THURSDAY, APRIL 26, 1917.

MEMORIES OF SIR DAVID GILL.

David Gill, Man and Astronomer. Memories of Sir David Gill, K.C.B., H.M. Astronomer (1879–1907) at the Cape of Good Hope. Collected and arranged by George Forbes, F.R.S. Pp. xi+418. (London: John Murray, 1916.) Price 12*s.* net.

LE volume publié par Sir David Gill en 1913 décrit son œuvre essentielle, mais ne renseigne pas sur l'homme même. Aujourd'hui, une plume autorisée fait connaître sa vaste intelligence, son caractère, son désintéressement, ses qualités du cœur. Un de ses amis, M. G. Forbes, en a peint un portrait dont les astronomes lui seront toujours reconnaissants. C'est la lecture de la correspondance largement reproduite dans ce livre qui l'a mis en état de pénétrer cette personnalité si ouverte et si franche. Gill était très réservé, et peut-être seule une femme connaît le bien qu'il a fait, révélé par des lettres dont la publication est impossible.

La formation, l'œuvre, le charme d'un véritable astronome, telles sont les trois parties de l'ouvrage. Le livre est d'une lecture entraînante. Gill a fait tant de choses, et si bien, que le lecteur non averti pourrait se croire en face d'une œuvre d'imagination. Mais c'est bien Gill que nous fait connaître M. G. Forbes. Nul doute qu'en France l'Amiral Mouchez et ses successeurs auraient donné à ce livre leur plus complète approbation.

David Gill naquit à Aberdeen, le 12 juin 1843, dans une maison d'horlogerie très prospère. Il y succéda à son père en 1869. Sa famille était très estimée. Sa mère, très intelligente, d'esprit large, active, enthousiaste, était fière de lui. Il l'adorait.

Ecolier, David, joyeux camarade, n'était pas un enfant prodige. C'est à Dollar, à quatorze ans, que se révélèrent ses aptitudes scientifiques. De 1858 à 1860, il assista à Aberdeen aux leçons de James Clerk Maxwell qui le distingua. Puis il parcourut en Suisse, en France, en Angleterre les centres horlogers, devenant un très habile artiste et se familiarisant avec la langue française. De 1863 à 1872, il resta dans la maison de son père.

Son mariage avec Isobel Black fut l'événement capital de sa vie. Dès la rencontre, en 1865, il en fut éperdument épris. Il avait vingt-deux ans, elle seize. M. Forbes a pu recueillir les premières impressions d'*elle* sur *lui*. Nous ne pouvons ni abréger, ni tout citer. Voici la dernière ligne: "It is 'the sound of a voice that is still' which haunts my memory every hour." Mariés en 1869, les jeunes époux s'établirent à Aberdeen, où Isobel comprit que, passionné pour l'astronomie, David ne pourrait passer sa vie dans les affaires. Mais quel miracle lui permettrait de réaliser son rêve? "En 1872, le miracle s'accomplit et il passa dans sa terre de Chanaan." Elle ne savait pas l'astronomie; "pas un mot, Dieu merci," répondit un jour Gill, mais elle n'hésita pas à laisser tout pour sa gloire.

Gill, apte aux études les plus diverses, débuta en astronomie à King's College, en installant un instrument pour donner l'heure, et un équatorial. Entre temps, lieutenant au corps des volontaires, il s'exerçait au tir. Sans goût pour le commerce, il s'y appliquait par devoir. Ayant monté, en 1867, dans le jardin de son père, un excellent miroir en verre argenté, il observa des étoiles doubles et prit, en 1869, une très bonne photographie de la Lune. L'ayant vue chez Huggins, Lord Lindsay obtint, en 1871, que son père prît Gill pour directeur de l'important observatoire qu'il projetait de créer dans sa résidence à Dun Echt. Pour Gill, c'était la réalisation de son rêve. Avec un entier désintéressement, sa femme et lui acceptèrent. De haut intérêt sont le tableau de cette collaboration où les deux jeunes hommes publièrent tout en commun, le récit du voyage de Gill en Europe pour la commande des instruments, celui du voyage de Lord Lindsay et de Gill à Maurice pour déterminer la parallaxe du Soleil par le passage de Vénus et par Junon; au retour, le levé de la grande pyramide, l'offre d'engagement par le khédive. Mais, revenu à Dun Echt, Gill recevait des visites des plus grands astronomes. Pour Lady Crawford, mère de Lord Lindsay, les conditions du contrat étaient changées; Lord Lindsay et Gill durent se séparer, mais restèrent étroitement amis.

Suivit le voyage à l'Ascension, en 1877, dont un récit a été publié en 1880 par Lady Gill sous le titre "Six Months in Ascension." Après des peines infinies, Gill fit une série splendide d'observations de Mars; la question de la parallaxe du Soleil était résolue. Lauréat de l'Institut de France, médailliste de la Royal Astronomical Society, Gill était classé parmi les astronomes illustres. Il eut la médaille d'or en 1908 pour la seconde fois, pour ses contributions à l'astronomie de l'hémisphère sud.

En 1879, il succéda à Stone au Cap; il apprit sa nomination par Lord Lindsay dont l'appui surmonta cet obstacle: Gill n'était pas un mathématicien de Cambridge. On m'excusera d'ajouter qu'aux fêtes du 250e anniversaire de la Société royale, Sir G. H. Darwin me dit combien grand encore était cet obstacle pour un astronome.

Les chapitres x. à xx. contiennent un tableau saisissant de ce qu'a fait cet homme de grande intelligence, qui savait bien ce qu'il voulait. Dès son arrivée, sa déférence vis-à-vis des représentants de l'Amirauté lui permit de commencer des travaux géodésiques qui ont abouti à cette extraordinaire entreprise: l'arc de méridien du Cap au Caire. En attendant un héliomètre de sept pouces, il achetait de ses deniers celui de Lord Lindsay et, avec Elkin, mesurait des parallaxes stellaires. Il voulait un grand télescope; Newall offrait de lui prêter le sien; on refusa; en 1894, F. McClean offrit à l'Observatoire du Cap le magnifique télescope Victoria. Il n'eut qu'en 1897 un cercle méridien retournable, mais c'est, sans doute, l'instrument le plus précis

existant. Il avait employé l'héliomètre de sept pouces à déduire la parallaxe du Soleil de mesures d'Iris, Victoria, Sappho, par cette magnifique coopération de vingt-deux observatoires et d'astronomes tels que Newcomb et Auwers.

Les accidents comme ceux qui avaient failli détruire les instruments avant le départ pour Maurice et l'Ascension ne troublaient Gill que quelques minutes; il y remédiait d'urgence. De hasards heureux, tels que l'offre de Lord Lindsay, ou l'obtention d'une remarquable épreuve de la comète 1882 avec l'objectif d'un amateur, il profitait. Voyant sur cette épreuve nombre d'étoiles, il annonça que l'on allait pouvoir photographier les cartes stellaires. Ce fut l'origine de la C.P.D. pour laquelle il eut la joie de recevoir l'offre de collaboration de Kapteyn.

L'Amiral Mouchez avait appuyé à l'Académie des Sciences l'affirmation de Gill concernant les cartes stellaires. On sait par quels efforts et avec quel succès P. et Pr. Henry construisirent des objectifs qui, en 1884 et 1885, leur donnèrent des clichés admirables qui furent tirés en héliogravure. En apprenant d'Huggins "in enthusiastic terms" ces importants résultats, Gill, le 23 décembre 1884, puis le 18 janvier 1885, demanda des renseignements à l'Amiral Mouchez, qui lui envoya, le 22 janvier, une épreuve ordinaire et une épreuve héliogravée, l'informant qu'il avait commandé un grand appareil spécial et ajoutant: "Je crois que nous allons obtenir la solution complète des cartes célestes par la photographie." Le 23 février, Gill répond à l'Amiral une longue lettre non publiée où il insiste sur les "splendides efforts faits à Paris": dans cette lettre, il est question de la C.P.D., des cartes écliptiques de Paris, des amas, de la voie lactée, travail à entreprendre sur un plan soigneusement préparé, et aussi de photographies d'aires uniformément distribuées. Le 11 mai, l'Amiral disait à l'Académie: "M. Gill . . . m'a adressé immédiatement un projet pour établir une entente entre divers observatoires afin d'entreprendre ensemble le plus tôt possible la Carte du Ciel qu'il serait facile d'exécuter ainsi en six ou huit années." Nous n'avons pu retrouver la lettre même de Gill; mais ces indications suffisent pour établir la part qui revient à l'initiative de Gill et de l'Amiral Mouchez, à la science et à l'extraordinaire habileté de P. et Pr. Henry, dans cette magnifique entreprise. On sait le reste. En 1909, au sixième Congrès, les Français ont été heureux de proposer pour Gill le titre de président d'honneur, voté d'acclamation.

M. Forbes s'étend sur les difficultés que Gill eut ensuite à surmonter; mais, depuis vingt ans, avec la France et huit autres nations, Greenwich, Oxford, le Cap, les colonies anglaises collaborent. Gill, Mouchez, P. et Pr. Henry ne sont plus; le travail n'est pas terminé; le travail d'Eros, tant à l'honneur du Comité Permanent et dont le résultat donné par A. R. Hinks est si glorieux pour Gill, a pris trois ans; et la guerre déchaînée par l'Allemagne le retarde encore; mais l'influence des initiateurs n'est pas éteinte; ce qui n'est pas fait se fera. Le Président du Bureau du Comité international Permanent n'a, au sujet de l'achèvement rapide de l'entreprise, aucune crainte.

Gill était un organisateur; il s'intéressait aux arts, aux affaires générales. Au Cap, il présidait maintes réunions et son knighthood fut en partie la récompense des services qu'il y rendit à l'Empire. Sa maison était ouverte aux artistes, aux marins, aux visiteurs distingués. Causeur plein d'entrain, il avait établi au Cap, avec la discipline d'Airy, la cordialité de Poulkowo. Son influence s'y fera longtemps sentir; il fut heureux du choix de son successeur. Rentré à Londres, il eut un rôle important dans les sociétés savantes et, sur le continent, dans les entreprises internationales. Il semblait toujours heureux de revenir à Paris, et non moins de faire les honneurs de son *flat*, à Londres.

Il aimait le peuple, sympathisait avec ceux qui souffrent. Il n'eut pas d'enfants, mais à la mort de sa sœur, Mrs. Powell, il en adopta les trois fils et les emmena au Cap. Dans la guerre déchaînée par l'Allemagne, l'aîné, capitaine Harry Powell, fut tué près d'Ypres; le second, major Fred Powell, deux fois blessé en Asie et décoré de la croix militaire; le troisième, Bruce Powell, ingénieur dans l'Afrique du Sud, vint à Londres offrir ses services et obtint une commission dans l'artillerie. C'est probablement aux obsèques de Sir Robert Ball, le 6 décembre, 1913, que Gill prit le germe de la maladie à laquelle il succomba. Très religieux, il avait choisi dans les ruines de l'ancienne cathédrale Saint-Machar, à Aberdeen, l'emplacement de son tombeau.

Heureux directeur sur qui l'on a pu écrire un volume entier d'anecdotes toutes à son honneur.

Gill, comme Tycho-Brahé, comme Bradley, a fait progresser l'astronomie de précision. En dehors des théoriciens, il fut sans doute le premier astronome de son temps. Je n'oublierai pas en quels termes M. Paul Cambon m'avait promis de demander que le Roi l'autorisât à recevoir la cravate de commandeur de la Légion d'honneur. Gill en fut heureux; c'était de notre part un témoignage de profonde reconnaissance. B. BAILLAUD.

SUGAR AND THE TINNED FRUIT INDUSTRY.

(1) *A Handbook for Cane-Sugar Manufacturers and their Chemists.* By Dr. G. L. Spencer. Fifth edition, partly rewritten and enlarged. Pp. xv+529. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1916.) Price 15*s.* net.

(2) *The Canning of Fruits and Vegetables Based on the Methods in Use in California, with Notes on the Control of the Micro-organisms Effecting Spoilage.* By Justo P. Zavalla. Pp. xii+214. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1916.) Price 10*s.* 6*d.* net.

(1) DR. SPENCER has largely rewritten this handbook, and it is now well adapted for the use of those in charge of the large central factories which have become such a marked

feature of the cane-sugar industry. As most sugar factories in the tropics have chemists in control, or at least managers who have some knowledge of chemistry as applied to sugar manufacture, the author seems to have been unnecessarily generous in devoting space to the description of common apparatus and customary methods of analysis. The opportunity might have been taken to direct attention to new sources of supply of apparatus which have become available since the war. No chemist, even in a neutral country, can wish to return to the pre-war dependence on one country for supplies of these materials. Heating appliances for laboratory use are often a difficulty in the tropics, but the author only refers to electrically heated plates and to an alcohol burner. Where current is available, electrically heated water-baths of the type readily obtainable in this country are often preferable to hot-plates, and where current is not available, petrol-air Bunsen burners are probably the best substitute. There must be few parts of the tropics where petrol is not obtainable, and there are British machines for producing the petrol-air mixture which are being used with success in laboratories in the West Indies, Mauritius, and elsewhere.

As regards materials used in sugar manufacture, it is disappointing to find no adequate discussion of the physical properties of sand and kieselguhr, on which the filtering value of these materials depends.

Beyond the statement in a table on p. 5 that the sugar-cane contains 0·2 per cent. of fat and wax, there is no reference to sugar-cane wax, although this may become an important by-product of the sugar-cane industry in the future, and is, in fact, already a commercial article. Another useful addition to the handbook would be a *résumé* of recent work on the improvement of sugar-canes, on which so much work has been done in recent years.

Some of these omissions are perhaps due to the fact that although the book appeared in 1916, it seems to have taken at least a year to pass through the press. The book is well produced on good paper, but it is difficult to see why 15*s.* net should be charged for a book of this size.

(2) Mr. Zavalla's book deals with one of the chief industrial uses of sugar, viz. the "canning" of fruits. It is provided with an introduction by the Dean of the College of Agriculture of the University of California, who begins by saying that "human beings may be traced in almost any part of the globe through the tin cans which they leave behind them," and ends with the hope that the labours of the author will contribute to "the realisation of a uniform and satisfactory food supply for the human race." Probably no one but a citizen of the United States could take the "canning" industry so seriously as all that. Mr. Zavalla describes the processes and plant used in preserving fruits and vegetables in California, from the making of the cans to the construction of the wooden cases in which the tins of preserved fruits and vegetables are shipped. He also discusses and gives a good deal of useful information on the micro-organisms which are found in spoiled tinned goods. This portion of the book would be worth separate and more fundamental treatment by a competent biologist who has given special attention to the subject. The book will, no doubt, be useful to those engaged in this industry, which is rapidly assuming large dimensions and bids fair to become of great importance in British tropical and sub-tropical colonies.

OUR BOOKSHELF.

Herbert Spencer. By Hugh Elliot. (Makers of the Nineteenth Century Series.) Pp. vi+330+1 portrait. (London: Constable and Co., Ltd., 1917.) Price 6*s.* net.

THIS is a vigorous and discriminating account of Herbert Spencer's contributions to modern intellectual development. It is written by one who saturated himself with Spencer's doctrines (and read all his works) when on service in the South African War, and has had the endurance to repeat the experience since 1914, with the bitter conviction that if Europe had followed Spencer the present war could never have occurred. "The spirit of Treitschke has triumphed over the spirit of Spencer—the metaphysics of Germany over the common sense of England."

Mr. Elliot's earlier discipleship has lost its dogmatism, but his admiration remains strong for the last of the great nineteenth-century apostles of reason and liberty. As is well known, Spencer expressed the larger and better part of his personality in his works, as an artist might in his paintings, and Mr. Elliot recognises this in his biographical sketch. There is a convincing unity —better, we think, than heretofore—in the picture which the author gives us of the synthetic philosopher. "Evolution and Liberty are the two guiding stars of Spencer's philosophy," and in his exposition Mr. Elliot develops the thesis that Spencer was a man of very strong natural penetration, who formed his theories first and established, or sought to establish, them by induction afterwards—which is, truth to tell, a very common mode of scientific procedure.

For much that Spencer achieved, for instance, in making the evolution-idea organic in all our thinking, a new generation is already forgetting to be grateful; many of his arguments, as this appreciation (which has the true Spencerian spirit) well shows, have lost their cogency; some of the foundation-stones, such as the transmissibility of individually acquired somatic modifications, have not borne the weight of the superimposed structure. But we share with the author of this effective and interesting book the hope that one of the rhythms of intellectual opinion spoken of in the "First Principles" may bring many—especially those whose thinking needs vertebration—back to a Spencerian study of Spencer's works. A good introduction is here to hand.

A Sylow Factor Table of the First Twelve Thousand Numbers, giving the Possible Number of Sylow Sub-Groups of a Group of Given Order between the Limits of 0 *and* 12,000. By H. W. Stager. Pp. xii+120. (Washington: Carnegie Institution of Washington, 1916.) Price 4.50 dollars.

THE main object of this publication is to answer the question: Given n, the order of a group, what are the possible orders of such Sylow sub-groups as it contains? This amounts to finding all divisors of n which are of the form $p\ (kp+1)$, where p is prime. For each n up to 11,999 the table gives the complete resolution of n into its prime factors, and the values of k (other than 0 and 2, which do not require entering) corresponding to each prime factor. Each prime value of n is entered in the body of the table in the form p_t; for instance, the entry p_{627} under 4639 shows that the latter is the 627th prime in order of magnitude, taking $p_1=1$. It is obvious that, apart from its special purpose, this table will be very useful to arithmeticians; every reasonable precaution seems to have been taken to make it accurate, and fortunately the table is of such a kind that every single entry can be tested with very little trouble, and any misprint almost certainly detected, unless a number n has been entered as prime, when really composite. Cases where $p\ (kp+1)=n$, and not merely a divisor of n, are noted, such numbers are called Ps by the compiler—for instance, $1074=3\ (3\cdot119+1)$, so 1074 is a P. On pp. xi and xii is a list of these numbers (1–12,229) in their natural order; and there are interesting tables and graphs on the distribution of P numbers and primes. Supposing that $\phi(n)$ means the number of primes not exceeding n, and $\psi(n)$ the number of P numbers not exceeding n, the tables suggest that when $n \to \infty$ the ratio $\psi(n)/\phi(n)$ converges to a definite limit not very different from e; of course this is a mere guess that might occur to anyone, but at any rate to find a formula for $\psi(n)$ analogous to Riemann's for $\phi(n)$ would be an interesting problem. It may not be superfluous to add that the table does not profess to enumerate *actually existent* Sylow sub-groups for different values of n.

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.*]

Aeroplanes and Atmospheric Gustiness.

THE question which Prof. McAdie raises in his letter in NATURE of April 12 is how to measure the unsteadiness of the air as it affects an aeroplane. Among those connected with flying the term "bumpiness" is used to express the unsteadiness of the air as it affects an aeroplane, and, in the absence of a better word, this may be used here. The problem is, then, to measure the "bumpiness" of the air by meteorological means.

As Prof. McAdie points out, gusts may occur in any direction, but gusts in different directions will not equally affect an aeroplane, those in a vertical direction having the greatest effect. There is evidence to show that the fluctuation in velocity of any individual portion of air is, on the average, roughly the same in any direction, so that, in view of the greater effect of vertical gusts, the fluctuation of the wind, as given by an anemometer, may give entirely erroneous indications of the "bumpiness." The best example of this is in the middle of a hot summer day, with a light wind, and sky partly covered with small cumulus clouds (themselves an indication of vertical currents). Under these conditions, the variation shown by an anemometer may be less than three metres per second, but the air will be very "bumpy" for an aeroplane.

On sunless days, with strong winds, the air is "bumpy" on account of the eddy motion set up by friction with the surface of the ground. If the conditions be the same, the fluctuation is roughly proportional to the mean velocity of the wind, but under different conditions—*e.g.* between night and day—the fluctuation may be very different for the same strength of wind. When it is remembered that the mean velocity of the wind does not in itself affect an aeroplane when flying (except as regards getting from place to place), it will be seen that the mean velocity of the wind should not enter into measurements of the "bumpiness" of the air. Further, the gustiness of the air near the ground is of little importance, except in getting off and landing, and also it cannot be taken as an indication of the "bumpiness" of the air at a height.

To obtain satisfactory information, it would be necessary to measure the fluctuation of velocity in three directions and at various heights. Several methods have been devised for obtaining the vertical velocity, as well as the horizontal velocity and direction, near the ground; to obtain such data at a height is very much more difficult.

The "bumpiness" of the air might be measured by an accelerometer carried on an aeroplane; but this would not be satisfactory to the meteorologist, since it would be difficult to discriminate between vertical currents and horizontal gusts. It may be pointed out that by the use of both a gravity-controlled and a spring-controlled air-speed indicator, this is at least theoretically possible.

If we suppose a satisfactory means of measuring the "bumpiness" to have been devised and standardised, it would be possible to compare the average "bumpiness," say, at one place with that at another, from which, no doubt, some useful information could be obtained. But to make real advance in this part of meteorology, it is necessary to go further and endeavour to find the real structure of the atmosphere and the causes which may give rise to this structure. It is, therefore, to be hoped that the work of meteorologists interested in this branch of the subject may be devoted more and more to these fundamental problems of cause and effect, rather than to the making and tabulation of routine observations, other than those made with the definite object of throwing light on some particular problem. GORDON DOBSON.

Farnborough, April 16.

IN reply to Prof. Alexander McAdie's request (NATURE, April 12) for a means of recording gustiness, I venture to throw out the suggestion that this might be done by observing what in German is called "wimmern." "Hoert Ihrs wimmern hoch vom Thurn? Das ist Sturm." This variation in the sounds heard from church bells during gusty weather is due to the irregular velocities in the atmosphere. That part of

a whirl of air which moves in the same direction as the sound will increase the pitch of the note heard, and *vice versâ*. If an instrument could be devised for recording rapid but slight changes of pitch of musical notes, a fairly accurate estimate of the irregularities of atmospheric velocities could be obtained.

C. E. STROMEYER.

Lancefield, West Didsbury,
April 15.

Gravitation and Thermodynamics.

As pointed out by Sir Oliver Lodge in NATURE of April 5, the case I cited of a disc pivoted about its centre of mass and started in motion does not lead to perpetual motion in the ordinary sense. But, as it seems to me, there will be long-sustained, oscillatory, motion. On rotating the disc by a small angle, the descending half will gain, and the ascending half will lose, heat. A turning-moment will arise, and will increase until the angle turned is $\pi/2$. It will then decrease until, when the angle turned is π, the moment is nil. This position gives the condition, quoted by Sir Oliver Lodge, of thermal symmetry about the vertical diameter of the disc. As the disc continues to rotate, due to its momentum, a moment in a reverse sense will be set up, so that when the whole rotation is nearly 2π, the rotation will be reversed. We shall thus obtain an oscillatory motion, long sustained if small friction is involved. In the final position the disc will have rotated from its initial position by angle π. Such a result would be phenomenal, since the mere act of rotating the disc by an infinitesimal angle would, in effect, convert a condition of neutral, into one of unstable, equilibrium.

Dr. Todd has suggested that this peculiar effect would not arise if $\partial\theta/\partial r$ is positive. We should then have the remaining peculiar effect, viz. a condition of neutral equilibrium would by a rotation be converted into one of stable equilibrium. Will this proposal satisfy philosophers?

P. E. SHAW.

Floating Earths.

I SENT Dr. Leaf's letter on "Floating Earths" (NATURE, March 15) to M. Salomon Reinach, and append his answer, which, I think, partly explains the matter.

J. OFFORD.

94 Gloucester Road, South Kensington, S.W.7.

DEAR MR. OFFORD,—

You won't build on uncertain texts. Dr. Leaf translates "in the case of an islet in Tyrrhenia," reading *νησίς*, which is corrupt; I prefer *γῆ τις* (Corey), a certain variety of earth in Tyrrhenia—the remainder concerning natural science, excepting *ἢ τὰ ἀργυρώματα ἐκμάττεται*, words which I take in the "trivial meaning."—Yours truly,

S. REINACH.

Musée National, Saint-Germain,
Le 4 avril 1917.

The New Food Orders.

IN my article in NATURE of April 12 there were inadvertently omitted, probably by myself, some words which make one of my suggestions an absurdity. In reference to the meat ration of the Army, what I meant to say was that "*a part* of the large meat allowance might, with advantage, be replaced by its equivalent in energy-value of carbohydrate."

W. M. BAYLISS.

EMPIRE DEVELOPMENT AND ORGANISATION.

THE final report of the Royal Commission on the natural resources, trade, and legislation of certain portions of his Majesty's Dominions has recently been issued and presented to both Houses of Parliament. The commission came into being in consequence of a resolution passed by the Imperial Conference in 1911. The members were appointed in April, 1912, six representing the United Kingdom, and one each the self-governing Dominions of Canada, Australia, New Zealand, the Union of South Africa, and Newfoundland. India, the Crown Colonies, and the Protectorates were not included.

The sittings of the commission ended, as they began, in London. In the interval the commissioners made four tours: the first to New Zealand and Australia, the second to the Union of South Africa, the third to Newfoundland and eastern Canada, and the fourth to central and western Canada. They visited every capital of every State or Province in each of the Dominions, and took evidence in all the most important cities. They say:—

In the course of this period we have travelled for many tens of thousands of miles to, through, and from the self-governing Dominions of your Majesty's Empire. In every district of this vast area we have done our utmost, collectively and individually, to make ourselves acquainted with its characteristics, its history, and its aspirations, as we hope, and indeed believe, not without success. We have also had the opportunity of hearing personally the opinions of every section of its population upon the problems upon which we have been engaged. It is therefore with a certain confidence as to their value that we present our unanimous conclusions for your Majesty's consideration.

It is to be noted, however, that in May, 1915, the Government of the Commonwealth of Australia withdrew its representative from the commission, and the final report does not contain the signature of any representative of that Dominion. No reason is given for this action on the part of Australia.

The main object of the commission was to inquire into, and report upon, (*a*) the natural resources of the five self-governing Dominions and the best means of developing them; (*b*) their trade with the United Kingdom, each other, and the rest of the world; and (*c*) their requirements and those of the United Kingdom in regard to food and raw materials, together with the available sources of supply. Broad as the scope of this inquiry was, it could not be kept within the prescribed limits. The commissioners say:—

During the whole course of our investigations . . . we have been conscious of two strong and impelling impressions.

First, for Empire purposes no survey can be complete without including India, the Crown Colonies, and the Protectorates. In themselves, and even as now developed, they form too vital and important a part of the Empire to be left out of present calculations. But it is plainly evident that their potentialities, measured by any fair standard, are immense,

and that their future contributions to the Empire's strength and greatness will far surpass those of the past. These parts of your Majesty's oversea possessions are vitally linked with the self-governing Dominions; the destinies of all are interwoven.

Secondly, we have been equally strongly impressed by the almost infinite variety of Empire domain, the extent of its area, the inequality of distribution of its population, and the disconnected character of its governing and directing machinery.

In other words, the only practicable subject of investigation turned out to be the British Empire itself. Successive interim reports on the five Dominions, following on the four tours undertaken by the commission, have already appeared.

The opening chapters of the final report are historical and descriptive, and show the leading characteristics of the Dominions and the development of their trade. They analyse briefly their chief resources and prospects of expansion. The survey falls under five heads, viz. agricultural and pastoral resources, minerals, forests, fisheries, and water-power. They describe also some of the chief measures for controlling and utilising natural resources for the common benefit which have been taken by the Governments concerned during the war, and lead up to two chapters outlining a policy in respect of the scientific development of natural resources for the future. Migration and its intimate bearing on the problems of development of the Empire forms the subject of the next chapter, succeeded by three dealing with Imperial communications. In the first of these stress is laid on the need for deeper harbours and the co-ordination of harbour depths in order to facilitate cheap, speedy, and efficient transport. Recommendations for developing fast Imperial services on several of the most important trade routes of the world are made. Ocean freight rates and the respective liabilities of shipowners and shippers under bills of lading come under consideration. In the second the handling of produce brought to, and distributed from, the ports of the United Kingdom is passed under review, while in the third cable and wireless services between the United Kingdom and Dominions are discussed and suggestions made for their improvement. Questions of commercial importance form the subject-matter of the next two chapters, and in the final one the commissioners criticise the past and existing deficiencies in Imperial organisation and outline a scheme for the creation of an Imperial Development Board, charged with the duty of undertaking and promoting the development of the natural resources, trade, and communications of the Empire.

As a preliminary to considering the conservation and development of natural resources in the future, the commissioners point out that before any adequate measures can be taken towards this end a preliminary survey is needed of the relation between Empire production and Empire requirements throughout the whole range of the articles required for the sustenance and well-being of the people, for the maintenance of industry, and for the production of munitions of war. As they say truly, no such survey has ever been undertaken. They go on to point out that it should divide the necessary materials of trade and commerce into the following three main categories:—

(1) *Materials of which the world's requirements are mainly or wholly produced within the Empire.* As instances, it may be mentioned that Canada produces much the largest proportion of nickel, cobalt, and asbestos, and, in conjunction with India, of mica. New Zealand produces practically the only supply of kauri gum and phormium fibre. The Union of South Africa has a virtual monopoly of diamonds and ostrich feathers. India has a monopoly of jute, while the West African Colonies yield the major portion of the world's supply of palm-nuts and palm-kernels, and the Eastern Colonies of plantation rubber. The British Empire produces from 40 to 45 per cent. of the world's total supply of wool, and more than 60 per cent. of the world's output of gold. To take one instance only of how little a valuable mineral is worked up into a manufactured article in the country of its origin, it may be mentioned that, although Canada is practically the only producer of raw asbestos in the world, the United Kingdom is largely dependent on outside sources, especially the United States, for the manufactured asbestos which it requires, and that even Canada imports manufactured asbestos to the average value of 70,000*l.* per annum.

(2) *Materials of which the Empire's requirements are approximately equalled by Empire production.* Examples of products falling within this category are wheat, butter, cheese, and wool. In certain cases, instances of which are zinc, tungsten, and monazite, the commissioners indicate the necessity for special action in order to secure the control and utilisation of Imperial supplies for the Empire's use.

(3) *Materials of which the world's requirements, and with them those of the Empire, are mainly produced and controlled outside the Empire.* Most careful inquiry is obviously needed in regard to substances of this kind, instances of which are cotton, petroleum, nitrates, and potash. Investigation should take two directions: (*a*) the possibility of finding new sources of supply within the Empire, and (*b*) the possibility of finding substitutes within the Empire. Means of preventing waste in existing sources of supply of all minerals should also be investigated.

The commissioners recommend that the responsibility for a survey and investigations on the lines indicated should be entrusted to a new Imperial Development Board. They say:—

We believe the time has come when a body should be created which could be referred to at any time and by any of the Governments, in order to smooth the path of Imperial development. There is, indeed, both scope and need for a new Imperial Development Board, which, without displacing any existing body, would devote its energies and experience to a continuous survey and consideration of Empire resources and opportunities, and to a study of the best means of co-ordinating Empire effort for the development of these resources, for the extension of Imperial trade,

and for the strengthening of Imperial lines of communication. It would be impossible to exaggerate the significance and influence of such a board, composed, as it should be, of men possessing an intimate knowledge of the Empire and its resources, in constant consultation and collaboration, on the watch for every opportunity, and alive to every possibility. . . . The primary condition of this new board must be that it should not encroach upon the political or administrative machinery of any of the self-governing parts of the Empire. In other words, it should be purely advisory in its initial stage. We are not prepared to suggest that at its inception any specific administrative functions should be assigned to it, but equally we hesitate to restrict the future activities of a new and, to some extent, experimental organisation. If, at some future time, the Government of the Empire should, either through the Imperial Conference or otherwise, desire to delegate any administrative duties to it, we see no inherent difficulty in giving effect to such a wish.

With regard to the constitution of the new organisation, the commissioners recommend that its numbers should be kept as low as possible, with the view of increasing its efficiency, and that its members should be required to give their whole time to the work. They suggest seven representatives for the United Kingdom, India, the Crown Colonies, and the Protectorates, and one each for the five self-governing Dominions. They recommend further that the board should carry out the research work required for the survey in the following manner:—

(*a*) In respect of the United Kingdom, through the recently formed Department for Scientific and Industrial Research, the National Physical Laboratory, etc.

(*b*) In respect of the self-governing Dominions, through the now existing scientific departments and the committees for research which are being set up in the Dominions.

(*c*) In respect of India, the Crown Colonies, and the Protectorates, through the local scientific departments and the Imperial Institute.

Finally, they say:—

The unanimity which is shown in all our reports, and has been maintained throughout the deliberations of the first Royal Commission comprising representatives of all the self-governing communities of your Majesty's Empire, is, we venture to think, of hopeful augury. We make bold to assert, after five years' experience throughout the Empire, that the spirit of co-operation, so splendidly demonstrated in war, will be succeeded, after peace is declared, by absolute concord in the great task of reconstruction and development.

It is quite certain that no Blue Book of such momentous importance as this is to the development of the resources of the British Empire as a whole has ever before been published. Great as the preoccupations of the Government must be at the present time, they should not be allowed to prevent the most weighty consideration being devoted to the recommendations unanimously reached by the commissioners. It may be doubted whether so favourable an opportunity for giving effect to them by legislative enactment will ever occur in the history of the Empire again. H. C. H. C.

NATIONAL REFORMS IN EDUCATION.

AN enthusiastic welcome was extended to the speech of the President of the Board of Education, Mr. H. A. L. Fisher, on introducing the Education Estimates on Thursday last. Whatever be the motives which prompted it, whether they arose merely from considerations relating solely to the industrial and commercial equipment of the nation, or from the need for more effective military preparation, or from a tardy conviction that the essential well-being of the people demanded a much more adequate provision for the due training of all the children, they are a gratifying index of the changed attitude of Parliament on this vital subject, and a sign, we hope, that the Presidency of the Board will always be occupied by someone familiar with educational problems and not be a purely political appointment as formerly. However distasteful the thought may be, there is lying at the back of men's minds the conviction that the industrial, commercial, and military position of Germany is due in the main to the sedulous cultivation, through many generations, from the days of Humboldt downwards, of the intellectual life of the nation, and that though we do not desire slavishly to imitate her methods or to pursue her ideals, yet we have arrived at last at the conviction that we cannot any longer, if we would preserve and advance our pride of place in the world, afford to ignore and waste the most vital asset of the nation, namely, the due cultivation, bodily, mentally, and spiritually, of its child life among all classes.

We are, according to Mr. Fisher, spending annually from all sources, public and private, some forty million pounds sterling on the education of the people of England and Wales (which large sum contrasts strangely with the first Parliamentary grant for education of 20,000*l.* in 1834, continued annually until 1840, for the building of elementary schools); and yet we are not providing effectively for their adequate training. Many more millions need to be spent before that purpose is fully assured, and so the President of the Board comes forward with a demand for nearly four millions in advance of the Estimates of 1916-17, which are to be applied chiefly to remedy the low and uneven remuneration of the teachers, both elementary and secondary, throughout the country, and to establish a scheme of pensions for secondary-school teachers; and measures are devised so that this important object may be secured with the willing co-operation of the local authorities. It is strongly felt that it will be impossible to secure any effective measures for the improvement of education unless the supply of suitably trained teachers can be adequately maintained. It is further the purpose of the Board to encourage the establishment of a much larger number of scholarships, with due maintenance grants, enabling duly qualified children to proceed to higher stages of instruction in secondary schools and universities, and also to provide advanced courses in central schools for children remaining at school until the close of the legal age of attendance.

All these urgent reforms can be instituted under the regulations governing the policy of the Board, and require no special legislative sanction. They appeared to receive the warm assent of the House, but it was the closing sentences of Mr. Fisher's statement which aroused the deepest attention, wherein he adumbrated the lines of a Bill for the reform of education, of which the measures he had already indicated were but an instalment, which he hoped shortly to introduce. He proposed in this measure, having regard to the deplorable waste of child life, to make provision in nursery schools for children under five; to secure for every boy and girl a full period of instruction until the fourteenth year; to provide for more satisfactory education in rural areas; to secure the proper co-ordination of every type and grade of school throughout the country, and to require county authorities, either separately or in combination, to make complete and progressive schemes of education for their areas; to make better and more complete provision for adolescent education so as to ensure for young persons engaged in employment a fuller intellectual, moral, and physical discipline; and, finally, as soon as occasion serves, to consider the problem of the universities with the view of meeting the urgent need for promoting free and independent post-graduate research and the higher forms of learning in the universities of this country, together with a liberal provision of scholarships with this object. We must await the introduction of this Bill before we can discuss fully the actual means proposed to give effect to these measures of reform, but it is well that a man speaking with the high authority of the President of the Board of Education and with the full knowledge of his colleagues in the Government is bold enough to set them forth as ideals to be shortly attained, and his effort demands the fullest and most earnest support of every enlightened authority throughout the kingdom. Not until the whole fabric of education is brought under review and each department of it made effective and duly related can its full value be realised and the highest forms of education be ensured on sound and satisfactory lines.

CO-OPERATION IN RUSSIAN AND BRITISH SCIENTIFIC UNDERTAKINGS.

DURING the past year the question of a closer relationship between British and Russian savants has been the subject of several meetings of different learned bodies in Russia, chiefly in Petrograd. Particulars cannot here be given, but a short account of the more important developments likely to give some positive results may be of interest.

In April, 1916, the Minister of Public Instruction invited a number of universities to state the measures which, in their opinion, would lead to the promotion of closer intercommunication between the Russian and the British scientific worlds. The council of the University of Petrograd discussed the matter in May, and stated in reply to the Minister in June last that a closer relationship would be desirable not only with British, but also with French men of science and those of other allied countries. This object could be best attained by forming an international association of universities and academies of sciences, which would promote mutual knowledge of scientific work and activity, the organisation of international scientific undertakings (expeditions, publications, etc.), and the dissemination of the languages of the members of the association.

Such an organisation could easily undertake to bring about such measures as: (*a*) delegation of professors and academicians to the chief universities of allied countries to give courses of lectures in the language of the country (not their own) and to promote personal intercommunication with foreign men of science; (*b*) mutual admission of students of science to the universities and scientific institutions of allied countries for the purpose of advancement of their scientific studies and the acquaintance with the scientific world of a given country; (*c*) organisation of congresses in separate branches of learning for deliberating on questions of international scientific and inquiry undertakings, and of pedagogy; (*d*) organisation of yearly reports on the scientific literature of a given country, to be printed in special periodicals; (*e*) reports on the scientific activities of different institutions and of persons working in these institutions. To promote the foundation of the International Association it is necessary first of all to form an association of Russian scientific bodies, which should undertake the necessary steps to begin the publication of yearly reports on Russian scientific literature in special periodicals. It is also necessary, as a second preliminary measure, to create at the Russian Legations abroad and at the British, French, and other Legations in Russia some sort of scientific attaché, who would be at the disposal of men of science.

The matter was then taken up by the Imperial Academy of Sciences, which considered the whole question at a plenary meeting on October 15 (28), 1916, after it had been reported upon by a committee composed of the permanent secretary of the Academy, S. Oldenburg, and the academicians N. Kondakov, P. Vinogradov, and P. Walden. The report of this committee was adopted at a plenary meeting, and was afterwards presented to the Minister of Public Instruction. It laid great stress on the necessity for mutual cognisance of scientific work and scientific undertakings of Russia and Great Britain. To this end the academy formed a committee of specialists charged with the editing of two scientific periodicals devoted to physico-mathematical and biological sciences, printed in Russian and French. These periodicals will contain a summary of scientific work of Russian savants. It is proposed further to make more accessible British scientific publications and books, which it is very difficult to obtain at present,[1] by way of new

[1] For instance, only *unbound* books are now allowed to enter Russia, whereas British books are always sold bound. I am obliged to order them with the *covers torn off*.

regulations and perhaps subsidies to leading booksellers. The other measures proposed are identical with those contained in the memorandum of the University of Petrograd.

The Academy of Sciences proposes further to call together soon a special congress of representatives of universities, learned societies, and other learned bodies in order to discuss the practical ways and means towards promoting a closer scientific relationship with Great Britain.

B. MENSCHUTKIN.

NOTES.

THE secretary to the Reconstruction Committee has favoured us with the following list of the members of the committee: The Right Hon. the Prime Minister (chairman); the Right Hon. E. S. Montagu, M.P. (vice-chairman); Prof. W. G. S. Adams; Mr. J. R. Clynes, M.P.; Sir A. M. Duckham, K.C.B.; Mr. Richard Hazleton, M.P.; Major J. W. Hills, M.P.; Mr. Thomas Jones; Mr. P. H. Kerr; Dr. Marion Phillips; Mr. B. Seebohm Rowntree; the Most Hon. the Marquess of Salisbury, K.G., G.C.V.O.; Mr. Leslie Scott, K.C., M.P.; Sir J. Stevenson, Bart.; Mr. J. H. Thomas, M.P.; and Mrs. Sidney Webb.

A SUMMARY of the Rockefeller Foundation grants for 1916 is contained in a pamphlet published in New York on March 19. The total amount of the grants made during the year was 1,649,820*l*. The largest grants were for war relief, and these reached 518,000*l*. in 1916, making 836,400*l*. since the beginning of the war. To the National Health Board 122,300*l*. was given, chiefly for the relief and control of "Hookworm" disease in the southern States, several Latin-American countries, and in certain British colonies. The board has also made a survey of the principal endemic foci of yellow fever, and experiments for the control of malaria. The China Medical Board received during the year 213,630*l*. for the promotion of medical education in China. Among the largest of the single contributions of the Foundation to outside agencies was the gift of 200,000*l*. to the New York Palisades Interstate Park Commission towards the sum necessary for the enlargement and improvement of the Palisades Interstate Park.

PROF. EMIL VON BEHRING, whose death was announced in NATURE of April 5, was born at Hansdorf in 1854. He received his professional education at the Army Medical College, Berlin, obtaining his doctor's degree in 1878. He afterwards served in the Army, and in 1889 was appointed assistant at the Institute of Hygiene, Berlin, being transferred later, in 1891, to a corresponding post in Koch's Institute for Infectious Diseases. He there commenced his researches on immunity in diphtheria, culminating in 1893 in the discovery and preparation of diphtheria antitoxin. For this work he received prizes from the Académie de Médecine of Paris and the Institute of France. In 1894 he received the title of "Professor" in recognition of his scientific work, and was appointed to the chair of hygiene in the University of Halle. In the following year he accepted a call to Marburg, where he held the post of professor and director of the Institute of Hygiene. In 1895 the title of Medical Privy Councillor was conferred upon him. Although Behring's name is best known in connection with the discovery of diphtheria antitoxin, he also carried out researches on tuberculosis, ascribing the major part of tuberculosis in children to infection from tuberculous milk, and prepared a form of tuberculin, "tulase," by the action of chloral on tubercle bacilli, which, however, does not appear to have more value than other forms of tuberculin. In 1913 he published an investigation on diphtheria bacilli carriers, and proposed to treat these with a mixture of diphtheria antitoxin and diphtheria toxin. With Löffler and Ehrlich, who have also died during the course of the present war, Behring must be regarded as one of the band of pioneers of modern bacteriology and immunology.

THE permanent committee for the study of the natural resources of the Russian Empire, formed by the Petrograd Academy of Sciences in 1915, has begun to publish the great work "Natural Productive Forces of Russia," which is intended to give, so far as it is at present possible, a complete review of the natural wealth of Russia, destined to play an important part in the future economic development of the country. This work will form six volumes—about 2400 pages large octavo—and is being printed in the Government printing office. The contents of the volumes will be as follows: Vol. i., "Utilisation of the Force of Wind." This volume is being prepared by a special sub-committee (president, M. A. Rykačev), and will be devoted to (1) the necessary meteorological data; (2) wind-motors, their best types, cost, and uses. Vol. ii., "White Coal"; a sub-committee under the presidency of V. T. Vernadskij will give (1) a geological and hydrological description of different regions of Russia; (2) characteristics of separate rivers and data for the utilisation of their water-power. Vol. iii., "Artesian Waters," by a sub-committee presided over by N. T. Andrusov. Contents. (1) Geological data in connection with water-bearing strata of different regions of Russia; (2) artesian bores already in existence and the future possibilities. Vol. iv., "Useful Minerals," is prepared by the geological committee and edited by K. T. Bogdanovič. It will give trustworthy information about the occurrence, localities, quantities, and properties of different ore deposits and important minerals of Russia. Vol. v., "Plants," edited by a sub-committee of specialists under T. P. Borodin: botanico-geographical review of the Russian Empire and a description of all the cultures of different regions in relation to agriculture and the utilisation of plants. Vol. vi., "Animals," edited by V. K. Bražnikov and E. F. Liskun: (1) Systematic survey of the animal representatives, wild and domestic; (2) utilisation of wild and domestic animals. The edition is limited to 5000 copies; the subscription price for all the six volumes is 10 roubles (=14*s*. at the present rate of exchange). The committee for the study of the natural resources of Russia has also edited during 1916 twelve monographs, under the title of "Materials for the Study of the Natural Productive Forces of Russia," dealing with ore deposits of different metals, medicinal plants, clays, etc.; and about a hundred more are in course of printing and preparation. These monographs are published by the Imperial Academy of Sciences.

THE Hanbury gold medal for 1917 has been awarded to Prof. H. G. Greenish, professor of pharmaceutics to the Pharmaceutical Society of Great Britain.

THE Fothergillian medal of the Medical Society of London for 1917 has been awarded to Sir Leonard Rogers, of the Calcutta Medical College, for his work on dysenteries, their differentiation and treatment.

THE treasurers of the Middlesex Hospital have received a donation of 1000*l*. from Sir John and Lady Bland-Sutton and 250*l*. from Mr. G. Vaughan Morgan in response to the appeal on behalf of the research fund of the pathological institute of the hospital.

THE seventh May lecture of the Institute of Metals will be delivered at the Institution of Civil Engineers on Thursday, May 3, at 8.30 p.m., by Prof. W. E. Dalby, on "Researches made Possible by the Autographic Load-extension Optical Indicator."

THE Jacksonian prize of the Royal College of Surgeons of England for 1916 has been awarded to Mr. E. W. H. Groves for his dissertation on "Methods and Results of Transplantation of Bone in the Repair of Defects caused by Injury or Disease." The subject for the Jacksonian prize for 1918 is "The Injuries and Diseases of the Pancreas and their Surgical Treatment."

THE death is announced, in his seventy-fourth year, of Dr. H. B. Cornwall, professor of applied chemistry and mineralogy at Princeton University from 1873 to 1910. He previously held posts on the faculty of Columbia University, and was for a short time the superintendent of a mining company in Mexico. He was the author of a manual of blow-pipe analysis and other works.

THE next informal meeting of the Chemical Society will be held at Burlington House, W., on Thursday, May 10, at 8 p.m. Owing to ill-health, Dr. Horace T. Brown will be unable to deliver, on May 17, his lecture entitled "The Principles of Diffusion: Their Analogies and Applications" as previously announced. The lecture has been postponed for the time, and the usual ordinary scientific meeting will be held on that day.

WE learn from the *Morning Post* that Mr. W. P. Fraser, plant pathologist, of Macdonald College, has been appointed to investigate the problem of grain rust on the prairie provinces of Western Canada. The Canadian Minister of Agriculture, the Hon. Martin Burrell, has been devoting special attention to the problem, and two well-equipped laboratories have been built on the experimental farms at Brandon and Indian Head.

THE death is announced of Sir Albert J. Durston, Engineer-in-Chief of the Navy from 1889 to 1907. We learn from the *Times* that Sir Albert was born in 1846, and was educated privately, in Portsmouth Dockyard, and at the Royal School of Naval Architecture, South Kensington. He entered the Royal Navy in 1866, became chief engineer in 1877, chief inspector of machinery in 1893, and chief engineer at Sheerness and Portsmouth in 1881. During his administration of the engineering department there were introduced the water-tube boiler, the turbine system of propulsion, and the use of oil fuel—all inventions which made for the increase in engine-power and the speed of the ships of the Fleet which has been so noticeable and valuable during the war.

WE learn from the *British Medical Journal* that Surgeon-General Sir William Taylor, K.C.B., late Director-General, Army Medical Staff, died at Windsor on March 10, aged seventy-four. In 1898 Sir William was appointed principal medical officer to the British Army in India and held that post for three years, until he became Director-General of the Army Medical Service on December 3, 1901, in the late stage of the Boer war. On August 21, 1901, he was gazetted honorary physician to the King, and in 1902 received the K.C.B. His *Alma Mater*, the University of Glasgow, bestowed upon him the honorary degree of LL.D. He retired on December 2, 1904, after forty years' service in the Army, during which he had served in six campaigns, and had risen to the highest position open to a medical officer.

AT the annual general meeting of the Institution of Civil Engineers held on April 17 the result of the ballot for the election of officers was declared as follows: *President:* Mr. W. B. Worthington. *Vice-presidents:* Mr. J. A. F. Aspinall, Mr. H. E. Jones, Sir John P. Griffith, and Mr. J. A. Brodie. *Other Members of Council:* Dr. C. C. Carpenter; Dr. Dugald Clerk; Col. R. E. B. Crompton; Mr. M. Deacon; Sir Archibald Denny, Bart.; Mr. W. H. Ellis; Sir R. R. Gales; Mr. A. J. Goldsmith; Sir R. A. Hadfield; Brigadier-General B. H. Henderson; Mr. R. W. Holmes; Prof. Bertram Hopkinson; Mr. G. W. Humphreys; Mr. Summers Hunter; Dr. W. H. Maw; Mr. C. L. Morgan; Mr. Basil Mott; Sir H. J. Oram; Mr. F. Palmer; Capt. H. P. R. Sankey; Sir J. F. C. Snell; Mr. E. F. C. Trench; Mr. W. F. Tye; Sir Philip Watts; Mr. E. J. Way; and Sir A. F. Yarrow, Bart. The council has made the following awards for papers read and discussed during the session 1916–17: Telford gold medals to Messrs. G. W. Humphreys and J. B. Ball; George Stephenson gold medals to Messrs. P. V. O'Brien and John Parr; Telford premiums to Messrs. P. V. O'Brien, J. L. Hodgson, W. Brown, and P. M. Crosthwaite; and a Crampton prize to Mr. F. J. Waring.

MR. ABEL CHAPMAN, in the *Scottish Naturalist* for April, demolishes the contention that there are two distinct sub-specific forms of the Brent goose, both of which, according to the most recent text-books, are to be found in the British Islands. The one is supposed to have a light-, the other a dark-coloured breast. Mr. Chapman is of opinion that these differences merely indicate dimorphism. And it would seem that the ornithologists who made the "sub-species" to which he objects have come to the conclusion that Mr. Chapman's interpretation is the right one.

THE extreme severity of the weather since January has told heavily on our native birds. One of the first records of this fact is that by Mr. H. M. Wallis in *British Birds* for April. During the February frost, in West Cornwall, he remarks, lapwings haunted the town rubbish-heaps and tiny grass plots in front of suburban houses; finally, they came to the windows for food, but eventually most of them seem to have died from starvation, their dead bodies, dreadfully emaciated, being picked up in gardens, beside roads, and in almost every field. After the lapwings, golden plover, gulls, thrushes, and starlings seem to have suffered most, though many other species are enumerated in his list of dead.

THE British Museum (Natural History) has just issued, in pamphlet form, some "Instructions for Collectors," dealing with the preparation of mammal skeletons in the field, with special notes on the collection of specimens of Cetacea. Since the skin of the latter cannot be successfully preserved, special emphasis is laid on the need for careful notes and measurements of carcases before dismemberment. Attention is also directed to the importance of very careful notes as to the colour of the "whale-bone" in baleen whales, and the number and position of the teeth in the "toothed" whales. In all cases, it is remarked, sketches or photographs of the external appearance of a Cetacean should be made before the work of preparing the skeleton is begun. These "Instructions" have been carefully drawn up by Dr. S. F. Harmer, the keeper of the department of zoology, and should prove very welcome.

THE insects attacking stored wheat in the Punjab are described, with admirable coloured illustrations, by J. H. Barnes and A. J. Grove in the Memoirs of the

Department of Agriculture in India (vol. iv., No. 6). This paper is especially noteworthy for a discussion of the effect on the insects of inert gases and variations in temperature and moisture, as connected with the respiratory function. Hydrogen kills beetles more rapidly than nitrogen, and nitrogen than carbon dioxide; an increase in temperature causes a shortening of the lethal period. As to the effect of moisture, Calandra and Rhizopertha are destroyed by desiccation, but Attagenus "prefers dry conditions to moist ones."

IT is thirty years since Profs. Tracy and Goff established in the United States the value of tarred paper discs in preventing the access to cabbage-roots of the cabbage-fly (*Phorbia brassicae*) for the purpose of egg-laying. Although the maggots of this insect are among the most destructive farm and garden pests known to us in these islands, British and Irish cultivators who have heard of the American preventive measure have usually derided it. They may perhaps be convinced by the "Report on a Trial of Tarred Felt Discs for Protecting Cabbages and Cauliflowers," which Mr. J. T. Wadsworth publishes in the *Annals of Applied Biology* (vol. iii., 1917, pp. 82–92). From his research, carried out for the Manchester University Department of Agricultural Entomology, it appears that 63 per cent. of unprotected cauliflowers and 13·2 per cent. of unprotected cabbages are lost, as against 5·1 per cent. and 0·2 per cent. respectively of those plants provided with cards. We understand that a local merchant is now putting effective discs on the market.

THE grading for stock-feeding purposes of the various "offals" produced in the milling of wheat has always been a source of much confusion to the farmer and his advisers. It is a common experience for offals sold under a particular name in one district to differ widely, both in general character and in chemical composition, from materials sold under the same names in other districts. The confusion is mainly due to local variations in milling practice, and little success has attended past efforts at standardisation. A substantial advance should now be possible, however, in the light of observations made by Messrs. T. B. Wood and R. H. Adie, which are recorded in the March issue of the *Journal of the Board of Agriculture*. Their results indicate that, excluding the extreme fractions, flour and bran, milling offals may be classified into three "pure grades" (fine middlings, coarse middlings, and pollards) coming from the mills where the intermediate offals are most completely separated, and three "mixed grades" coming from mills where the offals are not so completely divided. The number of samples examined by Messrs. Wood and Adie, though not large enough to establish standard compositions for the "pure grades," was sufficient to demonstrate that these grades are characterised, not only by a limited range in the size of their particles, but by a definite chemical composition. It is suggested that millers should adopt a uniform system of grading and naming their offals, and a simple method of achieving the latter object, whilst retaining the local trade names, is indicated.

MESSRS. STANFORD have just issued a new and enlarged edition of No. 17 of their large-scale war maps; it includes Tournai, Cambrai, and the environs of St. Quentin on the east, and shows the defensive line held by the enemy from the date of the Marne defeat until the opening of the Somme battle; and it also shows the line to which the enemy had been driven by April 17 during the battle of Arras. An interesting feature of this series is the diagrammatic way in which the levels of the land are shown; tints of brown colour distinguish the land lying between sea-level and 125 ft. above, between 125 ft. and 250 ft., 250 ft. and 500 ft., and 500 ft. and 1000 ft. above sea-level; this gives the map-reader an excellent idea of the lie of the country.

IN a Bulletin issued by the Department of Chemistry, Adelaide, the director, Dr. Hargreaves, discusses the practicability of manufacturing cream of tartar in South Australia. Grapes, the source of tartar, are largely grown in the country, but at present all the tartaric acid and most of the cream of tartar used in South Australia are imported from Europe. Experiments showed that a quite satisfactory process was available. The wine lees receive a preliminary roasting at a temperature of 120° to 150° C., which is high enough to decompose the albuminous and organic colouring matters without injuring the cream of tartar; this much facilitates filtration. The cream of tartar is then extracted with hot water, filtered, and crystallised out. There is not a promising field for a large industry, because the total possible production, it is calculated, would not be sufficient to supply the needs of the country. Nevertheless, the available tartar should not be allowed to go to waste as at present, and a start has been made with the manufacture.

WE learn from the *Geographical Journal* for April (vol. xlix., No. 4) that, at the request of the Astronomer Royal, the Royal Geographical Society is collecting information about possible observing stations for the total solar eclipse on May 29, 1919. The eclipse passes over the Amazon basin, the Atlantic Ocean, and the Congo basin to Tanganyika. Possible stations are suggested in the State of Ceará in Brazil, the Island of Principe, the neighbourhood of Libreville in the French Congo, and on the western escarpment of Tanganyika. Between Libreville and Tanganyika the forest conditions preclude the possibility of a station The essential conditions for an eclipse camp are the good chance of clear weather; reasonable accessibility, with means of transport for heavy instruments; available local labour and materials for the construction of huts and the foundations for instruments; and a good supply of pure water for photography. The society will be grateful to any correspondents who may be so good as to send advice in these matters.

IN fulfilment of the international scheme of which it is the centre, the Meteorological Institute of the Netherlands has recently issued copies of a number of records of magnetic disturbance obtained during 1914 and 1915 at De Bilt Observatory. In all, twenty-three magnetic storms are dealt with—twelve from 1914 and eleven from 1915. In each case the record includes thirty consecutive hours, declination, horizontal-force, and vertical-force traces being shown on the same sheet, referred to a common base or time line. The base-line values and the scale values of the ordinates are marked in each case. The disturbances selected afford excellent examples of "sudden commencements," "bays," slow and rapid oscillations, and isolated tooth-like protuberances on the curves. The tendency in the vertical force to be above its normal value during late afternoon hours in times of disturbance is conspicuous in the majority of instances. One or two of the storms selected for 1915 were of considerable size, especially that of June 17–18. The sensitiveness of the horizontal-force and vertical-force magnetographs is unusually high at De Bilt. This enables details of moderate movements to be more readily recognised, but increases the risk of loss of trace during large movements, and makes it more

difficult to prevent interference of traces when three elements are included in a single sheet. Only great care and resourcefulness could have dealt with the difficulties as satisfactorily as has been done in the present case.

IN addition to the high prices and short quantities of printing paper now available, strawboard, which is necessary for the binding of books, has risen enormously in price, whilst a famine in that commodity threatens soon to deprive the publishing trade altogether of the power to bind books in cloth. At no distant date, therefore, it is probable that we shall see English books issued with paper covers, a state of things which may continue indefinitely, depending not so much upon the cost of this essential material as the length of time which must elapse, even after the war, before there are again sufficient supplies available. It is clear that in the very near future publishers, binders, and booksellers will have, in regard to the majority of books, to adapt themselves to a new order of things, and the public will have to be satisfied with books issued, as is so widely the custom on the Continent, in paper covers.

MR. JOHN MURRAY'S new list of announcements contains, among others, "Collected Essays and Addresses," by Sir F. Darwin (some of the subjects dealt with are "Sir Francis Galton," "Sir George Darwin," "The Movements of Plants," "The Education of a Man of Science," and "The Teaching of Science"); a new and revised edition of "The Book of the Rothamsted Experiments," edited by Dr. E. J. Russell, containing a chapter by A. D. Hall on the secondary effects of manures on the soil, and one by Dr. Russell on the production of plant food in the soil; and "A Regimental Surgeon in War and Prison," by Capt. R. V. Dolbey.

OUR ASTRONOMICAL COLUMN.

A NEW COMET.—In a message to the *Times* of April 20, dated April 19, it is stated that a comet of marked brilliancy had been observed at Sydney. It was seen in the eastern sky at dawn, and Prof. Cooke is said to have described it as a new comet. The position of the comet had not been determined.

COMET *b* 1916 (WOLF).—The following continued ephemeris, for Greenwich midnight, is given by Prof. Crawford in Lick Observatory Bulletin No. 289:—

1917	R.A. h. m. s.	Decl. ° ′	Log Δ	Brightness
April 26	20 21 28	+11 12·2	0·1994	2·81
27	23 55	29·0		
28	26 22	11 45·9	0·1943	
29	28 49	12 2·8		
30	31 16	19·6	0·1892	3·01
May 1	33 43	36·4		
2	36 9	12 53·2	0·1841	
3	38 36	13 9·9		
4	41 2	26·6	0·1791	3·21
5	43 28	43·2		
6	45 55	13 59·8	0·1742	
7	48 21	14 16·4		
8	50 47	32·9	0·1694	3·42
9	53 13	14 49·3		
10	55 38	15 5·7	0·1646	
11	20 58 4	21·9		
12	21 0 29	38·1	0·1599	3·63

The unit of brightness is that on March 5, and the figures given in the last column should be multiplied by 17 to reduce to the unit of brightness on 1916 May 10.

The path of the comet during the above period is through the constellation Delphinus. On May 1 the comet rises about 10.45 p.m. G.M.T. It is now an interesting object in the telescope, but it has been disappointingly faint, and it does not seem very probable that it will become visible to the naked eye.

The distance of the comet from the earth on April 30 will be 144,000,000 miles, and on May 10 136,000,000 miles.

THE APRIL LYRIDS.—These meteors appear to have been more active than usual this year, and the maximum occurred on April 21. On April 20 Mr. Denning watched a beautifully clear sky at Bristol, and recorded twenty-one meteors in three and a quarter hours; of these, six were Lyrids. On April 21 the sky was overcast at Bristol, but Mrs. F. Wilson reports from Totteridge that the firmament cleared at about 11 p.m. G.M.T., and that thirty-five meteors, chiefly Lyrids, were observed in the two and a half hours up to 13.30 G.M.T. Others must have been missed while the paths of the brighter objects were being registered. The radiant point was at 272°+34°, and precisely the same as found independently at Bristol on the previous night. One fireball was observed at Totteridge, and the Lyrids were recorded as very swift and as usually leaving streaks.

On April 22 the weather at Bristol was very favourable after 9.30 G.M.T., but a watch for meteors maintained for about two and a quarter hours yielded only six, half of which were Lyrids.

The conclusion that this important meteoric stream recurs under a very plentiful aspect at periods of about sixteen years is confirmed by this year's observations.

STELLAR SPECTRA OF CLASS R.—The second volume of the publications of the Detroit Observatory, which has recently been issued by Prof. Hussey, furnishes further evidence of the energy and thoroughness with which astrophysical investigations are carried on in America. The chief subjects dealt with are stellar spectra of type B containing emission lines, by R. H. Curtiss; observations of stars of class M*d*, by P. W. Merrill; the spectrum of ζ Ursæ Majoris, by L. Hadley; and the spectra of stars of class R, by W. C. Rufus. In each case a review of previous work is a valuable feature, and the volume is enriched by numerous beautiful reproductions of spectra. While all the contributions add considerably to previous knowledge, that on the stars of class R calls for special notice, as there has been much doubt as to the place of these stars in the stellar sequence. The peculiarity of class R spectra is that they include rays of shorter wave-length than is the case with the ordinary fourth type (N) stars. Ten of the sixty-six known members of the class have been studied in great detail, and six spectra of class N were also photographed for comparison. Mr. Rufus finds that the strength of carbon absorption is not a distinguishing feature between classes R and N, and that the real criterion for differentiating them is the intensity of the continuous absorption in the violet. The outcome of the discussion is to suggest that stars of class R form a connecting-link between the solar type and class N, and that the evolutionary sequence divides at the solar type, classes K and M forming one branch, and classes R and N constituting the other. The alternative possibility that classes M and K may belong to an ascending branch of the temperature curve, as would be the case in Lockyer's classification, does not appear to have been considered.

The radial velocities of the ten class R stars range from −49 to +25 km. per second, and give an average of 14·9 km. when corrected for the solar motion. The average colour-index is 1·7, as compared with 2·5 for class N.

BEN NEVIS AND GLEN COE.[1]

SHEET 53 of the map of Scotland comprises the especially interesting area around Ben Nevis, Glen Coe, and Loch Linnhe. This district includes the highest summit in the British Isles; it presents geological problems, both tectonic and petrologic, of unusual variety, and it has a most instructive and diversified physiography. It is described in a memoir which is a most valuable contribution to Scottish geology. This work has been mainly written by Mr. E. B. Bailey, and is characterised by its high literary quality, its originality of view, its happy expressions and apt comparisons, and its sympathetic summary of previous work on the district, beginning with Macknight and Macculloch at the beginning of the last century. The problems in the Ben Nevis district of most general interest are those connected with the physiography of the Scottish Highlands. The Highland glens have been often attributed to glacial erosion, and some of their most conspicuous features to the glacial deepening of the valleys. Mr. Bailey, however, submits ample evidence that the valleys were pre-glacial, that Glen Nevis, for example, has not been glacially deepened, that some of the gorges have escaped any serious glacial modification, and that the much-quoted hanging valleys of the district, being pre-glacial, cannot be due to the glacial enlargement of the main valleys.

Mr. Bailey adopts the view that the main north-west to south-east valleys are due to a pre-glacial river system, and that they were broken by cross valleys into segments separated by secondary watersheds. In the development of these river valleys he admits that earth movements played an important part, though he considers that the fractures which determined the valleys remained latent until opened by river action. He compares the valleys to the Zambezi gorge, which, though admittedly guided by fractures in the rocks, lacks the features indicative of the structural origin of these Highland valleys. Mr. Bailey attributes many of the valleys to erosion along shatter-belts, which were attributed by Dr. Marr, the author of the term, to the crushing of a band of rocks along an oscillatory fault that may produce no final displacement of the rocks beside it. The description of shatter-belts in the memoir (pp. 215–16) gives no clear evidence as to their origin. Some are bands of broken rock along ordinary faults; some are later than the last of the Cainozoic dykes, and are therefore geologically modern. So far as can be judged from the scanty evidence given in the memoir, these formations may be bands of rocks shattered between parallel ruptures due to tension during the elevation of the country into broad, low upfolds. Mr. Bailey remarks that if many of the Highland valleys had been originated along tension clefts some of them

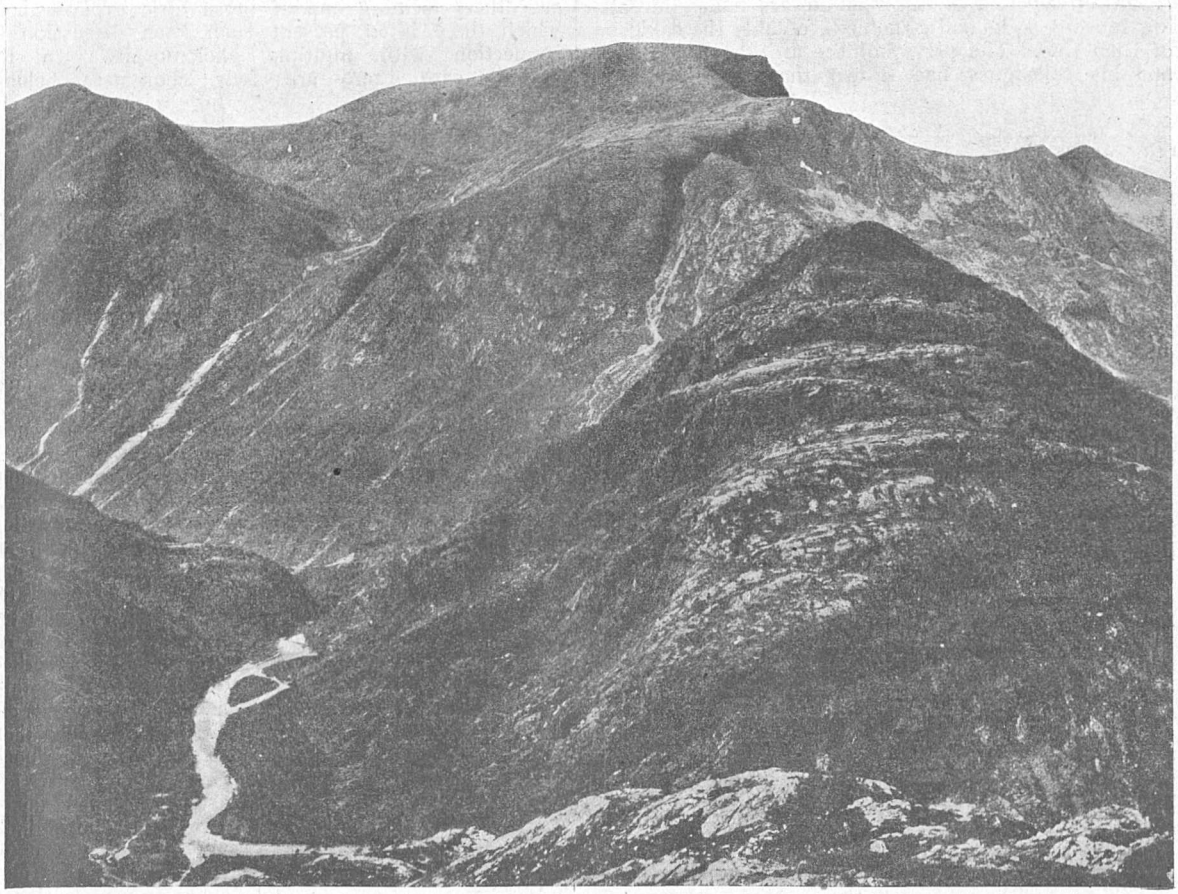

FIG. 1.—Ben Nevis and Glen Nevis Gorge. By permission of the Controller of H.M. Stationery Office.

[1] Memoir Geol. Surv. Scotland. "The Geology of Ben Nevis and Glen Coe, and the Surrounding Country." (Explanation of Sheet 53.) By E. B. Bailey and H. B. Mauffe. Pp. x+247+plates xi.

would be found filled by gravel; but this difficulty is inherent in all theories which assign the valleys a pre-glacial age. However the glens were formed, they must once have contained river gravels, and the fundamental difficulty in the pre-glacial history of Scotland is due to the removal of the earlier gravels during the glaciation. The author objects that by a mistake the view that the Central Valley of Scotland was a rift valley due to trough faulting has been attributed to him; but he stated so in the East Lothian memoir (1910, p. 10), referring to the time "when the Central Valley was originated as a structural feature directly influencing the scenery, a true rift valley, in fact, recalling that which at the present day includes the Great Lakes of Africa."

Within the area of this memoir are many interesting igneous rocks and structures, notably the cauldron of Glen Coe. The survey of the area by Mr. Bailey and his colleagues has shown that this formation

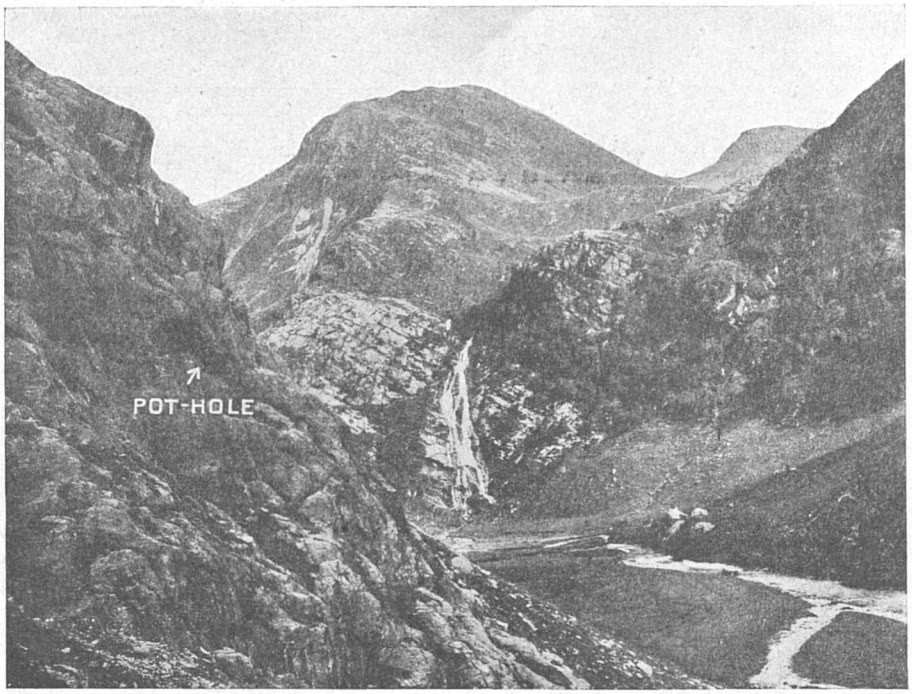

FIG. 2.—An Steall, the waterfall from a hanging valley, tributary to Glen Nevis. Water-worn crags on left due to stream tumbling down marginal crevasse. By permission of the Controller of H.M. Stationery Office.

was due to the subsidence of a block of ground along a circular fault, up which welled a ring of igneous rocks.

The memoir also contains an important contribution to the correlation of the Dalradian rocks of this area. Mr. Bailey explains the difficulties by assuming great recumbent overfolds. His colleague, Mr. Carruthers, on the other hand, adopts a simpler explanation based on a different classification of the rocks. Mr. Bailey recognises that Mr. Carruthers's interpretation is of equal standing with his own, which is advanced tentatively. It is difficult to judge the arguments without the map, the issue of which is delayed by the war. The discussion as to which of this series of schists is the oldest and which the youngest, and of their true succession, will probably be settled in areas further east, where the problem is simpler, as the rocks have been less disturbed by the complex earth movements and prolonged igneous activity to which the Ben Nevis district owes so much of its interest and beauty.

J. W. GREGORY.

THE GENETICS OF SILKWORMS.[1]

FEW animals lend themselves more readily to breeding work than the silkworm moth, and many valuable contributions to our knowledge of their genetics have been made by Japanese workers, among whom Dr. Tanaka has been one of the most successful. The present memoir deals with the inheritance of a number of characters. It is in part an amplification of data previously published by the same author, and in part a collection of new material. Tanaka has dealt for the most part with larval characters. He has worked out in detail the heredity of the patterns peculiar to the various races where his analysis has led him to the detection of seven Mendelian factors. Certain of these are inherited independently, but there are others forming one of those little groups about which there is at present such keen discussion in connection with multiple allelomorphs. In the present case there are four characters belonging to the group, viz. striped, moricaud, normal, and plain (or, in the absence of the P factor, striped quail, moricaud quail, quail, and pale quail). As in the other cases of similar nature, either the hypothesis of multiple allelomorphs or that of complete coupling covers the facts equally well.

One of the most interesting of Tanaka's earlier publications dealt with the peculiar relation existing between the factor for yellow cocoon and certain factors for larval pattern. In the present paper this relation has been worked out in great detail, and has involved the breeding of more than 100,000 individuals. Briefly, the results are as follows: The factor for yellow shows linkage with any one of the group of four characters mentioned above. In the female, linkage is complete, *e.g.* a female *ex* yellow striped × white normal forms yellow striped and white normal ova only, while a female *ex* white striped × yellow normal forms only white striped and yellow normal ova. In the male, however, the linkage is partial. The majority of the sperms are of the two parental types, but about one-quarter belong to the two other possible combinations. Thus a male *ex* moricaud yellow × striped white forms the four types of gamete, moricaud yellow, moricaud white, striped yellow, and striped white, nearly in the proportion 3 : 1 : 1 : 3.

In Drosophila, as is well known, a similar relation exists between sex and certain characters, but here it is always the male which shows complete, and the female partial, linkage. The significance of the parallel is brought out when it is remembered that in

[1] "Genetic Studies on the Silkworm." By Yoshimaro Tanaka. Journal of the College of Agriculture, Tohoku Imperial University, Sapporo, Japan, vol. vii., part 3, June, 1916. Pp. 129–256+plates i–vi.

Drosophila it is the male which is heterozygous for sex, while in moths it is the female.

The larval patterns investigated by Tanaka, though definite and distinct from one another, show in some instances much variation with respect to the intensity of their pigmentation. The normal and quail patterns can exist in several grades, so that a continuous series can be formed between the lightest and the darkest. Nevertheless, these grades are definitely transmitted, and Tanaka considers that his experiments afford good evidence that these apparently continuous series can be explained on the assumption of very few genetic factors.

An interesting section is that on the inheritance of moulting. In certain cases the three-moult behaves as a simple dominant to the four-moult character; in other cases the relation is more complex, though Tanaka considers that the facts can be explained by regarding the genetic difference here as one involving two factors. In any case, definite experiments show that the number of moults is much subject to environmental changes.

Records are given of a number of cases of mosaics and gynandromorphs, many of which are illustrated. In view of their importance for theories of sex-determination and fertilisation, it is to be regretted that no pedigrees are given.

Embodying as it does the greater part of our knowledge of the genetics of the silkworm, the memoir deserves careful study by the practical breeder, as well as by the professed geneticist, and we look forward to the publication of the author's analysis of cocoon characters which he promises upon some future occasion.

NEW DETERMINATIONS OF PROPER MOTIONS OF STARS.[1]

THE author of the catalogue before us is carrying out the suggestion of M. A. Donner that those observatories that finished their astrographic catalogue plates in good time should now repeat them, in order to determine proper motions. The Helsingfors plates were taken between 1892 and 1896; they were repeated, at similar hour-angles and calendar dates, between 1909 and 1913, giving an average time-interval of seventeen years.

The corresponding pairs of plates were examined simultaneously in the Blink apparatus, all cases of apparent shift being noted, and afterwards verified by measurement. A selection was made on each pair of eight faint stars that showed no shift; these stars were taken as the zero point to which the motions were referred. This method does not eliminate the small systematic effect due to the solar motion, or other common drift which the region may have. Correction was made for these effects by comparison with Boss, there being forty Boss stars in the region discussed (R.A. 9h. to 12h., N. dec. 39° to 47°). From these he adopts the corrections to his centennial motions, in R.A. −0·07s., in dec. 0″. There are eighteen additional stars in Porter's catalogues, which give centennial corrections −0·34s., +0·8″. Porter's proper motions do not claim to be reduced to an absolute system. A further comparison, not used by the author, is afforded by twenty-nine additional stars in the revised Groombridge catalogue. These give the centennial corrections to Helsingfors (small, but systematic) −0·15s., +1·1″. These tests show that the Helsingfors results are quite satisfactory, considering the shortness of the time-interval; they give us a useful list of 1016 proper motions, of which at least 900 are new. The following large motions of faint stars are noteworthy:—

R.A. 1900	N. Dec. 1900	Photo. Mag.	Centennial Motion	Pos. Angle.
h. m. s.	° ′	m.	″	°
8 58 54	39 13	10·2	48	182
9 17 35	40 35	9·3	38	262
10 0 40	42 13	11·0	48	211
10 25 29	46 3	8·8	84	225
10 50 25	42 26	9·0	74	248
11 5 50	45 58	11·1	75	234
11 29 18	40 43	10·6	64	223
11 31 17	39 45	10·1	60	130

The author gives an examination of the mean parallaxes of stars of various magnitudes, and of the solar motion. The latter must be considered premature until the results for the whole zone are available. The mean parallaxes for magnitudes 3 to 7 are 0·032″; magnitudes 7 to 9, 0·021″; magnitudes 9 to 11, 0·017″. These are much larger than those of Kapteyn, which is explained by the fact that the present catalogue contains only those stars that show a sensible shift in seventeen years; these are comparatively near us. ANDREW C. D. CROMMELIN.

[1] "Recherches sur les Mouvements Propres des Etoiles dans la zone photographique de Helsingfors." Par Ragnar Furuhjelm. (i) Clichés de 9h. à 12h. 4to, pp. 190. (Helsingfors: Imprimerie de la Société de Littérature Finnoise, 1916.)

CIVIL SERVICE ESTIMATES FOR SCIENCE AND EDUCATION.

CLASS IV. of the Estimates for Civil Services for the year ending March 31, 1918, dealing with Education, Science, and Art, has now been issued as a Parliamentary Paper. We record the main items of these estimates of expenditure, with details relating to scientific investigation and higher education.

It will be noticed, as has been pointed out already in these columns, that the grant in aid of scientific and industrial research has been increased to 1,038,050*l.*, an increase of 998,050*l.* on the grant for the year 1916–17.

United Kingdom and England.

BOARD OF EDUCATION.

	£
Administration	206,902
Inspection and examination	217,158
Grants in respect of public elementary schools, etc.	12,669,455
Grants for training of teachers	357,900
Grants towards expenditure on secondary schools and pupil teachers and bursars, etc.	962,600
Grants towards expenditure on other aided institutions, schools, and classes, and on assistance in choice of employment	613,960
Imperial College of Science and Technology and Chelsea Physic Garden (grants in aid)	33,650
Royal College of Art	7,743
The Victoria and Albert Museum	59,682
Science Museum	13,598
Geological Museum	3,171
Geological Survey of Great Britain	14,387
Bethnal Green Museum	2,249
Gross total	15,162,455
Deduct—	
Appropriations in aid[1]	2,675
Net total	15,159,780
Net decrease	26,952

[1] In addition, receipts from sale of catalogues and other publications supplied by the Stationery Office, estimated at 400*l.*, will be paid to the Vote or Stationery and Printing.

[The original estimate of 15,159,780*l.* for the Board of Education has since been increased to 19,015,780*l.* by a Supplementary Estimate of 3,856,000*l.*, made up as follows:—

	£
MISCELLANEOUS INQUIRIES, ETC.	
Fees, travelling and other expenses in connection with the introduction of a scheme of pensions for secondary, technical, etc., teachers	2,500
SUPPLEMENTARY GRANTS TO LOCAL EDUCATION AUTHORITIES FOR ELEMENTARY EDUCATION.	
These grants will be paid to local education authorities under regulations approved by the Treasury	3,420,000
GRANTS FOR SECONDARY SCHOOLS AND PUPIL TEACHERS AND BURSARS, ETC.	
Increased grants to secondary schools under regulations approved by the Treasury ...	433,500
Total	3,856,000]

BRITISH MUSEUM.	£
British Museum[2]	91,056
Natural History Museum	44,464
Gross total	135,520
Deduct—	
Appropriations in aid	6,925
Net total	128,595
Net decrease	4

SCIENTIFIC INVESTIGATION,[3] ETC.	£
Royal Society—	
(i) (*a*) Scientific investigations undertaken with the sanction of a committee appointed for the purpose (4,000*l.*) and (*b*) scientific publications (1,000*l.*)	5,000
(ii) Magnetic Observatory at Eskdalemuir	1,000
(iii) National Physical Laboratory ...	7,000
(iv) Aeronautical Section of the National Physical Laboratory	18,275
Total for Royal Society ...	31,275
Meteorological Office	22,500
Royal Geographical Society	1,250
Marine Biological Association of the United Kingdom	500
Royal Society of Edinburgh	600
Scottish Meteorological Society	100
Royal Irish Academy	1,600
Royal Irish Academy of Music	300
Royal Zoological Society of Ireland ...	500
Royal Hibernian Academy	300
British School of Athens[4]	—
British School at Rome	500
Royal Scottish Geographical Society ...	200
National Library of Wales	4,200
National Museum of Wales	10,500
Solar Physics Observatory	3,000
School of Oriental Studies	4,000
North Sea Fisheries Investigation[4] ...	—
Royal College of Surgeons in Ireland ...	2,000
Edinburgh Observatory	1,681
Imperial Transatlantic Expedition, 1914–15, Relief Expeditions	15,000
Total	100,006
Net decrease	1,665

SCIENTIFIC AND INDUSTRIAL RESEARCH.	£
Salaries, wages, and allowances	7,250
Travelling and incidental expenses	800
Grants for investigations carried out by learned and scientific societies, etc.[5] ...	24,000
Grants to students and other persons engaged in research[5]	6,000
Scientific and industrial research[6] (grant in aid)	1,000,000
Total	1,038,050
Net increase	998,050

UNIVERSITIES AND COLLEGES.	
Universities and Colleges, Great Britain.	£
University of London	8,000
Victoria University of Manchester	2,000
University of Birmingham	2,000
University of Wales	4,000
University of Liverpool	2,000
Leeds University	2,000
Sheffield University	2,000
Bristol University	2,000
Durham University	2,000
Scottish Universities	84,000
Colleges, Great Britain	150,000
University Colleges, Wales	12,000
Welsh University and Colleges: Additional grant	20,500
Total for Universities and Colleges...	292,500
Intermediate Education, Wales.	£
Examination and inspection, grant in aid...	1,200
Schools	27,500
Total for Intermediate Education, Wales	28,700
Grand total	321,200

Scotland.

PUBLIC EDUCATION.	£
Administration	28,384
Inspection	43,044
Elementary schools	2,071,230
Continuation classes and secondary schools	228,500
Royal Scottish Museum, Edinburgh ...	9,849
Training of teachers	131,245
Examination of accounts	1,513
Total	2,513,765
Net decrease	30,977

[2] The British Museum (Bloomsbury) (except the reading-room, etc.) and part of the Natural History Museum, South Kensington, are closed during the war.

[3] The expenditure out of these grants in aid, with the exception of that for the Meteorological Office, will not be accounted for to the Comptroller and Auditor-General, nor will any unexpended balances of the sums issued be surrendered by the payees at the close of the financial year. In the case of the Meteorological Office the expenditure, though not liable to surrender of balance, will be subject to audit by the Comptroller and Auditor-General.

[4] These grants are suspended owing to the war.

[5] These grants will be distributed by a Committee of the Privy Council, on the recommendation of an Advisory Council, to promote the development of scientific and industrial research in the United Kingdom, and will be subject to such conditions as the committee may think necessary.

[6] This grant in aid will be paid to the account of the Imperial Trust for the Encouragement of Scientific and Industrial Research. The expenditure of the Trust will be audited by the Comptroller and Auditor-General, but any balance remaining on the account will not be surrendered at the close of the financial year. Grants will be made by the directions of a Committee of the Privy Council over an agreed period to approved trade associations for research, to supplement the funds of the associations, and payments in respect of such grants will not be liable to surrender by the grantees at the end of the financial year.

Ireland.

PUBLIC EDUCATION.

	£
Administration	32,167
Inspection	49,094
Training colleges	62,713
Model schools	3,891
National schools	1,591,580
Manual and practical instruction	12,415
Teachers' residences	6,700
Superannuation, etc., of teachers (grants in aid)	60,158
Gross total	1,818,718
Deduct—	
Appropriations in aid	700
Net total	1,818,018
Net decrease	173,566

INTERMEDIATE EDUCATION.

	£
Towards salaries of teachers, including cost of administration	40,000
Endowed Schools Commissioners	850
Total	40,850

SCIENCE AND ART.

	£
Institutions of science and art	47,950
Schools of science and art, etc.	103,550
Geological Survey	1,588
Examinations in courses of instruction conducted in technical schools	650
Gross total	153,738
Deduct—	
Appropriations in aid	1,520
Net total	152,218

UNIVERSITIES AND COLLEGES.

Grants—	£
Queen's University of Belfast	18,000
University College, Dublin	32,000
University College, Cork	20,000
University College, Galway	12,000
National University of Ireland and University College, Dublin	28,500
Additional grant to University College, Galway	2,000
Total	112,500

SUMMARY.

United Kingdom and England.

	£
Board of Education	15,159,780
British Museum	128,595
National Gallery	11,421
National Portrait Gallery	3,631
Wallace Collection	4,031
London Museum	2,300
Scientific Investigation, etc.	100,006
Department of Scientific and Industrial Research	1,038,050
Universities and Colleges, Great Britain, and Intermediate Education, Wales	321,200

Scotland.

Public Education	2,513,765
National Galleries	3,980

Ireland.

	£
Public Education	1,818,018
Intermediate Education (Ireland)	40,000
Endowed Schools Commissioners	850
National Gallery	1,830
Science and Art	152,218
Universities and Colleges	112,500
Total	21,412,175
Net increase	764,787

[Supplementary Estimate for Board of Education, 3,856,000*l.*]

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

GLASGOW.—The following degrees of doctors of science were conferred on April 24:—H. H. Green: Thesis, "Note on the Estimation of Potassium in Urine; Investigations into the Nitrogen Metabolism of Soil; The Sulphur Sheep Dips; Upon the Composition and Analysis of Polysulphide Solutions; Arsenical Dip-Tester; with other papers." T. M. MacRobert: Thesis, "Functions of a Complex Variable." W. R. Smellie: Thesis, "Contributions to the Geology of the West of Scotland: The Sandstones of the Upper Red Barren Measures to the East of Glasgow; The Cowal 'Landslip' of August 5, 1912; The Tertiary Composite Sill of South Bute; The Igneous Rocks of Bute." J. M'Lean Thompson: Thesis, "Studies in Floral Zygomorphy: I. The Initiation of Staminal Zygomorphy; The Anatomy and Affinity of *Deparia Moorei*, Hook; The Anatomy and Affinity of *Platyzoma microphyllum*, R.Br."

IN an article on technical education in the *Electrician* for April 6 Mr. F. M. Denton outlines the proposals made by Viscount Haldane and by Sir Trevor Dawson for the improvement of education in this country, and makes some further suggestions. In general, he agrees with Lord Haldane that history, literature, language, and science should be taught to each boy, and that early specialisation should be discouraged. He points out that both Lord Haldane and Sir Trevor Dawson distinguish between what he calls the "applied humanities," which give a man knowledge of human nature and enable him to understand his neighbours, and the "useless humanities," the dead languages. With Lord Haldane he advocates the substitution of thought-stimulating work like the study of scientific phenomena for the mere memory exercise involved in the ordinary study of dead languages. Sir Trevor Dawson thinks the technical engineer should leave school at fourteen, enter a works as a half-timer, devoting the rest of the day to study at a technical school, and if he passes successfully through a five years' course should proceed to the university. Mr. Denton thinks half-time schemes inadequate, and stigmatises evening classes for boys who have put in a day at the works as "State sweating." He urges the State to undertake the education of each boy from fourteen to eighteen at a secondary school, and from eighteen to twenty-one at a technical school, as a good investment likely to advance the nation's welfare.

THE number of programmes of educational reform issued by associations competent to speak on the subject of our national education continues to increase, and fortunately an examination of the proposals made by them reveals a growing unanimity as to the essential changes which must be made in our system of education if national efficiency is to be secured.

One of the most recent of these programmes is that issued by the National Association of Head Teachers, which has a membership of nearly 6000. Among outstanding recommendations of the head teachers are the following: The age of exemption from full-time attendance should not be lower than fourteen; the leaving age should be raised to fifteen and then to sixteen, so soon as the necessary arrangements can be made; no class should exceed forty on the roll, and steps should be taken immediately to reduce them to that limit, and there should be a fully qualified teacher, trained and certificated, for each class. The head teachers urge that a committee of competent educationists should decide what subjects form a necessary and basic part of every curriculum, up to, say, twelve years of age, and the amount of time per week which should be devoted to them, and what subjects should be added in later years, attention being directed to the needs of particular localities. They insist, too, that the curriculum of every school should include an amount of practical work sufficient for the needs of the locality, and that a special room for such work should be attached to each school. They ask for a sufficient and suitable supply of secondary schools of varying type and character, and that every child with the requisite ability and inclination should be able to proceed to them. In large elementary schools where children remain beyond the age of fourteen, provision, the programme states, should be made for instruction in drawing, music, science, language, handicraft, and domestic economy. So far as continuation schools are concerned, the head teachers suggest that the employer of any person under eighteen should be required to enable him or her to attend day continuation classes for not less than eight hours a week, for which the employee should be paid the ordinary rate of wages, and that, in addition to this attendance at school, the hours of labour per week should not exceed forty-eight.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, March 29.—Sir J. J. Thomson, president, in the chair.—Sir William **Abney**: The fourth colourless sensation in the spectrum sensation curve when measured in the centre of the retina. At the end of the last century the author carried out a large series of observations on the luminosity of spectra of very low density, but only recently has he had an opportunity of working some of them out. Some time ago he published in the *Phil. Trans.* the three-colour sensations which apparently suffice to account for all the spectrum colours. There was a doubt if in the mixture of the sensations to form these colours some account ought not to be taken of the colour sensation which appears when a coloured ray is diminished in intensity for all colour to be absent and only a colourless residue is left. The author confines himself to the colours received on the centre of the retina, for on the periphery other conditions exist. The paper shows the method of observation which was employed, and, discussing the results, the author comes to the conclusion that the admixture of the colourless sensation with the three-colour sensations is so small as to be inappreciable, and that the sensation curves given in his paper, to which reference has been made, need no correction on this account.—G. W. **Walker**: Magnetic inertia. It is shown that a magnetised body may be expected to possess magnetic inertia just as an electrified body possesses electric inertia. In the case of a sphere of radius a and magnetic moment m the inertia for acceleration parallel to the magnetic axis is $2/5m^2a^{-3}C^{-2}$, and for acceleration perpendicular to the magnetic axis $4/5m^2a^{-3}C^{-2}$. (C is the velocity of radiation.) The order of magnitude of this inertia is considered in an astronomical as well as in an atomic connection.—F. **Tinker**: The selective properties of the copper-ferrocyanide membrane. In the present paper the selective properties of copper-ferrocyanide have been studied by measuring the change in solution concentration which takes place when the dry colloid is immersed in cane-sugar solutions of various strengths. It is found that the sugar solutions become stronger, owing to the fact that the water and not the sugar is taken up selectively by the ferrocyanide. The experimental results lead to the hypothesis that a colloidal hydrate, $Cu_2FeCy_6.3H_2O$, is first formed, and that this colloidal hydrate then takes up still more moisture by adsorption. The amount of adsorbed moisture taken up by the colloid decreases as the strength of the solution increases. It is also shown in the paper that the side of a membrane in contact with pure water has a greater moisture content than the side in contact with sugar solution. This fact supports the hypothesis—first advanced by Graham on experimental grounds—that osmosis across a membrane takes place because pure water induces a greater moisture pressure and concentration inside the membrane than the solution does.—C. M. **Williams**: X-ray analysis of the crystal-structure of rutile and cassiterite.—Dr. J. G. **Leathem**: Discontinuous fluid motion. The subject of the paper is the flow, with free stream-lines, of infinitely extended fluid past a finite obstacle with a sharp prow and curved sides. The methods of Levi-Civita, Cisotti, Villat, and Levy are compared with the writer's own method, and translated into formulations by curve-factors.

Zoological Society, April 3.—Prof. E. W. MacBride, vice-president, in the chair.—R. H. **Burne**: Notes on some of the viscera of an okapi (*Okapia johnstoni*, Lankester). The author described the anatomy of the soft parts of various portions of this animal.

Royal Meteorological Society, April 18.—Major H. G. Lyons, president, in the chair.—E. G. **Bilham**: The diurnal variation of atmospheric pressure at Benson, Oxon., during 1915. By means of hourly measurements of traces from the Dines float barograph at Benson Observatory, the mean diurnal inequalities for each calendar month of 1915, and for the year, have been obtained and submitted to Fourier analysis. With the exception of the amplitude of the 24-hourly oscillation, the mean results for the year are in good agreement with the normal values for Kew and Oxford. A discussion of the probable errors to which the results are liable leads to the conclusion that the first order term is the most susceptible to casual error due to non-periodic changes of pressure. It is, moreover, well known that this term is largely dependent on local meteorological and geographical conditions, so that considerable fluctuations are to be expected. Comparing the Benson results for individual months with the normal values for Kew, it is found that relatively high values of the diurnal range are associated with high values of the amplitude of the 24-hourly oscillation. The second and third order amplitudes show similar seasonal variations at the two stations.—Lieut. C. D. **Stewart**: Atmospheric electrical phenomena during rain. A preliminary investigation has been made into the values of the potential gradient occurring during rain. It is found that maximum values occur in summer and minimum values in winter. The maximum fine-weather values occur in winter. The form of the diurnal variation of rain potential gradient is still uncertain, although

it appears to have only one oscillation in twenty-four hours, as compared with the double oscillation in fine weather. In most cases rain depresses the potential gradient. Mean depressions have been compared with their corresponding mean hourly rainfalls. The depression was found to be a function of the rate of fall of rain. At Kew the potential gradient is measured directly in volts per metre by taking the potential in volts at the height of a metre. This method gives the time value as obtained from the surface density only where the electrical charge in the air is negligible. This is the case in fine weather, but probably not during rain. The possible errors have been calculated for different potential gradients; in the case of very fine rain the error may be some hundreds of volts per metre.

PARIS.

Academy of Sciences, April 2.—M. d'Arsonval in the chair.—G. **Bigourdan**: The position and co-ordinates of the observatory of the Montmartre gate.—Ch. **Lallemand**: Time on board ship. It is pointed out that with the method at present in use for fixing true time at sea, it is possible that two vessels, coming from opposite directions, and noting at the moment of their meeting the time of the same phenomenon, may differ in their record by as much as 100 minutes, and it is impossible to deduce the true time. It is proposed by the Bureau des Longitudes that as soon as circumstances permit the true time shall be substituted, the time of the universal system of hour-zones, already in use on land in most civilised countries. From March 25 this plan has been adopted in the French Navy and on mobilised vessels.—M. Emile Picard was elected permanent secretary for the mathematical sciences in the place of the late G. Darboux.—J. **Renaud**: The influence of the Hermelles on the *régime* of the bay of Mont Saint Michel. An adverse criticism of the views recently published by MM. Galaine and Houlbert relating to the formation of the Hermelles reefs.—L. **Tribondeau** and J. **Dubreuil**: New microscopic stains derived from methylene-blue. Detailed descriptions are given for the preparation of methylene-violet and methylene-azure from methylene-blue. The preparation of three staining fluids from these colouring matters is also given.—Ph. **Glangeaud**: The peat bogs, the lakes, and the ancient glacial lakes of the Mont Doré volcanic massif.

WASHINGTON, D.C.

National Academy of Sciences (Proceedings, No. 2, vol. iii., February).—C. **Schuchert**: Atlantis and the permanency of the North Atlantic Ocean bottom. The Azores are volcanic islands and not the remnants of a continental mass. The tachylites dredged up from north of the Azores were probably formed where they now are. No known geologic data prove the existence of Plato's Atlantis in historic times.—G. H. **Parker**: The responses of hydroids to gravity. The geotropic response in Corymorpha is the result of activity of the neuromuscular sheath and not of the core cells.—E. P. **Allis,** jun.: The lips and the nasal apertures in the Gnathostome fishes, and their homologues in the higher vertebrates.—J. **Lipka**: Natural and isogonal families of curves on a surface.—G. H. **Hardy** and J. E. **Littlewood**: Some problems of Diophantine approximation: the series $e(\lambda_n)$ and the distribution of the points $(\lambda_n\alpha)$.—H. S. **Uhler**: Moseley's law for X-ray spectra. The law that the square root of the frequency of the lines is a linear function of the atomic numbers of the radiating elements is found to depart from the observed facts far more than the experimental errors, and an additional term is suggested which yields a formula agreeing with the facts. The order of magnitude of the high-frequency radiations of elements of small atomic number the spectra of which have not yet been obtained is discussed.—J. R. **Miner**: A note on the fitting of parabolas. Pearson's formula for fitting parabolas by the method of moments assumes the origin at the mid-point of the range. Similar formulæ are developed by the author when the origin is assumed one unit below the first ordinate, as in least squares.—F. G. **Pease** and H. **Shapley**: Axes of symmetry in globular clusters. The axis of symmetry of Messier 13 appears to be independent of magnitude, length of exposure, and distance from the centre. An elliptic distribution of stars is not confined to the Hercules cluster.—E. G. **Conklin**: The share of egg and sperm in heredity. The author discusses assumed equivalence of inheritance of both persons, egg differentiations which persist in embryo and adult, Mendelianism of inheritance through the egg cytoplasm.—J. P. **Iddings** and E. W. **Morley**: A contribution to the petrography of the island of Bawéan, Netherlands Indies. Six detailed analyses are given.—W. M. **Wheeler**: The phylogenetic development of subapterous and apterous castes in the Formicidæ. An array of facts bearing on the question of continuous variation *versus* mutation, with the conclusion in favour of the former.—C. **Barus**: Refractivity determined, irrespective of form, by displacement interferometry.—J. P. **Baumberger**: The food of *Drosophila melanogaster,* Meigen. The food of the larvæ is yeast; the insect depends upon these cells for its proteins. Adult flies do not need proteins, but survive much longer on sugar agar than upon yeast agar.—E. **Huntington**: Temperature optima for human energy. The optimum temperature appears to be very nearly 63° F., and largely independent of race or locality.—A. van **Maanen**: The parallax of the planetary nebula N.G.C. 7662. The value 0·023″ is obtained, placing the nebula at a distance of 140 light-years with a linear diameter of nineteen times that of Neptune's orbit (see NATURE, April 19, p. 153).—C. T. **Brues**: Adult hymenopterous parasites attached to the body of their host.

VICTORIA.

Royal Society, December 14, 1916.—Mr. J. A. Shephard in the chair.—F. **Chapman**: New or little-known Victorian fossils in the National Museum, part xx. Some Tertiary fish-teeth. The occurrence of the genus Carcharoides (*C. totuserratus,* Amegh., and *C. tenuidens,* Chapm.) affords an additional link in the evidence for the contemporaneity of the South American (Patagonian) and the Victorian (Janjukian) series. *Odontaspis elegans,* Ag. sp., *Myliobatis moorabbinensis,* Ch. and Pr., and *Sargus laticonus,* Davis, are now recorded from undoubted Janjukian (Miocene) beds, the latter being hitherto known only from the Oamaru beds of New Zealand. Rostral teeth of Pristis allied to the Mediterranean species, *P. antiquorum,* occur for the first time in the southern hemisphere, in the basal Kalimnan at Beaumaris. Pristiophorus (the side-gilled shark of Hobson's Bay), hitherto known only from the molasse of Würtemberg and the Upper Cretaceous of Mount Lebanon, is represented by a rostral tooth from the same beds, and the author shows Davis's *Lamna lanceolata* from the Oamaru series of New Zealand to belong to that genus, and conspecific with the Victorian form.—A. J. **Ewart**: Contributions to the flora of Australia, No. 25. The author notes the sudden appearance of aliens belonging to the genera Brachypodium and Orthocarpus. Other plants recorded as being established in Victoria are Ceratogyne, *Digitalis purpurea, Erica arborea,* and two species of plantain.—Elinor **Archer**: A disease or malformation of lucerne. The proliferation discovered in this plant was investigated

for traces of parasitic fungi and malformation caused by insects, but with negative results. The provisional inference is drawn that this malformation was caused more or less directly through malnutrition of the plant, which was growing in droughty country.—E. W. **Skeats**: The age of the alkali rocks of Port Cygnet and the D'Entrecasteaux Channel in the south-east of Tasmania. The previous evidence of the age of the alkali rocks of this district pointed to the Permo-Carboniferous or Trias, since they did not appear to intrude the diabase. Fresh evidence is now recorded which shows, at Kettering, that these rocks cut the diabase, and are therefore referred to a Cainozoic age.—A. D. **Hardy**: Teratological notes on Victorian plants. The author described a number of abnormal occurrences as affecting root, stem, branch, and fruit of indigenous flora, chiefly of the genus Eucalyptus. Fasciation in *Exocarpus gracilis* and spiral torsion in *Casuarina stricta* were noted.

BOOKS RECEIVED.

La Réforme Rationnelle de l'Heure. By E. Désortiaux. Pp. 14. (Paris: Gauthier-Villars.)

Seven Doubts of a Biologist. By S. A. McDowall. Pp. 64. (London: Longmans and Co.) 1*s*. net.

Transactions and Proceedings of the Royal Society of South Australia. Vol. xxxix. Pp. 892+70 plates +50 figures. (Adelaide: The Society.) 21*s*.

British Antarctic Expedition, 1907–9. Reports on the Scientific Investigations. Geology. Vol. ii., Contributions to the Palæontology and Petrology of South Victoria Land. By W. N. Benson and others. Pp. vii+269+38 plates+18 figures; also index to vols. i. and ii. (London: W. Heinemann.) 3 guineas net.

The Causation of Sex in Man. By E. R. Dawson. Second edition. Pp. xiv+226+illustrations. (London: H. K. Lewis and Co., Ltd.) 7*s*. 6*d*. net.

Bacon's New Series of Physical Wall Atlases. British Isles. (London: G. W. Bacon and Co., Ltd.) 26*s*.

DIARY OF SOCIETIES.

THURSDAY, APRIL 26.

ROYAL INSTITUTION, at 3.—Industrial Finance after the War: Prof. H. S. Foxwell.

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—High-tension Overhead Transmission Lines: G. V. Twiss.

ROYAL GEOGRAPHICAL SOCIETY, at 5.—A New Series of Economic Maps: G. Philip.

FRIDAY, APRIL 27.

ROYAL INSTITUTION, at 5.30.—The Organs of Hearing in relation to the War: Dr. Dundas Grant.

SATURDAY, APRIL 28.

ROYAL INSTITUTION, at 3.—Principles of Aerial Navigation: Prof. G. H. Bryan.

PHYSICAL SOCIETY, at 5.—Note on the General Equation for Wave Motion in an Elastic Medium: Prof. J. A. Fleming.—The Effect of Stretching on the Thermal Conductivity of Wires: A. Johnstone.—Cohesion: Prof. H. Chatley.

MONDAY, APRIL 30.

ROYAL SOCIETY OF ARTS, at 4.30.—The National Shortage of Iron Ore Supplies. I.: Available Home Supplies of Iron Ore: Prof. W. G. Fearnsides.

TUESDAY, MAY 1.

ROYAL INSTITUTION, at 3.—Tetanus: Prof. C. S. Sherrington.

FARADAY SOCIETY, at 8.—*Discussion*: Osmotic Pressure: Opener: Prof. A. W. Porter.—Papers: The Colloidal Membrane: Its Properties and its Function in the Osmotic System: Dr. F. Tinker.—Osmotic Pressure in Relation to the Constitution of Water and the Hydrates of the Solute: W. R. Bousfield.

RÖNTGEN SOCIETY, at 8.15.

ZOOLOGICAL SOCIETY, at 5.30.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 5.—Some Human and Animal Bones, Flint Implements, etc., discovered in Two Ancient Occupation-levels in a Small Valley near Ipswich: J. Reid Moir.

WEDNESDAY, MAY 2.

GEOLOGICAL SOCIETY, at 5.30.—Supplementary Notes on Aclisina, De Koninck, and Aclisoides, Donald, with Descriptions of New Species: J. Longstaff.—The Microscopic Material of the Bunter Pebble Beds of Nottinghamshire, and its probable Source of Origin: T. H. Burton.

ROYAL SOCIETY OF ARTS, at 4.30.—Herb growing in the British Empire: Its Past, Present, and Future: J. C. Shenstone.

ENTOMOLOGICAL SOCIETY, at 8.

INSTITUTION OF CIVIL ENGINEERS, at 5.30.—James Forrest Lecture: The Standardisation of Engineering Materials, and its Influence on the Prosperity of the Country: Sir J. Wolfe Barry, K.C.B.

SOCIETY OF PUBLIC ANALYSTS, at 8.—The Estimation of Phenacetin and Allied Compounds by means of Hypochlorous Acid: A. D. Powell.—A Rapid Method for the Determination of Nickel and Cobalt in Ores and Alloys: Dr. W. R. Schoeller and A. R. Powell.—Note on Opium Poisoning Cases: J. Webster.

THURSDAY, MAY 3.

ROYAL SOCIETY, at 4.30.—Croonian Lecture: The Excitation Wave in the Heart: Dr. Thomas Lewis.

ROYAL INSTITUTION, at 3.—Pagan Religion at the Time of Coming of Christianity: Prof. Gilbert Murray.

MATHEMATICAL SOCIETY at 5.30.

IRON AND STEEL INSTITUTE, at 10.30 a.m.—Steel Ingot Defects: J. N. Kilby.—Influence of Surface Tension on the Properties of Metals, especially of Iron and Steel: F. C. Thompson.

INSTITUTE OF METALS, at 8.30.—Seventh May Lecture: Researches made Possible by the Autographic Load-Extension Optical Indicator: Prof. W. E. Dalby.

FRIDAY, MAY 4.

ROYAL INSTITUTION, at 5.30.—Some Guarantees of Liberty: H. Wickham Steed.

IRON AND STEEL INSTITUTE, at 10 a.m.—The Penetration of the Hardening Effect in Chromium and Copper Steels: L. Grenet.—Cementation by Gas under Pressure: F. C. Langenberg.—Origin and Development of the Railway Rail: G. P. Raidabaugh.—Case Hardening of Iron by Boron: N. Tschischewsky.—Determination of the Line S.E. in the Iron-Carbon Diagram by Etching Sections at High Temperatures *in vacuo*: N. Tschischewsky and N. Schulgin.

GEOLOGISTS' ASSOCIATION, at 7.30.—The Correlation of the Ingletonian Slates: J. F. N. Green.—The Landslips of Folkestone Warren and the Thickness of the Lower Chalk and Gault near Dover: C. W. Osman.

SATURDAY, MAY 5.

ROYAL INSTITUTION, at 3.—The Electrical Properties of Gases: Sir J. J. Thomson.

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