground that the work involved seemed to be beyond their capacity.

C. WELBORNE PIPER.

THE CLASSIFICATION OF HELIUM STARS.

WHILE it is now generally admitted that the spectroscopic differences between the different classes of stars are mainly due to differences of temperature, there are two widely divergent views as to the order of celestial evolution which may be inferred. In one of them, the evolution is supposed to proceed by a continuous decline of temperature from the white to the red stars; in the other, which has been consistently advocated by Sir Norman Lockyer during nearly thirty years, it is maintained that the progression is from stars at a low stage of temperature to the hottest stars, and from these to stars at a low temperature, so that a given star will have the same temperature twice in the course of its evolution. The classifications of Rutherfurd, Secchi, and Vogel, and the expansion of these into the Harvard system, may be interpreted in terms of the first hypothesis, though actually they may be regarded as merely empirical and independent of any such consideration. The classification of Lockyer, on the other hand, is essentially based upon the supposition that there must be stars which are getting hotter as well as stars which are cooling, in accordance with the theory of condensing masses of gas or swarms of meteorites.

If the spectrum of a star depended solely upon the surface temperature, there would evidently be no observational means of distinguishing between the two hypotheses. But Lockyer finds that when stars at any given stage of temperature are brought together by reference to the relative intensities of certain lines, selected according to the indications of laboratory experiments, they are divisible into two distinct groups. The spectra, therefore, seem to depend in part upon physical conditions other than those imposed by temperature alone. The difference is quite probably due to a difference in the degree of condensation, and Lockyer's interpretation assigns one of the groups to the ascending, and the other to the descending, branch of the temperature curve. The Harvard classification takes no account of these differences, and is accordingly along one line of temperature only.

The difference between the opposing views as to the order of celestial evolution is clearly of a very fundamental character, and it is important that the question should be attacked in as many ways as possible. The work of Prof. H. N. Russell (NATURE, vol. xciii., p. 283) on the absolute magnitudes of stars has already given considerable support to the main principle of Lockyer's classification, by especially emphasising the idea that the order of celestial evolution is primarily one of increasing density, with a maximum of temperature near the middle of the sequence. As regards the helium stars, Dr. Ludendorff found in 1912 (NATURE, vol. lxxxviii., p. 424) that the radial velocities showed a very decided systematic difference for the ascending and descending stars classified by Lockyer, a difference which was not so clearly shown when the velocities were referred to the Harvard sub-classes.

Since the publication of Ludendorff's results, Lockyer has supplemented his original catalogue of 470 stars by a second catalogue of 354 stars, and a third catalogue of 287 stars, photographed and classified at the Hill Observatory, Sidmouth (*Hill Obs. Bull.*, Nos. 3 and 5). The first attempt to utilise some of the additional data which have thus become available has been made by Dr. B. P. Herassimovitch in a recent communication to the Petrograd Academy of Sciences (Bull. Acad. Imp. Sci., 1916, p. 1419). In this paper the helium stars included in the first two catalogues of Lockyer are discussed in relation to the radial velocities, so far as they have been determined. For the ascending branch there are 57 such stars in the two catalogues, and for the descending branch 47 stars.

It should perhaps be recalled that the helium stars constitute type B of the Harvard classification, and are subdivided into classes Bo to B9, in accordance with variations in detail. In Lockyer's system, seven classes of helium stars are recognised, three on the ascending branch, one at the apex, and three more on the descending branch of the temperature curve, thus:—

	Alnitamian	
↑ Crucian		Achernian ↓
Taurian		Algolian
Rigelian		Markabian

It was found by Campbell that after eliminating the apparent velocity due to the sun's motion, the helium stars showed a systematic positive (receding) velocity of +4·07 km., the apex of the sun's way being taken as $\alpha = 270°$, $\delta = +30°$. This systematic error, which was designated "K" by Campbell, has not yet been satisfactorily accounted for, but it is such as would arise if, in the helium stars, the lines were subject to a pressure effect which caused them to be displaced slightly to the red side of their normal positions; the effect of such a displacement would clearly be to superpose on the real radial motions a receding velocity of about 4 km. for all the stars, irrespective of their positions on the celestial sphere. The magnitude of K, and the sun's velocity, are determined on the supposition that, in the mean, the stars are at rest with respect to the stellar system.

Forming the helium stars on the ascending branch of Lockyer's series into one group, and those of the descending branch into another, Dr. Herassimovitch proceeds in the usual way to determine the sun's velocity and the K term for each group, using equations of the form

$$V_0 \cos \phi + K = V,$$

where V_0 is the velocity of the sun, ϕ the angular distance of the star from the apex of the sun's way, V the observed radial velocity reduced to the sun by correction for the earth's orbital motion, and K the residual velocity. In each group, K is thus the mean algebraic residual after eliminating the solar motion. The results are as follows:—

From 57 stars on the ascending branch $\begin{cases} K = +\ 6{\cdot}32 \text{ km.} \pm 1{\cdot}50 \text{ km.} \\ V_0 = -20{\cdot}84 \text{ km.} \pm 2{\cdot}40 \text{ km.} \end{cases}$

rom 47 stars on the descending branch $\begin{cases} K = +\ 1{\cdot}17 \text{ km.} \pm 1{\cdot}136 \text{ km.} \\ V_0 = -20{\cdot}03 \text{ km.} \pm 2{\cdot}29 \text{ km.} \end{cases}$

Thus, while the resulting velocity of the sun is almost the same for the two groups, the values of K are strikingly different. For the descending branch, in fact, K almost disappears, while for the ascending branch its value is considerably in excess of that found by Campbell from all the helium stars taken together. Lockyer's differentiation of the ascending and descending branches thus receives substantial corroboration.

It was already known from the work of Campbell that the groups of stars giving the largest values of K (*i.e.* the Harvard classes B, K, and M [1]) are among the most distant, and Dr. Herassimovitch has therefore further discussed the ascending and descending groups in relation to the mean parallaxes. Applying Kapteyn's formulæ, it results that for the helium stars on the ascending branch the probable mean parallax is 0·005″ ±0·0009″, and for the descending branch 0·012″ ±0·0030″. By the same process, Campbell has found for the Harvard classes Bo–B5 a mean parallax of 0·006″, and for the classes B8–B9 a mean parallax of 0·0129″, which are nearly identical with the values now found for the ascending and descending stars. A predominance of Bo–B5 stars on the ascending branch, and of B8–B9 stars on the descending branch, would thus account for the observed difference in the mean parallaxes. But this cannot account for the whole difference, for although there are actually a greater number of B8–B9 stars on the descending than on the ascending branch of Lockyer's curve, the excess among the stars here considered is only four. It would seem, then, as in the general case, that the more distant group of helium stars gives the larger value of the K term, and it is interesting to find that Lockyer's criteria for spectroscopic classification have so successfully withstood this further test.

Dr. Herassimovitch has also investigated the ascending and descending groups in relation to the magnitudes of the stars involved. Omitting those at the summit of the curve, there are 155 helium stars available for this part of the inquiry, and the figures show that the stars on the descending branch are in general fainter than those on the ascending branch. This difference cannot be explained entirely by the excess of classes B8–B9 on the descending branch, because within the limits of a given Harvard sub-group, say B3–B5, there is the same increase in the number of faint stars on the descending branch as when all the B stars are taken together. When correction is made to absolute magnitudes, by applying the mean parallaxes previously deduced, it also appears that the stars of the descending branch are in general fainter than those of the ascending branch which fall in the same Harvard sub-class, and are therefore presumably at the same stage of temperature.

Stars at the same heat level on opposite sides of the temperature curve probably have the same intrinsic brightness, and if it be assumed that the average masses are equal, it would follow that the stars on the ascending branch must in general be of greater volume and lower density than those on the descending branch. This is precisely the physical difference which is demanded by Lockyer's hypothesis, and also by that of Russell, and it may reasonably be supposed capable of explaining the spectroscopic differences which have enabled Lockyer to sort out the two classes.

The nature of the K term remains obscure. If the greater brightness of the stars of the ascend-

[1] K is practically zero for stars of classes A, F, and G.

ing group, which gives a large value of K, could be attributed to greater mass, and not merely to greater volume, it might be possible to regard K as a function of the mass. The effect of great mass might then be to produce the pressure displacement mentioned by Campbell as a possible explanation. Or, as Dr. Herassimovitch points out, a displacement of the stellar lines to the red, such as would account for the K term, might possibly result from the gravitational field in the case of great masses, in accordance with Freundlich's deduction from the theory of relativity. There appear to be some difficulties, however, in connection with the latter hypothesis, and it may be added that the Mount Wilson observers have been unable to detect any systematic effect of this kind in the case of the sun, although the calculated effect is considerably greater than the errors of observation (Mt. Wilson Report, 1914, p. 255). On either supposition, however, it seems improbable that there would be so great a difference in masses for Lockyer's two groups of helium stars as to account for the large value of K in the ascending group and its practical disappearance in the descending group.

It at least seems clear, from the above results, that K can no longer be regarded as a constant error, having a fairly definite value for each of the Harvard classes. Prof. Perrine has also recently been led to this conclusion (*Astrophys. Journ.*, November, 1916), and is inclined to the opinion that the observed residuals represent velocity displacements. Whatever the true explanation may be, Dr. Herassimovitch's investigation emphasises the importance of taking account of Lockyer's criteria in the classification of stars of the helium group.

A. FOWLER.

THE POTATO SUPPLY.

THE average potato crop of Great Britain is a little over 2 million tons, and that of Ireland a little under this figure. Great Britain and Ireland together contribute rather less than 5 per cent. of the world's crop of 91½ million tons. In normal years the British Isles grow nearly, or quite, enough potatoes to satisfy home needs. Accessory supplies are, however, derived from the Channel Islands, Normandy, Brittany, and other sources.

Hence it might be doubted whether even in these exceptional times there is need for any large measure of forethought or room for much anxiety with respect to our potato supplies.

A combination of circumstances, however, has co-operated to make this year's potato crop a matter of considerable national importance.

First among these circumstances is the fact that very large quantities of potatoes are required for his Majesty's forces. Moreover, there is reason to believe that the French have been large purchasers. Secondly, last year's potato crop was below the average, both in Scotland and in certain parts of England. In some districts the crop, though fair in amount, proved to be badly diseased at lifting time; a sure indication of loss in store. Exact information as to the total yield in this country is not available, but it may be taken as probable that it does not amount to two-thirds of the average crop.

The reasons for the shortage are numerous, but one of the chief is undoubtedly the adverse season of 1916; lack of labour for hoeing, absence of supplies of potash manures, and the high price of other artificial manures also contributed to the misfortune.

In consequence of the partial failure of the crop it was foreseen that prices would rise to a high level, and it was hoped that official action would be taken while the bulk of the crop was in the ground, and before contracts were entered into. The hope was not realised. Warnings were ignored—for to warn before it is too late is to be premature. More serious than the rise in price of ware (food potatoes) was the rise in the price of seed. Scotch seed, which, together with Irish, gives a higher yield than English seed, was known to be scarce, and thrifty men, in order to secure seed betimes, paid so much as 25*l.* to 30*l.* per ton for seed of good varieties.

At this stage prices were fixed—maximum price for last year's crop, maximum for the crop not yet sown, and for the seed for sowing. The price fixed for next year's crop had the immediate effect of determining everyone whose patriotism was not very much deeper than his pocket to abandon the idea of growing potatoes, for they knew that a maximum price of 115*s.*–130*s.* per ton would mean growing the crop at a loss. Plain men were puzzled to know why a beleaguered city must at all costs save itself from a glut of potatoes. There was an outcry, and the maximum price for next year's crop became a minimum.

With respect to seed the fixed prices remain: 12*l.* per ton as a maximum, and at the present moment anyone who wants to grow potatoes can, as we are assured by the Board of Agriculture, buy the *best seed* from the Board at 12*l.*, or from any of the leading seedsmen at double the price. If the article supplied by the Board proves indeed to be the best with respect to origin, size, and trueness to name, purchasers who waited on providence will have reason to laugh at their more provident brother-growers who bought betimes. The authorities have gone one better than the parable: the late-come labourers get twopence instead of the penny earned by those who bore the heat and burden of the day. Nevertheless no public-spirited person will grumble if he can be assured that the Board has dealt justly with the grower of the seed, and is able to supply seed tubers *of the best quality* at 12*l.* per ton. Rather will he incline to a belief in miracles. The view is commonly held that there will be too many potatoes grown this year. Facts, however, do not warrant that view. There is a general shortage of corn crops, transport is disorganised, farm lands lack expert labour, artificial manures are dear and scarce, and seed is likely to be of inferior quality. The more the situation is considered, the more imperative appears the need to cultivate every rod of fertile ground. Unless the omens are false, and whether peace come soon or no, all the vegetable produce that can be raised will be sorely needed. F. K.

PROF. GASTON DARBOUX, For. Mem. R.S.

BY the recent death of the permanent secretary of the Academy of Sciences of the Institute of France, mathematical science, and all that it stands for in the evolution of human progress, has suffered a grievous loss. Of dark complexion and large build, which were a continual reminder of his southern Provençal origin, and of the exquisite courtesy which marks the French man of learning at his best, Prof. Darboux was no stranger in this country. Those who were present in December, 1907, at the great concourse which followed the remains of Lord Kelvin to his tomb adjacent to that of Sir Isaac Newton in Westminster Abbey will remember the striking figure who, in the uniform of the Institute of France, represented the sister nation among the bearers of the pall. Already in those early days of the Entente France made a point to send of her best—Becquerel, Darboux, Lippmann—to represent her in our national mourning for a man of science whose work had united so happily the genius of the two nations. Later, at the London meeting of the International Association of Academies in 1912, Darboux was naturally prominent as one of the French representatives; and, though even then showing signs of failing health, he contributed notably as usual, by his tact and moderation and sympathy, to the successful issue of business not always easy to negotiate.

Jean Gaston Darboux[1] was born at Nîmes on August 13, 1842, in a house which had once been a chapel of the cathedral. He lost his father at seven years of age; and he and his only brother were educated under the anxious care of their mother at the local lycée, attending as demi-pensionnaires, as was not unusual in those days, from six o'clock in the morning until eight in the evening. He passed on to the more special classes of the lycée of Montpelier in 1859, and in 1861 he headed the lists for admission both to the Ecole Polytechnique and to the Ecole Normale. Of these, true to his desire to devote himself to the profession of teaching, he chose the latter, thereby setting a fashion followed in later years by other illustrious men who came out high on both lists. His mother went specially to Paris in order to introduce him to Pasteur, then the scientific director of the school.

At the Ecole Normale his bent was towards geometry, and he found time for minute study of the classical works of Monge, Gauss, Poncelet, Dupin, Lamé, and Jacobi. In 1864 his own studies on orthogonal surfaces had already borne fruit in the *Comptes rendus*, and in 1866 he sustained a memoir "Sur les surfaces orthogonales" as a thesis at the Sorbonne for the doctorate in mathematical science. He then plunged into teaching, to which he had been looking forward, collaborating with Joseph Bertrand in mathematical physics at the Collège de France, and with Bouquet at the Lycée Louis le Grand; but he also found time to elaborate two of his principal memoirs, both published in 1870, one on partial differential equations of the second order, the other the famous treatise, "Sur une classe remarquable des courbes et des surfaces algébriques." In the latter work was developed the theory of cyclides, so named after the special cyclide surface of Dupin, a study which had been initiated by Moutard and envisaged under more general forms by Kummer. The Irish mathematician Casey published about the same time, and in the main independently, several very elegant and elaborate memoirs on the same topic, developed by more purely geometrical methods; and the fascination of their results and the beauty of the processes attracted great attention to the subject in this country during the succeeding years. It was another instance of the affinity of the Irish school of mathematics to the French school, on which it had for long been consciously modelled. Near the end of his life Darboux returned to this subject and prepared an extended edition of his earlier work.

From 1873 to 1878 he assisted Liouville, then of advanced years and in bad health, in the chair of rational mechanics at the Sorbonne; and some of the fruits of this course are preserved in the elegant and valuable notes, in his best geometrical vein, that he appended to an edition of Despeyrous's "Cours de Mécanique."

Darboux finally entered upon his life-work in 1880 in the professorship of Géométrie supérieure which had been founded at the Sorbonne for Chasles in 1846. As part of the activities of this chair he elaborated the great treatise on infinitesimal geometry, the "Théorie générale des Surfaces," which came out in four volumes between 1887 and 1896. This constitutes his chief expository work; into it much of his own previous researches is condensed; and, as usual with the French treatises on analysis, it ramifies into adjoining domains, such as general dynamics, whenever the methods of his exposition are adapted to illuminate such cognate theories.

He was elected a member of the Académie des Sciences in 1884, and there he gained the highest mark of the esteem and appreciation of his colleagues in being chosen as Secrétaire perpétuel in 1900. The efficiency and charm with which he executed the delicate duties of that office have been universally recognised. He held honorary rank in the Universities, amongst others, of Cambridge and Christiania and Kasan. He was elected a foreign honorary member of the Royal Society in 1900, and last autumn, just in time, he received the award of its Sylvester medal.

JOSEPH LARMOR.

[1] Use has been made for these facts of a monograph on M. Darboux published by M. E. Lebon in 1910.

NOTES.

A STRIKING example of the utilisation of waste products was given by Mr. Forster, the Financial Secretary to the War Office, in the House of Commons on March 1. The waste product in question was fat. Everybody knows now that glycerine is obtained from fat, even if in the early days of the war this fact was new to certain of our officials whose education had, presumably, been exclusively classical, and who were therefore unaware that there was any connection between the supply of fat and the production of explosives. Beef of medium leanness contains on an average about 20 per cent. of fat, calculated upon the edible part of the joints; mutton and pork contain about 30 per cent. On heating these fats with a solution of alkali, the glycerides of which they consist are decomposed, yielding glycerine and soap. Theoretically, the pure fats should give glycerine equal approximately to 10·8 per cent. of their weight. Formerly meat scraps and other table refuse at the military camps were either destroyed or else sold for a small sum; but the authorities now have these remnants collected and sorted, in order that the fatty portions may be used for the making of glycerine. Special plants have been erected for this purpose, one in this country and one in France, and others are shortly to be installed. It was stated that the present rate of output of glycerine from the food of the troops is 1000 tons annually, and that this quantity provides propellant explosive charges for approximately twelve and a half millions of 18-pounder shells. The War Office sells the glycerine to the Ministry of Munitions for 50*l*. a ton, whereas if it were bought in the United States it would cost 240*l*. a ton.

MR. FORSTER, referring in the House of Commons to the Medical Service of the Army, stated that as regards Mesopotamia the War Office has become directly responsible for the medical arrangements in that theatre of war. The general conditions there may now be regarded as satisfactory. During the summer there was necessarily some considerable sickness, but the admission rate has steadily diminished since, and the supply of nurses and medical *personnel* is fully equal at the present time to that at the other fronts. In France, Salonika, and Egypt the general conditions are satisfactory, but in East Africa the authorities have had to contend with a good deal of malaria owing to the exceptionally unhealthy climatic conditions. One of the most remarkable features of the whole campaign is the almost total disappearance of enteric (typhoid) fever. The last weekly returns show that the numbers in hospitals suffering from this disease were: France, four cases; Salonika, nine; Egypt, three; Mesopotamia, eight; total, twenty-four cases. The number of cases of typhoid fever among British troops in France up to November 1 of last year was 1684; paratyphoid, 2534; and indefinite cases, 353; a total of 4571. In the South African War nearly 60,000 cases were admitted into hospital, and there were 8227 deaths; there were thus approximately twice as many *deaths* from typhoid fever in South Africa as there were *cases* in France up to November 1 last. The admission rate for typhoid fever among those who had not been protected by inoculation was fifteen times higher than among those who had been inoculated, and the death-rate was seventy times higher! At home the hospital system has been developed and extended, and the system of utilising the services of the voluntary aid detachments has been highly successful and is much appreciated. Arrangements have been made by which the problem of the treatment and training of the discharged disabled soldiers will be more effectively dealt with. The venereal diseases rate in the Army to-day is no higher than it was in ordinary times of peace, and every effort is being made to reduce the rate still more by the provision of lectures to the troops on the subject in collaboration with the National Council for the Prevention of Venereal Diseases.

THE report of the committee appointed by the Home Secretary to inquire into the social and economic results of the Summer Time Act, 1916, has just been issued (Cd. 8487, price 3*d*.). The committee recommends: 1. That summer time should be renewed in 1917 and in subsequent years. 2. That the period of the operation of summer time should be from the second Sunday in April to the third Sunday in September in each year. 3. That the change from normal to summer time should be made on the night of Saturday–Sunday and the reversion to normal time on the night of Sunday–Monday. 4. That the variation from normal time should be one hour throughout the whole period. The evidence presented by the committee is not of a very substantial kind, but, taking it as a whole, it leads to the conclusion "that the vast preponderance of opinion throughout Great Britain is enthusiastically in favour of summer time, and of its renewal—not only as a war measure, but as a permanent institution." To prevent loss of sleep by children being permitted to stay up beyond their proper bed-time during the long light evenings, it is recommended that all possible steps should be taken by education authorities through the school medical services and the care committees to ensure that this tendency shall be kept within the narrowest possible limits. The opinions of farmers and others concerned with agriculture as to the effects of summer time are more conflicting than those of any other interests; on many farms and in some entire districts (so far as the agricultural community was concerned) the Act was not observed at all. Representatives of the cotton trade complained to the committee of the inconvenience arising out of the necessity for lighting up the factories in the early morning in the second half of September, and it is partly to meet this objection that the reversion to normal time is to be made at an earlier date this year than last. Sir Napier Shaw informed the committee that a great deal of confusion arose with observers as regards the hours at which meteorological observations were made, and he remarked: "From the scientific point of view the discontinuity of hour introduces a defect which is fatal, and for which there is no remedy." On this matter the committee expresses the hope that the proposal for a permanent acceleration by one hour of the international service of weather reports will receive further consideration.

POLITICAL questions do not often figure in the pages of scientific journals, and the publication in *Science Progress* for January (No. 43) of a leading article, by Mr. W. H. Cowan, M.P., on "Scientific Parliamentary Reform" will undoubtedly arouse considerable discussion. In this article, which treats the present national position from a political point of view, the main issue is largely identical with that urged from the point of view of a man of science in January, 1910, by the late Dr. Johnstone Stoney, F.R.S., in a tract entitled "The Danger which in Our Time Threatens British Liberty." In the past Great Britain, after many struggles, secured a form of representative government that has been adopted as a model by all progressive modern nations. But in recent years there has been an ever-growing tendency to subjugate the will of Parliament to the influence of a Cabinet autocracy which, if unchecked, will reduce what professes to be Parliamentary government to the worst form of tyranny. A study of Mr.

Cowan's article will convince the reader that at the present time the average M.P. has practically no opportunity of bringing his capabilities as an independent expert to bear on problems of national importance. Moreover, under the closure, opportunities for discussion are practically nil, except for a handful of members who are able to catch the "Speaker's eye," and the member who attempts to introduce a private Bill will soon find his attempts stifled by Ministerial and other pressure. As for the control of the House of Commons over finance, this is described as an empty boast, untold millions being voted without discussion at the fag-end of an all-night sitting. While not claiming to propose any final cure for this growing disease of bureaucratic tyranny, Mr. Cowan suggests the following possible remedies: Voting by ballot in divisions of the House; shorter Parliaments; an alteration in procedure enabling a Bill dropped in one session to be taken up at the same stage in the next session; and the more controversial proposal of "Home Rule All Round."

THE latest issue of the *Victorian Naturalist* to reach us brings the news of the death of Dr. E. P. Ramsay, of Sydney, at the age of seventy-four years. Dr. Ramsay was best known as curator for many years of the Australian Museum, Sydney, and his "Tabular List of Australian Birds" was long the standard index for Australian ornithologists.

A LETTER lately received from Dr. Ragnar Karsten, leader of the Swedish expedition in Ecuador, is dated El Tena, East Ecuador, October 10, 1916, and states that the expedition was then half-way along the difficult road from Quito to Napo, at which latter place and at Curaray ethnographical studies and collections would be made.

SWEDISH papers announce the death, on January 23, in his seventy-first year, of Dr. Edward Welander, the leading specialist on skin and venereal diseases. Many of his published investigations deal with the action of mercury. On one occasion he injected a mercurial preparation into his own arm-muscles, and followed its course through the system by a series of X-ray photographs. He fought these diseases also by popular education, and founded a home for the upbringing of children with congenital syphilis, an example followed in other European capitals.

THE agricultural institute of Alnarp, Scania, proposes to devote a plot of its land and about 4000*l.* to the erection of a building for studies in heredity, under the direction of H. Nilsson-Ehle, the recently appointed professor at Lund. It will also provide a maintenance grant of 200*l.* per annum. It is felt that such studies are of the greatest importance at this time, when Sweden is thrown on its own resources in the matter of food production, and the institute is convinced that any material sacrifices it may make for this purpose will be more than repaid by the economic results of the research, on which the institute will naturally have the first claim.

THE Daimler Company, Ltd., has placed at the disposal of the council of the Institution of Automobile Engineers a sum of money for the provision of an annual premium of 25*l.* to be granted to the graduate submitting the best paper on an appropriate subject in any session. Papers must reach the secretary of the institution, 28 Victoria Street, S.W., during September of each year.

THE following have been elected ordinary fellows of the Royal Society of Edinburgh; G. B. Burnside, Dr. B. Cunningham, T. C. Day, R. W. Dron, Prof. A. Gibson, J. Harrison, Prof. J. C. Irvine, A. King, Sir Donald Macalister, Rev. H. C. Macpherson, Lieut. L. W. G. Malcolm, A. E. Maylard, G. F. Merson, F. Phillips, Dr. H. H. Scott, Sir G. A. Smith, Dr. J. Tait, Dr. W. W. Taylor, J. M'Lean Thompson, W. Thorneycroft, and Prof. D. F. Tovey.

WE learn from the *Times* that the Reconstruction Committee which was appointed by the late Prime Minister to advise the Government on the many national problems that will arise at the end of the war has now been reconstructed. The Prime Minister will be chairman of this committee. Mr. Lloyd George will, of course, not be able to give continuous attention to the detailed proceedings of the committee, and it is understood that his deputy, on whom the work will fall, will be Mr. Edwin Montagu, the Minister of Munitions in the late Government.

THE death is announced, in his ninety-second year, of Mr. James Forrest, honorary secretary, and for many years the secretary, of the Institution of Civil Engineers. The famous "James Forrest" lecture of the institution was endowed by him a few years before his retirement, when a presentation was made to him by the council. His intention was that the lecture should illustrate the dependence of the engineer in his practical professional work on the mathematical and physical sciences. The first lecture was delivered by Dr. W. Anderson in 1893 upon the subject of "The Interdependence of Abstract Science and Engineering," and the whole of the lectures form a very valuable series.

THE report of the Philosophical Institute of Canterbury, New Zealand, for the year 1916 records that the council has recognised the importance of furthering the national movement to advance scientific research and extend the application of scientific knowledge. Addresses on "Education and our National Requirements" and "The Importance of Research to Industry and Commerce," by Mr. G. M. Thomson and Prof. T. H. Easterfield respectively, were arranged with these ends in view. In order that matters connected with research and the technical application of science should be constantly watched, the council set up a special committee, with Dr. C. C. Farr as hon. secretary. The New Zealand Board of Industries, having invited the institute to send delegates to confer with the Board on matters affecting post-war reconstruction, the council appointed the president, with Dr. Farr and Dr. Hilgendorf, to act. Application has been made for part of the 250*l.* granted by the Government for research; and investigations are being arranged on the phosphate rocks of Canterbury, the deterioration of apples in cold storage, and the electrical prevention of frosting in orchards.

SIR JAMES J. DOBBIE, president of the Institute of Chemistry, referred, in his presidential address to the institute on March 1, to the services of professional chemists in connection with the war. The institute has acted as a chemical clearing-house, assisting public departments and firms engaged on Government work to obtain the chemical service they required. Apart from that, the researches on glass initiated by the institute, particularly the work of Prof. Herbert Jackson, have proved of great value, and have been specially recognised by the President of the Board of Trade. After indicating a number of new industrial developments which call for the help of practical chemists, the president advocated the extension of the training of chemists, particularly in higher physics and physical chemistry, and, therefore, the adoption of a four, instead of a three, years' course. He emphasised the importance of mechanics to chemists who intend to practise in industry, and recommended a training as wide as possible for chemists generally. Dealing with the recent discussions on the subjects of education and the reform of the school curriculum, he criticised what was termed "generalised science," by which he supposed was meant a composite course, including a little physics, a little chemistry, a little biology, and a little of everything else, and suggested that school science should be as simple as possible, and that the first place should be given to mechanics experimentally treated, as being essential to the study of all other experimental science.

MR. J. W. OGILVY, secretary of the Microscopical Section of the Young Men's Christian Association, has sent us a copy of the report just issued. The object of this section is to give exhibitions and deliver lectures on microscopical subjects to the troops in the camps and hospitals in the Metropolitan and Home Counties areas; for this purpose sixty-five microscopists have volunteered their services. For the three months October to December, 1916, seventy-three exhibitions have been held and twenty-two lectures delivered, all branches of natural history, together with physiology and pathology, being dealt with. One of the most popular lectures is entitled "Some Huns of the Microscopical World," which treats of some of the disease-producing micro-organisms, and in which the opportunity is taken to refer to syphilis, its causation and spread. There is much evidence among the troops that venereal diseases are spread to a considerable extent through ignorance and thoughtlessness, and an endeavour is being made to enlighten the men upon the subject. These lectures and demonstrations have proved a great success, and it is proposed in the near future to commence a series of Saturday and Sunday afternoon rambles for munition boys.

MR. A. H. SMITH, of the British Museum, contributes to vol. xxxvi., part ii., of the Journal of the Hellenic Society for 1916, an interesting account of the history of the acquisition of the marbles of the Parthenon by Lord Elgin, and of their purchase by the British Government. The late Lord Elgin, on the centenary of the acquisition of this collection by the public, placed in Mr. Smith's hands all his papers bearing on the subject, his desire being that the episode of the marbles should appear in its due proportion in a full biography of his distinguished grandfather, the other aspects of his career being discussed by Sir Harry Wilson, K.C.M.G. We have now a full collection of the original letters and reports dealing with this collection, the glory of the British Museum. An important incident is that of the work of Signor Giovanni Battista Lusieri, by whose efforts, in a large measure, the operations were successfully completed. By an unlucky accident an important collection of drawings and some artistic objects were lost in the wreck of the *Cambrian*, a 48-gun frigate, commanded by Capt. Hamilton, wrecked on the coast of Crete on January 31, 1828. The ship was attacked by pirates, and it was necessary to abandon her at once, without saving even the ship's dog and muster-book, with the large case containing the drawings.

THERE is happily a very general desire among us that such wild spots as still remain to us in these islands should, so far as possible, be jealously guarded. Thus the announcement in the Press of February 22, to the effect that Sir Thomas Acland had placed some seven or eight thousand acres of Exmoor under the guardianship of the National Trust, will be very welcome. A lease has been granted the trust for the next five hundred years. By arrangement, Sir Thomas and his successors will continue to enjoy the rents and profits and all the ordinary rights and powers of an owner, except that the owner will have no power to develop the land as a building estate.

PROF. E. C. STARKS, in the Leland Stanford Junior University Publications, University Series, gives a valuable survey of that extraordinarily variable bone in the mandible of fishes, the sesamoid articular, illustrated by numerous figures. He confirms the opinion of Dr. W. G. Ridewood that it is to be regarded as a sesamoid. Contrary to the views of some earlier investigators, he regards the sesamoid articular as useless as a factor in the classification of groups larger than species, as it often differs within the genus. Nor until much more extensive investigations have been made will it be possible, he considers, to pronounce upon its value in differentiating species.

AMONG the vast numbers of Brent geese which visit our shores during the winter months a considerable sprinkling occurs of the American form (*Bernicla leucogaster*). Until now it has been supposed that this sub-species occurred with greatest frequency on the Northumberland coast, where, indeed, it appears to be more abundant than the British *B. brenta*; and the same is apparently true in regard to its numbers on the south-east coast of Ireland. While it has been by no means regarded as a rarity in Scotland, it seems possible that further observation may show that it is of far commoner occurrence than was supposed. For the Misses Rintoul and Baxter, in the *Scottish Naturalist* for February, record the fact that an examination of the specimens of Brent geese in the Royal Scottish Museum shows that the large majority belong to the American race.

SIR FREDERICK TREVES, in the *Observer* of February 25, directs attention to the grave results likely to follow from the introduction of the American grey squirrel into Richmond Park. Not only has it driven out our native red squirrel, but it has also now spread beyond the confines of the park into adjoining gardens, working serious damage there. "They eat everything that can be eaten, and destroy twenty times more than they eat." The buds and shoots of young trees, apples, pears, and stone fruits, peas, and strawberries are all laid under a heavy contribution. Already it seems the Office of Works has given orders for the destruction of these pests. The order, however, has come somewhat late, for they have already made their way into the open country of Surrey with a steady persistence and in good force. "When it has reached the fruit-gardens and young plantations of Surrey and Kent, we shall hear more." We are evidently in grave danger of having another very practical lesson in the folly of "acclimatisation," of which the rabbit in Australia forms a familiar and awful example.

ALL interested in the formation and management of War Food Societies will find useful guidance in Special Leaflet No. 32 of the Board of Agriculture and Fisheries, of which a revised edition is now available. Examples of what has already been done by war food societies and women's institutes since the first issue of the leaflet are now given. It is of interest to note that the Women's Institute at Criccieth, with a membership of about eighty, realised in the first nine months more than 200*l*. by the sale of surplus produce beyond home requirements. Instructions are given as to how a food society or women's institute may be started, and numerous suggestions are made as to the different directions in which their activities may be exercised. Special attention is directed to the powers now conferred upon the Board of Agriculture and Fisheries for securing the use of unoccupied land for purposes of food production.

IN view of the difficulty of securing delivery of basic slag, superphosphate, and other phosphatic manures, the President of the Board of Agriculture and Fisheries asks farmers not to apply phosphates to meadows and pastures during the remainder of the present season. All available supplies should be reserved for other crops, especially for roots and potatoes. Having regard to the short supplies, it is not advisable to apply more than three-fourths of the usual dressings of these phosphatic manures, since better results may be expected from the same total weight of manure if the whole area under any particular crop is manured lightly than if a part is heavily dressed and the balance left without artificial manure. This rule applies only where the land is uniform in quality. In those cases in which farmers know that certain fields are poorer than others the manurial treatment must be adapted to the special conditions. Where land in good condition can be given full dressings of farmyard manure, artificial phosphatic manures may often be omitted without materially reducing the crops.

AT the meeting of the Society of Glass Technology, held at the University of Sheffield on February 15, some samples of glass manufactured from British sands were exhibited by Mr. C. J. Peddle, but the principal business of the meeting was the discussion of the effect of the temperature at which the annealing of glass is carried out on the time required by the process. Contributions to the discussion were made by Mr. F. Twyman, of Messrs. Adam Hilger, Ltd., London, and by Mr. S. English, of the Glass Technology Department of the University of Sheffield. As the temperature is raised towards the softening point of the glass, the speed at which the internal strains disappear is increased, and the object is to find for each type of glass the highest temperature at which it is safe to carry out the annealing process. The observations are conveniently made on a glass rod mounted between Nicol prisms, so that light passing through the system shows the rings and cross characteristic of a uniaxial crystal. As the annealing proceeds the rings disappear, and the times of disappearance of the last four rings were found in a particular sample of glass to be as follows: At 500° C. 1230 minutes, at 550° C. 50, at 600° C. 20, and at 625° C. 12. These temperatures are all considerably below that of actual softening of the glass.

VOL. xii. of "Contributions from the Jefferson Physical and the Cruft High-tension Electrical Laboratories of Harvard University" for the year 1915 consists of reprints of nineteen papers, the outcome of researches aided financially by the Coolidge fund for research, the Bache fund of the National Academy of Sciences, and the Rumford fund of the American Academy of Arts and Sciences. The volume extends to 400 pages, and is a record of which Harvard may well feel proud. The Cruft laboratory provides two of the nineteen papers—one by Mr. F. Cutting on the design of radiotelegraphic transformers, another by Mr. E. L. Chaffee on coupled circuits. Of the Jefferson laboratory contributions, that of the director, Dr. T. Lyman, is of special interest, as it extends the ultra-violet end of the spectrum to wave-length 600 Ångström units. Dr. P. W. Bridgman's five valuable contributions occupy a large share of the volume, and deal with the effect of great pressures on the temperature and velocity of transition of polymorphic forms of the same substance into each other. Altogether, 150 substances have been examined, and it is unfortunate that the polymorphic diagrams obtained show no tendency to fall into simple types. The subject appears to be very complicated, and Dr. Bridgman suggests that the explanation of the great variety of behaviour of the different substances must be sought in the actual shapes of the atoms.

A COPY of the Year-Book of the Scientific and Learned Societies of Great Britain and Ireland, 1916, has been received from Messrs. Charles Griffin and Co., Ltd. This, the thirty-third annual issue of a useful work of reference, contains a record compiled from official sources of the work done in science, literature, and art during the session 1915–16 by numerous societies and Government institutions. The list of societies dealt with is remarkably comprehensive; but the plan of selection is not always clear. Under the section entitled Psychology, for instance, space has been found for particulars of the Nature Study Society and the School Nature Study Union, but nowhere in the volume have we found data concerning the work of, say, the Association of Public-School Science Masters. Similarly, under the section Literature and History, the English Association is included, while the Historical Association is overlooked. The man of science, however, will find the volume as useful as ever in discovering the work done in his particular subject during the year under review. The book is published at 7*s*. 6*d*. net.

AN interesting and very full botanical catalogue (New Series, No. 77) has just been issued by Messrs. J. Wheldon and Co., 38 Great Queen Street, W.C. It comprises floras of all countries, and is arranged most conveniently according to the countries dealt with. Many of the works are scarce. We notice that several belonged to the late Sir Joseph Hooker.

PROF. FRASER HARRIS writes to correct an error made by him in his letter in NATURE of January 18 (p. 389) on the introduction of the term "metabolic." He referred to the first edition of Foster's "Text-book of Physiology" as having been published in 1883, whereas it appeared in 1877.

OUR ASTRONOMICAL COLUMN.

EFFECT OF HAZE ON SOLAR ROTATION MEASURES.—Attention has previously been directed to Mr. De Lury's suggestion that the apparent variations in the rate of solar rotation, as determined by the spectrographic method at different times, and from different lines, might be accounted for by variations in the haziness of the sky (NATURE, vol. xcviii., p. 99). Messrs. St. John and Adams have since made observations to test the possible influence of haze, and have found that to obtain equality of density in photographs of the spectra at points just outside and just within the sun's limb, it was necessary to give exposures in the ratio of 100 to 1. These observers concluded that, under the usual working conditions at Mt. Wilson, scattered radiation is a negligible factor, and is not a probable source of error in the observations of solar rotation (Journ. R.A.S., Canada, vol. x., p. 553). In a further note on the subject (*ibid.*, vol. xi., p. 23) Mr. De Lury points out that the density of a negative is proportional to a power of the time, usually within the range 0·6 to 0·9, and that equal densities with a ratio of 100 in the times of exposure would correspond to a ratio of scattered light to limb light ranging from 6·3 to 1·6 per cent. A probable value would be about 4 per cent., which would produce about half the effect noted in the Mt. Wilson observations, and, allowing for other circumstances, could conceivably account for the whole effect. If atmospheric haze be proved insufficient, it is alternatively suggested that the differential effects may possibly be accounted for by assuming the production of a spectrum of non-rotating matter in the solar atmosphere.

THE NINTH SATELLITE OF JUPITER.—An investigation of the ninth satellite of Jupiter has led Messrs. Nicholson and Shapley to estimate its diameter as lying between 11 and 17 miles (*The Observatory*, vol. xl., p. 107). From photographs of this tiny object taken with the 60-in. reflector at Mt. Wilson, the photographic magnitude at mean opposition was found to be 18·6, as compared with 17·5 and 18·0 for the seventh and eighth satellites respectively. Allowing for a probable colour-index of one magnitude, the angular diameter of the ninth satellite at mean opposition works out at 0·006″ or 0·009″, according to the value adopted for the visual albedo, and these lead to the limits of diameter stated above.

GERMANY'S EFFORT TO OBTAIN NITROGENOUS COMPOUNDS.

ALTHOUGH elementary nitrogen is not only useless, but positively antagonistic, to the life of plants and animals (except to that of some bacteria which take free nitrogen from the atmosphere and convey it to the roots of leguminous plants), combined nitrogen is absolutely necessary for their metabolism. Animals obtain nitrogen from the vegetables they consume, plants from the nitrogenous constituents of the soil. The soil obtains part of its combined nitrogen from decaying vegetable matter and from the waste products of animals; the remainder has to be added. The two chief forms in which it is added are sodium nitrate and ammonium sulphate, which to a large extent are interchangeable. But for the manufacture of explosives sodium nitrate is absolutely necessary and ammonium sulphate useless. Germany, foreseeing that its supply of Chilean nitrate would be cut off by the blockade of the British Fleet, was faced with irremediable disaster unless it could lay in a sufficient stock before declaring war, or devise methods of synthesising nitric acid. The manner in which this difficulty has been overcome is described by Prof. Camille Matignon in the *Revue générale des Sciences* (January 15 and 30). Before the war Germany was the greatest consumer of combined nitrogen. In 1913 the consumption amounted to 750,000 tons of Chilean nitrate, 35,000 tons of Norwegian nitrate, 46,000 tons of ammonium sulphate, and 30,000 tons of cyanamide. In 1913 great efforts were devoted in Germany to the preparation of materials necessary for war, and no attempt was made to conceal them. The German Ammonium Sulphate Syndicate had a reserve of 43,000 tons, and on the declaration of war there was probably a stock of 100,000 tons of Chilean nitrate. Immediately after the battle of the Marne, when a long war was evidently certain, the production of artificial nitrates and of ammonium sulphate was stimulated, the Badische Aniline Company and Bayer and Co. being subsidised to the extent of 30,000,000 marks for the installation of factories to convert ammonia into nitric acid. In peace time 550,000 tons of ammonium sulphate were produced annually in Germany, but this output was reduced once war was declared. As this substance is a by-product in the manufacture of gas and cast-iron, people in Germany were instigated to use gas and coke instead of coal, and by such means an annual output of 250,000 tons of ammonium sulphate was attained. The problem of converting the ammonia into nitric acid was solved by the Frank and Caro and the Kayser processes. A French chemist, Kuhlmann, had discovered that ammonia is oxidised to nitrogen peroxide when mixed with air and passed over warm, finely divided platinum. The reaction was employed on a commercial scale by Ostwald, and improved both by Kayser and by Frank and Caro. By the end of 1915 the Anhaltische Maschinenbau Society of Berlin had established thirty installations for the conversion by Frank and Caro's process, and these had a capacity of more than 100,000 tons of nitric acid per month. But this was only one of the methods adopted. Given a cheap source of electrical energy, it was known to be commercially practicable to prepare nitric acid by the direct oxidation of nitrogen in the electric flame, and this process had been established in Norway by Birkeland and Eyde, who used the waterfalls as a source of energy. The Germans have established a factory employing Pauling's process (a modification of that of Birkeland and Eyde) at Muhlenstein, in Saxony, in the neighbourhood of the lignite beds, which form the source of energy, and this has an annual output of 6000 tons of nitric acid.

The third principal method adopted for the preparation of combined nitrogen was the direct synthesis of ammonia. Bosch and Mittasch, two chemical engineers of the Badische Company, had adapted Haber's synthesis to industrial conditions, and the company had established a factory with an annual output of 30,000 tons of synthetic ammonium sulphate. In April, 1914, the company increased its capital in order to raise the output to 130,000 tons, and after the battle of the Marne it was subsidised by the German Government to increase the production to 300,000 tons.

Before the war the production of cyanamide in Germany was comparatively small, but it has increased largely under Government stimulus. The cyanamide manufacturers desired a monopoly, but this was opposed by the Badische and other companies and by the gas manufacturers, and the project seems to have been abandoned.

In the direction of the manufacture of manures, it was necessary to economise sulphuric acid, so ammonia was neutralised with nitre cake, and the resulting mixture of sodium and ammonium sulphates was mixed with superphosphate. Moreover, it was found that superphosphate will absorb gaseous ammonia, and although the calcium acid phosphate is thereby converted into the insoluble tricalcic phosphate, it is formed in an easily assimilable condition, and the product is found by experience to act both as a nitrogen and phosphorus manure.

Prof. Matignon seems to be correct in claiming that chemistry has saved Germany from disaster.

E. H.

SUBSIDENCE RESULTING FROM MINING.

THE very important question of subsidence resulting from mining operations has recently been discussed in a bulletin issued by the Engineering Experiment Station of the University of Illinois. The report is prepared by Dr. L. E. Young, mining engineer for the Illinois Coal Mining Investigations, and Prof. H. H. Stock, professor of mining engineering in the University of Illinois, under a co-operative agreement between the University, as represented by its Engineering Experiment Station, the Illinois State Geological Survey, and the United States Bureau of Mines. Apparently, whilst we in this country content ourselves with talking about the need for closer co-operation between the technical faculties of our universities and the industries concerned, in America such co-operation is already an established fact, and reports such as the present one show evidence of its value.

This bulletin is merely a preliminary one, presenting a complete and concise account of what is known up to the present on the subject of subsidences due to mining operations, and the authors have done their work in a most thorough and painstaking fashion, and have missed very little of the published information on the subject, in spite of the difficulty of bringing it together from the large number of scattered records through which it is disseminated. It need scarcely be said that the subject is one of the greatest importance in this country, where so many of our most densely populated industrial centres are situated upon the coalfields themselves. The problem whether large masses of coal should be left in the form of supporting pillars, and thus be permanently lost to the nation, or to what extent it is advisable to remove them, with the risk, or even with the certainty, of causing a certain amount of surface damage, is obviously one of first-rate importance, especially at times like the present, when the proper conservation and full utilisation of our natural resources demand our utmost attention.

Messrs. Young and Stock have contented themselves with summarising the theories on subsidence promulgated by various writers, notably the Belgian, French, Prussian, and Austrian theories; there cannot really be said to be any British or American theories, although various British engineers have proposed formulas, notably for determining the angle of "draw," and the size of the coal pillars that must be left in order adequately to protect any given area of surface; the wide divergence of these various formulas is well shown by a diagram, reproduced from a paper by Prof. George Knox, which shows that some of these give results ten times as great as those given by others.

The introductory notice to the present bulletin suggests that the Illinois authorities propose to study the problem in a systematic fashion, by taking careful levels across selected groups of mines at regular intervals, and simultaneously noting the conditions of the underground workings, such observations to be continued for a number of years, when it may be hoped that it will be found possible to correlate surface subsidences and underground workings, and thus to obtain data that will enable the conditions of maximum economy to be determined. This is a subject that might with the greatest advantage be taken up on similar lines by one or other of the committees formed to deal with industrial research in this country.

H. L.

FURTHER STUDIES IN PLANT GENETICS.

THE September number of the *American Naturalist* (vol. l., No. 597) is devoted to studies of inheritance in plants. Dr. H. H. Bartlett writes on "The Status of the Mutation Theory, with especial reference to Œnothera." He "finds incredible the arguments that have been brought forward in favour of the idea that mutation and Mendelian segregation are the same." Nevertheless, it still remains to be decided "whether or not mutation is always, or ever, conditioned by previous hybridisation." Dr. O. E. White describes some researches in continuation of Mendel's original subject—the inheritance of cotyledon colour in Pisum. Alleged differences between the colour of segregated seeds of the F_2 generation and those of the original parents are attributed to environmental changes: yellow-cotyledon varieties may produce green seeds because of immaturity, absence of sunlight, or excess of moisture, while green-cotyledon varieties may fade to yellow or yellowish-green through excess of sunlight. In one variety—"Goldkönig"—with yellow cotyledons, the yellow colour is, contrary to the usual rule, recessive to green. This form "may be regarded as lacking both the factor for causing green pigment and the factor for causing that pigment to fade on the maturity of the seed." When "Goldkönig" is crossed with yellow-seeded varieties in which yellowness is dominant, the F_1 generation are all yellow-seeded, and the F_2 generation are segregated in the proportion of three green to thirteen (9+3+1) yellow.

"Inheritance of Sex in the Grape" is discussed by W. D. Valleau. Wild vines bear flowers which are functionally either male or female, but the carpels or pistils are respectively present in a reduced condition; the plants are thus transitional between the hermaphrodite and the diœcious form. Functional hermaphrodites, however, appear in cultivation. Breeding experiments suggest that "both the staminate and functionally pistillate vines carry the determiners for femaleness and maleness, respectively, partially suppressed."

The *Journal of Genetics* for September (vol. vi., No. 1) is completely occupied by Prof. A. H. Trow's analysis of form and inheritance in the common groundsel (*Senecio vulgaris*). In a long paper he discusses the number of nodes and their distribution along the main axis in this species and its segregates. Dividing the families of plants studied into "low" (9–16 nodes), "medium" (18–26 nodes), and "high" (30–31 nodes), he finds that medium characters are dominant to both low and high, and infers, therefore, the existence of two pairs of alternative determinants. However, from the cross "medium" × "high" there emerge families with from 36–39 nodes, forming a "very high" group; this "segregates out from 'high' as a recessive." From the cross "low" × "high" other anomalous results were obtained, and the author foresees many years' work before definite conclusions can be reached. In a short paper Prof. Trow discusses the inheritance of "albinism" in groundsel; he finds that in some forms the expected ratio of green to white plants as 15 to 1 is obtained in the F_2 generation; in others it is unaccountably departed from.

THE ORGANISATION AND DEVELOPMENT OF CHEMICAL INDUSTRY AND RESEARCH.[1]

SOUTH AFRICA is a country which has hitherto existed, and still does at the present moment exist, on its rich stock of raw materials. Its exports, in addition to the raw products of agriculture, are chiefly metals, crude and unrefined, and diamonds uncut. The chief chemical industry is the preparation of raw gold bullion from the quartzitic ore of the Transvaal. This is carried out in three operations—the first being fine pulverisation by mechanical means; the second, amalgamation with mercury; and the third, solution of the unamalgamated gold still remaining by means of sodium cyanide solution, followed by reprecipitation with excess of zinc shavings and final treatment of the metal, so as to get rid of as much of the base metal present as possible before pouring into commercial bars. The major portion of the plant necessary for these operations consists of iron and steel, and the raw materials for their manufacture exist in comparative abundance in the Transvaal. A thorough and scientifically com-

[1] From the presidential address delivered to Section B—Chemistry, Geology, Metallurgy, Mineralogy, and Geography—of the South African Association for the Advancement of Science at the Maritzburg meeting, July 4, 1916, by Prof. J. A. Wilkinson.

plete investigation of these has not yet been undertaken, but in the interests of the country at large and not merely of the metal industry this should be one of the first, since iron is the most important necessity for industrial progress of every kind. The normal value of the iron and steel imports into the country annually is almost one million pounds, and with an expanding population this must rapidly increase, as there is, practically speaking, no industry, operation, or even trade for which it is not necessary in some form or other. One small manufactory is working at Vereeniging, but this is not engaged in the production of cast iron from the raw ore and its subsequent conversion into steel of known and definite composition; and, further, what is being done is not, so far as I am aware, under strict chemical control, by which means alone can proper and definite results be achieved.

The function of the chemist in the control of matter and its energy content is imperfectly, if at all, understood, even in industries such as this, where one might at least expect that the methods which have been successful, and hence adopted in their entirety in other countries, would be followed here.

The second process mentioned involves the use of mercury, which must necessarily be imported at present. The case, however, is otherwise so far as sodium cyanide and zinc are concerned, the imports of which amount to half a million sterling, and both of which can be manufactured here. The former can be obtained indirectly from atmospheric nitrogen through cyanamide, which would find great use as an artificial manure, and thus stimulate agricultural progress. In point of fact, the Rand may be said to be primarily responsible for this great and growing industry, since it was the search for a new method of preparing cyanide that first discovered the reaction. Zinc blende is also found native, and the winning of the metal offers no great difficulty.

The mining of gold ore or other mineral deposits would be, practically speaking, impossible without the use of explosives, and to meet this necessity three large explosive factories have been established in the country, all of which are entirely dependent for their raw materials on other countries. The value of these imports in 1913, the last completely normal pre-war period, was as follows:—Sulphur, 78,386*l.*; nitrates, 235,984*l.*; glycerine, 563,014*l.*; or a total of 877,384*l.*, iron pyrites not being given. Of these, no large deposits of sulphur or pure pyrites are known to exist in South Africa, but nitric acid and its salts can now be prepared in any quantity from the nitrogen present in the atmosphere, and glycerine is a by-product in the manufacture of soap, factories for which have recently been erected here.

The production of the oils for the latter purpose would necessitate the provision of artificial fertilisers, an industry of prime importance for the progress of every branch of agriculture. Happily the problem of the transference of atmospheric nitrogen to the requirements of the soil, first stated by Sir William Crookes in his classic address to the British Association at Bristol in 1896, has now been solved in various ways, two of which have been indicated, and would therefore serve, if established, a double function. Unfortunately deposits of potassium salts or mineral phosphates of any large extent and degree of purity have not hitherto been discovered here; but in this respect South Africa is in no worse case than most other countries, and hence this problem is by no means insoluble. The manufacture of superphosphate, however, could and should be undertaken, the value imported in 1913 being 95,273*l.*, and of raw phosphates only 1705*l.* It should also be mentioned in this connection that more than 13½ million pounds of basic slag, a by-product of the steel industry, were imported in 1914—another valid argument for the creation of the latter. With regard to potassium salts there are no deposits of easy chemical access outside the celebrated Stassfurt beds, but there are sources within South Africa which could be realised if the necessity arose.

Returning again to the consideration of the exports of the country, we find that copper ore and matte, tin ore, lead ore, and raw asbestos, along with coal and diamonds, form the remainder. It is, indeed, a sad reflection that we must needs export these raw materials, as such, without making even the slightest attempt to extract their valuable contents or work them up in any manner whatsoever, but rather in addition pay freightage on admixed dross. A pitiable confession of failure in very truth, since the paths are easy and rendered still more so by the value of the prospect! If the Chinaman and the Malay are capable enough to win the tin from its ore, why should we hesitate?

A successful industry must be founded upon, and controlled by, true scientific knowledge, and the transformations of matter form the province of the chemist, whether it be the manufacture of the food on which we live, the bricks, lime, and cement with which we build our homes, the medicines to cure our infirmities, the paper and ink to disseminate and preserve our ideas, or the explosives we use as weapons of destruction.

South Africa has been endowed beyond measure with rich stores of useful minerals, and whilst these are being exploited she is dependent entirely on others to supply her most elementary wants. Thoughtless criticism might saddle me with lack of a due sense of proportion in that the economics of these possible industries have been left wholly out of consideration. In this regard I maintain that the duty of a country is to its own people, and the primary necessity is to furnish, so far as it can do so, its own immediate requirements. South Africa is not nearly at present so self-contained as is possible, and hence the necessity for the establishment of chemical industry in our midst is, in every sense, a vital one. Private enterprise has to some extent made a beginning, as illustrated by the success of the soap and cement factories established within the last few years, but the coal industry is still confined to the utilisation of the raw material accompanied by the waste and loss of its most valuable by-products.

There are two points of view which make this particular industry of supreme importance—first, the defence of the country; and, secondly, conservation of its natural resources. Phenol, benzene, and toluene are three of the most important distillates obtained from coal tar, and apart from their own use as motor fuels, when treated with nitric acid these substances yield on one hand the highest explosives at present known, and on the other the mother substances for the preparation of dyes, drugs, and perfumes.

Lord Beaconsfield once said that the prosperity of a country could be gauged by the extent of its chemical industry, a statement which was received by his contemporaries with scorn and derision. The years which have elapsed since then have proved, as is often the case, that his words were not the accident of an impulsive verbosity, but the reasoned verdict of a deliberative mind. The realisation of this dictum has been most profoundly shown by the stupendous progress in chemical industry made by Germany during the last forty years, especially in the domain of organic chemistry.

It may appeal to some to state here that Germany's great chemical factories, each with a capital of from one to two million pounds, paid dividends out of profits varying from 14 per cent. to 30 per cent. in 1913, and as a specific example may be quoted the firm of F. Bäyer and Co., of Elberfeld, which on a capital of 1,800,000*l*. made a net profit of 838,092*l*., figures which remind one of a rich Transvaal gold mine.

If we leave out of consideration the exploitation of her metalliferous minerals, which will in the not far distant future be but memories, South Africa may be considered as a country where chemical industry is, practically speaking, non-existent. Hence, to prepare the nation for the future prosperity we should so earnestly desire to see attained, the obligation rests upon this generation to develop, at the earliest possible moment, those chemical industries, in the first place, needful for its own existence, and only when this has been achieved to attempt an expansion beyond its borders.

The second portion of my theme relates to the organisation of chemical industry and the part which research should play therein. Reference has already been made to the enormous progress which Germany has made in this direction, but, unfortunately, it has required a war of the present dimensions to pierce the armour-plated conservatism of the governing classes in England, and, even yet, it is a matter of grave doubt whether much impression has been made.

By way of preface it would, perhaps, at this stage be of interest to take a few illustrations of the manner in which some of Germany's chemical industries have risen to their present state of flourishing activity, and although the story is an oft-repeated tale, constant reiteration does not yet seem to have brought home the lessons it teaches. I shall first refer to the synthetic preparation of indigo.

The synthesis of indigo was first accomplished by Nencki in 1876, but it was not until Bäyer and his pupils had five or six years later thoroughly investigated and proved its constitution that simple methods for its synthesis became available. The next step, namely, the translation of the laboratory methods thus discovered into commercially economic processes, proved a source of extreme difficulty, in which success was only achieved after nearly one million pounds had been spent on innumerable and laborious experiments, and at the end of seventeen years' work, artificial indigo prepared from the naphthalene of coal tar being first put on the market in 1897. If anything can excite our admiration, surely this example of one of the finest industrial achievements known to science should do so. The result of this vast amount of labour and expenditure is shown in the following table given by Prof. P. F. Frankland in 1915 in a paper on the chemical industries of Germany:—

Indigo.

	British East Indies		Germany	
	cwt.	Value of exports £	Imports £	Exports £
1896	188,337	3,569,670	1,036,000	319,550
1899	135,187	1,980,319	415,450	392,250
1902	89,750	1,234,837	184,350	923,100
1905	49,252	556,405	60,100	1,286,050
1908	32,490	424,849	44,100	1,932,750
1911	16,939	225,000	22,300	2,091,500
1913–14		60 to 70,000		

In 1895–96 the acreage under cultivation was approximately 1,400,000 acres, and on December 31, 1915, the *Indian Trade Journal* (Calcutta) published an estimate that the total area in 1915 was 314,300 acres, as compared with 148,400 acres in 1914, this increase being due to the high prices ruling on account of the war and the cessation of the German industry. The total yield was estimated at 39,000 cwt., as against 25,200 cwt., the revised estimate for 1914–15, and the average output per acre 14 lb., as against 19 lb. in the preceding year. The price of indigo (100 per cent.) in 1897 was 16*s*. per kilo, and in 1913 7*s*.

The knowledge of what was being done in Germany prior to the advent of the marketing of synthetic indigo was not unknown to the Indian planters, but they were sceptical of the results, many believing that it was an impossibility to prepare the substance from coal tar, with the result that, practically speaking, they took no steps whatever to improve either the yield per acre or the quality of their finished product. Having thus lulled themselves to sleep, their awakening in 1897, when synthetic indigo was placed on the market at a price much below that demanded for the natural substance, was somewhat of a bolt from the blue. Owing to the stress of the competition, which they at last realised would take place, they attempted some improvements; but, as seen above, they were somewhat belated. It is difficult to predict with any degree of accuracy whether the natural product would have been entirely ousted had there been no war, because tradition is hard to kill, and there are still dyers who prefer to use the natural dye. On the other hand, there can be no doubt that the production of the latter would have been insignificant in comparison with that of the synthetic material, as happened in the previously well-known and analogous case of the dye alizarin, formerly extracted from madder-root. The indigo fields would have shared the same fate as those of the madder.

The tannin industry in this province is in a similar position to that in which the indigo industry found itself about 1880–82. The master synthesis of tannin was effected in 1913 by Prof. Emil Fischer and Dr. Karl Freudenberg in Berlin. The formula of tannin is now known with a great degree of certainty, and the researches are still being continued. The next step is the commercial utilisation of this knowledge, which means the synthetic production of artificial tannin on a commercial scale from raw materials found in Germany. This, as stated above, in the case of indigo took seventeen years' work and one million pounds in money.

The value of the tannin bark industry to Natal is approximately 300,000*l*. per annum.

The problem which confronts the industry in this province is therefore how, whilst there is still time, to protect it against any competition which might possibly arise from the presence on the market of an artificial substitute. The answer to this may be put in the form of a question. If, during the years 1880–96, the indigo planters of India had invested one million pounds in the scientific investigation and development of their industry, would they have for one moment feared to have faced competition at the end of that period? This would have meant an expenditure to the extent of between 50,000*l*. and 60,000*l*. per annum for seventeen years invested so as to obtain results which would not only have made the future secure, but at the same time would also have increased the output annually during the period of its outlay. In point of fact, it would in all probability have placed vegetable indigo beyond competition. Moreover, just as India was compelled to export the indigo which she grew, so also must Natal at present export her tannin bark until the chemical industry of leather manufacture be established here, in which case the leather would be required to stand the strain of the competitive market. In passing, it may be noted here that of the twenty-five large classes into which Germany officially divides material connected with chemical industry, one of the divisions is "tanning extracts" and another "dyes and dye material."

In both these industries, the production of indigo and tannin, the problems are so very similar that the lesson of the former should be the incentive for the latter in the superlative degree. It is oft-times the wail of the profitmonger that the industry will not "stand the expense," and in annual balance-sheets we look in vain for the record of "investments" in the future of the industry itself. The work of the botanist and chemist is the corner-stone upon which these organisations must not only be built up initially, but also must be conducted throughout. Each must have had the highest training possible, must be thoroughly skilled in his work, thoroughly conversant with all that has been done, and must be selected for the work on these grounds and no other. They must be provided, so far as they can be, without stint or question with all that they deem necessary for the prosecution of their investigations, and results will follow. The days of rule-of-thumb experience, the legacy of a former generation, are as dead as the dodo, and he who still clings to them will be left behind his more enlightened contemporaries as the cab-horse is outdistanced by the aeroplane.

Chemical industry requires a complex organisation beginning with the chemist and ending with the patent agent and advertising salesman, sometimes also the machinery for running to earth patent thefts and fraudulent imitations.

But at the outset the chemist is the most important factor in chemical industry, because it is in the first degree upon his work that the operations depend. This may seem to some a self-evident truth, but, as a chemist, I can give the assurance that it is, unfortunately, otherwise in most instances in South Africa, with, of course, results which are easily foretold; in fact, this is one of the main reasons why our chemical products are not up to the standard of imported goods. Given the chemist and the problem of the industry to be undertaken, the next procedure is its complete investigation—in other words, to ascertain as much as possible of what is already known, for which access to a good technological and scientific library is required, and then to carry out, after complete analyses of the raw materials have been made, such tests on a small scale as will give some clue to the difficulties to be encountered on the large scale, for which purpose the establishment of a properly equipped laboratory is indispensable. If these meet with success, and the industry is undertaken, the laboratory can be utilised to aid the engineer in selecting the best materials of construction, until such time as it is necessary for controlling the daily routine. At the same time, it should serve as an instrument of research with the view of improving methods of daily control, methods of manufacture, and the discovery of new methods or processes. Whether any or all of the functions be efficiently performed depends on the equipment and staff of the laboratory, but more especially on the man who is the head. Routine operations soon become to a certain extent standardised, and can be carried out efficiently by well-trained assistants, but research work of the beneficial kind can only be effectively performed by the head of the laboratory in touch with every phase of the manufacturing process, or by chemists specially appointed for this purpose working independently. The sad aspect of the special cases with which we are concerned here is that it has hitherto been considered sufficient for these industries to employ business men and engineers alone, all excellent in their own lines, but quite unfitted to govern an industry the fundamental basis of which is a chemical process. This, in fact, is one of the chief reasons why England lost her supremacy and was outstripped by Germany, and the appreciation of this fact at the present moment by the Americans is manifesting itself in a keen endeavour to take the lead.

Another reason is that Germany has appreciated to the full the value of scientific research and education, and it is necessary for us to realise this in like measure if we are to utilise efficiently the abundance of raw material found in this country. We have seen above in the case of one industry the vast sums of money the Germans were willing to spend to effect its capture, and this was strictly in keeping with their general policy, both on the part of the State and the individual. That the Empire is beginning at last to appreciate this is shown by the steps being taken in England, Canada, and Australia. Little has, as yet, been done in England compared with what we should expect, but this may be partly accounted for by the war. The Canadians, at the instigation of Lord Shaughnessy, have made a beginning in the establishment of the Canadian Research Bureau at Montreal, thus seconding the excellent work which has been accomplished in recent years by their Mines Department. The proximity of the United States will doubtless assist in making for efficiency, as the work of the scientific departments attached to their bureaux of agriculture, geology, mines, commerce, standards, etc., is too well known to need description. The Australian Government has endowed a similar institution, the Commonwealth Institute of Science and Industry, to the extent of half a million pounds as a beginning, the object in both cases being the development of the natural resources for the benefit of the country in the first, and of the Empire in the second, place. So far as I am aware, in South Africa nothing has yet been done in this direction other than the meeting of the scientific societies of the Rand held recently in Johannesburg, which laid stress on this matter and formed a committee to further the project.

No opportunity like the present has ever before presented itself, and the cessation of the war will witness the still fiercer struggle of industrial competition, for which we must gird on our armour. At present we are, as I have shown, exporting our raw materials and importing the articles manufactured from them; hence our first and foremost need is to attempt to make ourselves independent of others, so far as our own wants are concerned. For this purpose research is necessary, and, in my opinion, the prime mover must be the State, since its proper execution demands, if performed efficiently, an organisation which is beyond the scope of the individual. It would take too long to enter fully, as the subject most rightly merits, into all the details of its requirements, and I shall therefore content myself with a brief summary of the most essential considerations and necessities. In the first place, however, I desire to explode a popular fallacy, that there are two kinds of research, which have been miscalled pure and applied research. They correspond to the undignified and unworthy divisions into which even science itself has been classified. If research be undertaken, as it is, to thrust back the boundaries of the unknown, and to widen the areas of existing knowledge, then, no matter if the purpose for the moment be, in a sense, the abstract, such as the proof or establishment of a law, principle, or hypothesis, or the concrete, such as we find exemplified in the successful development of the contact method of manufacturing sulphuric acid, as a result of the commercial preparation of indigo, it is somewhat of an anachronism to draw a sharp line of division. More especially is the practice to be condemned, since in the popular mind research of the former kind is supposed to have no utility whatever, whereas without it the latter would be absolutely impossible, and hence in any scheme which may be put forward it must claim the part to which it is justly entitled. The steps which are necessary here for this work are as follows:—

1. *Preliminary.*—(*a*) A complete census of existing laboratories and workers; (*b*) a complete census of facilities for the education of scientific workers of all kinds and classes; (*c*) a complete census of all manufactures, their location, methods, raw materials, and output; (*d*) a complete census of all known existing raw materials of the country, which might be put to use for manufacturing or other purposes; (*e*) the collection of information from, and reciprocity with, organisations having similar objects throughout the Empire, and in Allied or friendly States.

2. *Standardisation.*—(*a*) Of scientific instruments of all kinds, whether used in laboratories or works; (*b*) and scientific control of apparatus and materials required in research.

3. *Initiation.*—The appointment of a central council which shall (*a*) receive and suggest problems for research; (*b*) by the organisation of manufactures of the same or similar products, ascertain what is necessary for their progress; (*c*) keep in close touch with all the universities and scientific societies in the country.

4. *Assistance.*—(*a*) By endowments to laboratories and workers; (*b*) by the collection, publication, and dissemination of information; (*c*) by the establishment and endowment of libraries; (*d*) by the advancement of scientific education in schools, colleges, and universities; (*e*) by increasing the equipment, etc., of existing laboratories, and the establishment of new ones; (*f*) by the provision of laboratories for carrying out suggested industrial processes on a small commercial scale with the sanction and approval of the central council.

5. *Co-ordination.*—(*a*) By annual reports from all laboratories; (*b*) by bringing all workers in the same branch together; (*c*) by the dissemination of information respecting similar work being done elsewhere; (*d*) by annual congresses of all scientific societies; (*e*) by annual congresses of manufacturers and trade interests.

If research should show that new industries can be established in this country with advantage, of which I cannot entertain the slightest doubt, it will be possible, by legislation if necessary, to assist their inception by the establishment of industrial banks which would advance funds for the purpose of financing them in their early stages, provided that the methods to be employed had been sanctioned by a competent authority as mentioned above. In addition to this, protection could be given, for a time at least, by patent laws, which, if unsuitable, could be amended, but this is a shield upon which too much reliance should not be placed.

History has shown that wars in the past have proved a stimulus to industry. There is no valid reason to believe that the present one will prove an exception to that rule, and hence the urgent necessity for the immediate organisation of all our resources, even were that not desirable on other more fundamental grounds. Co-operation is the key, and science, education, commerce, and manufacture must form one organic whole, each contributing its share to the common stock, their united effort for the common weal.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—The committee for geography has issued its third annual report, 1915–16. The school remains under the acting directorship of Mr. H. O. Beckit pending the appointment of a successor to the late Dr. A. J. Herbertson. The number of students devoting the whole or a great part of their time to geography during the year was twenty-three, and there was also a number of part-time students. Despite depletion of the staff, the whole work of the school was successfully carried out, thanks to the assistance of past students. Dr. R. N. Rudmose Brown was appointed an examiner in succession to Mr. A. R. Hinks, whose term of office had expired. The eighth biennial vacation course, held last August, was attended by 125 students.

AT a conference of directors of public instruction held at Delhi on January 22 Lord Chelmsford, Viceroy of India, in an address of welcome referred to the paramount importance of education in India. From the *Pioneer Mail* we learn that, speaking of technical training, he said at the present moment, when the Government of India is hoping for a lead from the Industrial Commission in the direction of industrial development, technical training looms large in the educational sphere. The term "technical" should, he urged, be used in its widest and not its narrowest sense—that is to say, the claims of agricultural and commercial education should not be overlooked. "There are," he continued, "some who say we have nothing to teach the men on the land in this country. I cannot claim to talk with authority on such a question, but having seen something of the work of scientific agriculture in other parts of the world, I take leave to doubt such a statement. The great advance made by scientific agriculture during the last half-century justifies us in pressing forward with a policy of agricultural education, and though you would not claim to speak as experts on the agricultural side, your educational experience qualifies you to give us useful hints with regard to an advance along this road." Referring to the commercial side of education, the Viceroy expressed surprise to find how little has been done, in spite of India's large and growing commerce, to develop commercial education. Compared with a technical institution, a commercial school is, he said, a relatively cheap institution, and one would think that there was a great opening in big towns for good commercial schools. The second point on which Lord Chelmsford laid emphasis is that in technical training in its narrower sense we must not lose sight of workshop practice in outside works. Laboratory training, however good, is no real substitute for the discipline of the workshop. Technical training divorced from workshop experience is likely to prove a snare and a delusion.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, February 22.—Sir J. J. Thomson, president, in the chair.—S. A. **Smith**: The fossil human skull found at Talgai, Queensland. This is a description of the fossil human skull that was shown by Profs. Edgeworth David and J. T. Wilson at the meeting in Sydney of the British Association. Before the specimen could be studied it was necessary to clear away a hard mineral incrustation of carbonate of lime which was coloured with iron salts. It was then found to be the highly fossilised and much fractured skull of a male youth not more—probably some years less—than sixteen years of age. The brain-case, the capacity of which was at least 1300 c.c., is well within the range of variation of modern aboriginal Australian skulls, to which it presents a very striking similarity in general conformation, as well as in respect of the distinctively Australian characteristics. But the facial skeleton reveals an important contrast. The exceptionally large teeth—the canines especially—have been responsible for a great development of that portion of the alveolar process which lodges the incisor, canine, and premolar teeth. In respect of this feature the Talgai skull is probably more primitive and ape-like than that of any other known specimen belonging to the human family, excepting only the Piltdown skull, the dental arcade of which that of the Talgai skull, in spite of its immaturity, nearly approaches, not only in actual size, but also in its relative proportions. The fact that the brain-case had already reached the stage represented in the modern Australian aboriginal, while the face still retained much of the grossness and uncouthness of the ape's, is a further confirmation of the view that, in the evolution of man, the brain first acquired the human status and the refinement of the features came afterwards.—Dr. C. **Chree**: The magnetic storm of August 22, 1916. The paper gives an account of a magnetic storm, accompanied by aurora in Scotland, which occurred on August 22–23, 1916. A comparison is made of the results derived from the magnetic curves at Kew and Eskdalemuir Observatories. The disturbance was much larger at the latter station than at the former. During, however, the most disturbed period, both places afforded a conspicuous example of the type of storm in which the direction of the disturbance vector shows a rapid rotation. During this period the disturbance vector diagram in the horizontal plane was described continuously in a counter-clockwise direction, nearly a complete revolution being effected in the course of one hour.—Prof. W. H. **Young**: The ordinary convergence of restricted Fourier series.

Optical Society, February 8.—J. W. **French**: More notes on glass grinding and polishing. Glass is abraded by splintering, and the efficiency of an abrasive is determined by the form of the grains, their hardness, and their cleavage. A grain that cleaves and presents flat surfaces loses its cut, whereas one that retains its original form when broken suffers only a temporary loss of cut during the grinding process. When precautions are taken to prevent clogging of the abrasive, the amount of glass removed is directly proportional to the relative speed of the grinding tool and the glass. In lubrication too much water has the same bad effect as too little water. A new method was described of comparing the qualities of ground glass surfaces. Polishing was divided into wet polishing, in which material is principally removed, and dry polishing, in which the surface sleeks are filled or closed. A mechanical theory of polishing was elaborated. Rouge consists of grains of ultra-microscopic size. These grains appear to gather, snowball fashion, into lumps of about two wave-lengths diameter, and in this condition they plough grooves in the surface layer. During the second stage these grooves are closed up, thus improving the brilliancy of the surface. When a rounded point is drawn heavily over the surface, a series of semicircular cracks is produced. The cracking takes place on the tension side, and not on the pressure side; the cohesion of the surface layer is less than that of the underlying material. The diameters of the cracks produced have a definite relationship to the pressure. With the semicircular cracks there are associated two series of tangential cracks. Fire-glazed surfaces and fracture-glazed surfaces give similar results; also polished quartz; but the natural polished surfaces of crystals resulting from crystal growth do not exhibit sleeks or surface cracks, thus suggesting the non-existence of a surface layer.

Linnean Society, February 15.—Sir David Prain, president, in the chair.—J. H. **Owen**: The home-life of the sparrow-hawk (*Accipiter nisus*, Linn., Pall.). After a brief description of the life of the birds from autumn to spring, an account was given of the nesting habits, from the selection of the nesting site in March to the scattering of the young at the end of July or in the early part of August. A series of lantern-slides was exhibited to illustrate various features of the nesting habits and growth of the young. Of these, particular interest attached to a series showing the various methods of brooding in wet weather and the care taken over the welfare of the youngest nestling. Another series showed the young able to feed themselves, while the hen keeps watch above the nest during the course of the meal until the young are all asleep after the food is finished. Slides were shown of the visits of young and the old birds to the nest after the young had left.

Royal Microscopical Society, February 21.—Mr. E. Heron-Allen, president, in the chair.—Drs. A. H. **Drew** and Una **Griffin**: The parasitology of *Pyorrhoea alveolaris*. The authors stated that careful microscopic examination of material from cases of pyorrhœa showed that, in the great majority of cases, at least two species of Amœbæ were present. One of these Amœbæ appeared to be a semi-parasite partially modified by anaerobic life in the pockets around the teeth. When stained by the iron-hæmatoxylin method, this form showed a valkamfia type of nucleus; it also possessed a flagellate phase in its life-cycle. The name *Amoeba buccalis* was proposed for this type, which had been successfully cultivated, after concentration of the cysts by Dr. Cropper's method. The other species was a true Entamœba, and corresponded to *Entamoeba gingivalis*. Two new flagellates had been found in the pockets, together with at least six species of spirochætes.

Mathematical Society, March 1.—Mr. G. H. Hardy, vice-president, in the chair.—A. E. **Jolliffe**: Some properties of a quadrangle formed by the points of contact of the tangents drawn to a nodal cubic from any point.—E. H. **Neville**: Indicatrices of curvature.

PARIS.

Academy of Sciences, January 15.—M. d'Arsonval in the chair.—G. **Bigourdan**: The first scientific societies of Paris in the seventeenth century.—E. **Ariès**: The law of molecular entropy of fluids taken at corresponding states. The application of the equation of state deduced in an earlier paper.—W. **Kilian** and J. **Révil**: The history of the Arc valley at the Pleistocene period.—A. **Khintchine**: Asymptotic differentiation.—H. **Arctowski**: The heliographic positions of the sun-spots and magnetic storms. After a historical summary of the previous work on this subject the author especially examines the hypotheses of Veeder, Ricco, and Terby. Using data for magnetic storms from observations made at Porto Rico and Greenwich, and Greenwich figures for sun-spot areas, the conclusion is drawn that Veeder's hypothesis is completely out of accord with the observed facts. Terby's hypothesis is equally faulty, but the views of Ricco are partially verified.—J. **Deprat**: The Ordovician and Gothlandian in the north of Tonkin and the basin of the upper Iou-Kiang.—M. **Raclot**: The origin of terrestrial magnetism. Assuming that the internal mass of the earth consists of an alloy in which iron predominates, then, on account of the high temperature, the iron under the continents would be above the critical point at which magnetic properties disappear (750° C. to 900° C.). Under the oceans, on the contrary, by reason of the more rapid cooling assumed by Faye, the superficial layer could have arrived at a temperature below 750° C., and, in consequence, a certain thickness of this could be magnetic. Wulde has shown that if a globe is covered with thin sheets of iron covering the ocean areas, then the distribution of magnetism on this globe reproduces terrestrial magnetism.—L. **Bordas**: Biological and anatomical observations on some Cetononæ.—H. **Vincent**: The prophylaxy of the infection of wounds received at the front. Comparative study of some antiseptic agents. Trials have been made of sodium fluoride, sodium formate, zinc chloride, calcium hypochlorite, boric acid, borax, copper sulphate, ferrous sulphate, potassium permanganate, and, as an accessory, iodoform. The iodoform, borax, and boric acid were applied in powder; the remainder also in powdered form, but diluted with 90 per cent. of inert powder. Iodoform, ferrous sulphate, boric acid, borax, potassium permanganate, formate of soda, and zinc chloride proved to have insufficient bactericidal power. Sulphate of copper and sodium fluoride have strong antiseptic properties, but are too toxic. A mixture of calcium hypochlorite (10 parts) and dry powdered boric acid (90 parts) is finally recommended for first-aid treatment. It possesses the necessary bactericidal power, gives no pain, and is hæmostatic on account of the calcium chloride it contains. Details of the results obtained by the use of this powder will be given later.—L. **Rompant**: The preservation of eggs.

BOOKS RECEIVED.

Year-Book of the Scientific and Learned Societies of Great Britain and Ireland. Thirty-third annual issue. Pp. vi+336. (London: C. Griffin and Co., Ltd.) 7*s*. 6*d*. net.

Minor Surgery and Bandaging (Heath-Pollard) for the Use of House Surgeons, Dressers, and Junior Practitioners. By Dr. H. M. Davies. Sixteenth edition. Pp. x+476. (London: J. and A. Churchill.) 8*s*. 6*d*. net.

Community: A Sociological Study. By Dr. A. M. Maciver. Pp. xv+437. (London: Macmillan and Co., Ltd.) 12*s*. net.

Fundamental Conceptions of Modern Mathematics. Variables and Quantities, with a Discussion of the General Conception of Functional Relation. By R. P. Richardson and E. H. Landis. Pp. xv+216. (Chicago and London: The Open Court Publishing Co.) 1.25 dollars net.

DIARY OF SOCIETIES.

THURSDAY, MARCH 8.

ROYAL SOCIETY, at 4.30.—Some Effects of Growth-promoting Substances (Auximones) on the Growth of *Lemna minor* in Culture Solutions: W. B. Bottomley.—Some Effects of Growth-promoting Substances (Auximones) on the Soil Organisms concerned in the Nitrogen Cycle: Florence A. Mockeridge.

ROYAL INSTITUTION, at 3.—Sponges; a Study in Evolutionary Biology: Prof. A. Dendy.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Voltage Regulation of Rotary Converters: G. A. Juhlin.

FRIDAY, MARCH 9.

ROYAL INSTITUTION, at 5.30.—The Treatment of Wounds in War: Sir Almroth Wright.

MALACOLOGICAL SOCIETY, at 7.—The Genitalia of *Neanthinula aculeata*: Dr. A. E. Boycott.—(1) The Radula of the Genus Cominella; (2) A Colony of *Purpura lapillus*, with Operculum Malformed or Absent; (3) Note on the Adventures of the Genus named Lucena; (4) Note on the Da Costa Plates adapted for Rackett's Edition of Pulteney's Catalogues: B. B. Woodward.

ROYAL ASTRONOMICAL SOCIETY, at 5.—Occultations Observed at Eltham, 1915: M. E. J. Gheury.—Sun-spot Observations made at Rostow-on-Don: G. D. Tscherny.—(1) The Viscosity of the Earth. III.; (2) Two Applications of Jacobi's Integral: The Moulton-Gylden Theory of the Gegenschein, and Orbital Motion in a Resisting Medium: H. Jeffreys.—The Number of Stars of Different Magnitudes in the Hyderabad Astrographic Catalogue, Zone—17°: R. J. Pocock.—The Surface Currents of Jupiter during the Apparition of 1916-17: G. Bolton.—Preliminary Values of the Variations of Latitude at Greenwich for 1916 Royal Observatory, Greenwich.—(1) Differential Star Corrections; (2) Wireless Time Signals; Some Suggested Improvements: W. E. Cooke.—Frederick de Houtman's Catalogue of Southern Stars, and the Origin of the Southern Constellations: E. B. Knobel.—*Probable Paper*: The Opportunities Afforded by the Eclipse of 1919, May 28, for Verifying Einstein's Theory of Gravitation: Sir F. W. Dyson.

PHYSICAL SOCIETY, at 5.—To Measure the Pressure in a High Vacuum by Means of Logarithmic Decrement: Dr. P. E. Shaw.—(1) A Diffraction Colour Box; (2) Demonstration of Interference Effects with a Thorpe Grating: A. W. Clayden.

SATURDAY, MARCH 10.

ROYAL INSTITUTION, at 3.—Imperial Eugenics; Saving the Soldier: Dr. C. W. Saleeby.

MONDAY, MARCH 12.

ROYAL SOCIETY OF ARTS, at 4.30.—Memorials and Monuments: L. Weaver.

TUESDAY, MARCH 13.

ROYAL INSTITUTION, at 3.—Geological War Problems: Prof. J. W Gregory.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 2 (Joint Meeting with the Prehistoric Society of East Anglia).—Presidential Address: Dr. A. E. Peake.—Plateau Deposits and Implements: R. A. Smith.—The Position of Prehistoric Research in England: J. Reid Moir. At 5.30.—Some Prehistoric Questions: The President.—The Menhirs of Madagascar: A. L. Lewis.

WEDNESDAY, MARCH 14.

ROYAL SOCIETY OF ARTS, at 4.30.—The Supply of Fertilisers during the War: Dr. J. A. Voelcker.

GEOLOGICAL SOCIETY, at 5.30.

THURSDAY, MARCH 15.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: The Initial Wave Resistance of a Moving Surface Pressure: Prof. T. H. Havelock.—Experiments with Mercury Jets. (1) The Relation between the Jet-length and the Velocity of Efflux; (2) A Comparison with Jets of Other Liquids: Prof. S. W. J. Smith and H. Moss.—The Mode of Approach to Zero of the Coefficients of a Fourier Series: Prof. W. H. Young.—The Dissipation of Energy in the Tides in Connection with the Acceleration of the Moon's Mean Motion: R. O. Street.

ROYAL INSTITUTION, at 3.—Sponges: a Study in Evolutionary Biology: Prof. A. Dendy.

ROYAL SOCIETY OF ARTS, at 4.30.—The Industrial and Economic Development of Indian Forest Products: R. S. Pearson.

FRIDAY, MARCH 16.

ROYAL INSTITUTION, at 5.30.—Scientific Forestry for the United Kingdom: Sir J. Stirling Maxwell.

INSTITUTION OF MECHANICAL ENGINEERS, at 6.—Heat Treatment of Large Forgings: Sir W. Beardmore, Bart.—Heat Treatment of Steel Forgings: H. H. Ashdown.

SATURDAY, MARCH 17.

ROYAL INSTITUTION, at 3.—Imperial Eugenics: Saving the Future: Dr. C. W. Saleeby.

CONTENTS.

PAGE

Editorial and Publishing Offices:
MACMILLAN & CO., LTD.,
ST. MARTIN'S STREET, LONDON, W.C.

Advertisements and business letters to be addressed to the Publishers.

Editorial Communications to the Editor.
Telegraphic Address: PHUSIS, LONDON.
Telephone Number: GERRARD 8830.