THURSDAY, AUGUST 15, 1918.

OLD UNIVERSITIES AND NEW NEEDS.

The Life of Sophia Jex-Blake. By Dr. Margaret Todd ("Graham Travers"). Pp. xviii + 574. (London: Macmillan and Co., Ltd., 1918.) Price 18*s*. net.

SOPHIA JEX-BLAKE was born in 1840 and died in 1912. The world, when she entered it, offered to an intellectual woman neither the education nor the openings which her more fortunate brothers enjoyed as a right and sought to preserve as a monopoly. It is to her, probably more than to any other individual, and to her long and often bitter fight in the women's cause, that their right to a liberal education has been conceded and the gates of the medical profession opened to them. She was a born chronicler and recorder, as well as a downright and formidable antagonist, and this, which has enabled her biographer to write a full and accurate account of her career, often stood her in good stead against her opponents. Reproduced as an appendix is the correspondence in the *Times* in which she replied to the representations of the Principal of Edinburgh University—a masterly instance of the power of facts over the most skilful advocacy and embroidery. As her biographer remarks: "The two letters represent two conflicting schools of historians, the one sweeping, picturesque, probable; the other definite, statistical, true."

Dr. Margaret Todd has worked through and drawn upon an immense accumulation of original material for her biography. Losing herself and her own personality in her task, her literary gifts severely confined to the sifting and proper presentation of voluminous correspondence, diaries, and other records, she succeeds in giving a living, human portrait of the old warrior and of what manner of women they were—how unlike popular caricature—who broke down the barriers and burst the fetters of the Victorian age. Around the central figure, her faults and her strength faithfully and sympathetically rendered, seeming to stand out by themselves without aid, so artistically has the elimination of everything not essential been performed, much of the history of the earlier phases of the women's moment has been reconstructed and much of permanent interest saved from oblivion.

But the book is something more than a biography of a remarkable personality and history of a period. It presents an epitome of the universal struggle between progress and reaction as it was fought out at one of the ancient seats of learning. That fight is over, the victory has been won, and the issue at stake has ceased to be a living question. Much of what is here recorded it is difficult to believe happened only fifty years ago. Is not this, it may be asked, itself a tribute to the magnitude and rapidity of the progress made? Unfortunately, progress is not to be measured by the magnitude of the opposition surmounted, nor is victory the term to apply to the forced retirement of the opposing armies from a position rendered untenable. The test of progress and of victory is the dominant spirit of the ancient universities to-day, and their attitude to the needs of the present rather than the past generation. It is just because, for this one celebrated instance, their devious and familiar methods of obstruction have been remorselessly pilloried by Dr. Todd that her work and the story she tells of the Edinburgh fight deserve a wider and more critical interest than would be aroused were it merely the biography of the protagonist or the record of a conflict long since decided.

As it is told here without rancour and with the minimum of the most moderate comment, the story is one that few to-day could read unmoved by indignation. No more soul-destroying labour can well be imagined than the task that must have been involved in its telling, the task of wading through the interminable insincerities, sophistries, evasions, and legal chicaneries by which an ancient university, having in an unguarded moment honestly sought the solution of a modern demand, then attempted to draw back and escape the consequences at no matter what cost to its honour and self-respect.

Regulations were duly framed by the University of Edinburgh in November, 1869, for the medical education and matriculation of women students, but every conceivable obstacle was then thrown in the path of the handful of young women who presented themselves. The onus of finding teachers willing to instruct them was put upon them, influence being exerted to prevent even those willing from undertaking the work. The medical students, on the outlook for mischief and ready "to follow a beck," were loosed upon them. The women students, mere girls for the most part, were pelted in the streets with mud and greeted with filthy epithets. One of them confessed in later life that she would make a detour of miles rather than pass the places where these incidents occurred. Another, who, when the storm first burst, had retired to the country "to listen to the nightingales," returned in earnest with an indignant protest at any woman being left to the care of the sort of practitioners these young ruffians would make. But, again, with the common sense and penetration characteristic of these early pioneers, she is found writing: "Do not be hard on the students. They are very bad, but they are not so bad as the professors." Posterity in the enjoyment of the fruits of victory is apt to be forgetful of its cost.

Two days prior to their first professional examination the medical faculty interdicted the issue of papers to the women candidates, and only withdrew under threat of legal proceedings. The Principal attempted to stop them matriculating, though, in the words of a friendly professor, he "had no more authority to issue this decree than a janitor." Though loyally supported by the then Lord Provost and many of the prominent citizens of Edinburgh, and by the powerful advocacy of the *Scotsman*, and having in the University many true friends, among whom Prof. Masson shines out conspicuously, the women students were finally driven to seek redress in the courts. One is appalled by the lengths to which an institution existing to minister to the desire for education went in its efforts to thwart and repress it. The University defended the suit, ultimately with success, on the ground that it had exceeded its legal powers when in 1869 it framed regulations admitting women! These legal proceedings form not the least instructive chapter. The women first won, but by a bare majority in a court of thirteen judges lost on appeal, the University being absolved from all responsibility to its matriculated women students, who were mulcted in the costs. As one of the dissenting judges ruled in his judgment, this puts the onus of defending the laws of the University, when their lawfulness is challenged, on the student who obeys them rather than on the authority that framed them. The University Court which framed the regulations it afterwards prayed to have declared illegal contained many learned in the law. To quote the *Times* letter already referred to: "It is a tolerably striking instance of 'the glorious uncertainty of the law' that the two highest judges in the land should concur in an action which is subsequently declared by a majority of their brethren to be illegal." Thus the Edinburgh battle ended. After Parliament had intervened and London University and the Irish Colleges had led the way, the University of Edinburgh twenty-five years later, in 1894, reopened its doors to women without further demur.

It would be difficult, after reading these proceedings, to retain much faith in the essential integrity of our laws and institutions and their suitability for the existing age. Were it not that precisely similar tactics are still available whenever an ancient university is confronted by a modern need, one could wish that the author, as she must often have been tempted to do, had given up the task of putting this indictment on record. As it is, a perusal of the book will serve to explain to many how it is that the ancient universities can lag so far behind the spirit of the age, and can drag the country with them even to the brink of national extinction. At a time when it is imperative for a century of arrears to be made up and great numbers of really educated men and women to be turned out to carry on and modernise the State, the old universities remain much as they were, paralysed by the past, and probably even less well disposed to change than they were fifty years ago. The exuberant, strange, and new vitalities which the growth of human knowledge and power has called into being within the last century hammer away at them from without. Monuments of bygone days, they remain changeless and resistant as marble, owning no law other than crystallised convention, no logic save that of the stricken blow. Is it always to remain a dream, Pygmalion-like, to desire them alive, the brain and heart of the age resident within their walls, and the elements of growth fostered rather than exorcised? The hardihood of the aspiration, rather than any hope of its fulfilment, is the abiding impression left by this record of pioneer achievement, epic of "progress" and "victory" though it be. FREDERICK SODDY.

APPLIED BIOLOGY.

(1) *Mind and the Nation: A Précis of Applied Psychology.* By J. H. Parsons. Pp. 154. (London: J. Bale, Sons, and Danielsson, Ltd., 1918.) Price 7*s.* 6*d.* net.

(2) *The Third and Fourth Generation: An Introduction to Heredity.* By E. R. Downing. Pp. xi+164. (Chic., Ill., Univ. of Chicago Press; London: Camb. Univ. Press, 1918.) Price 1 dollar net.

(1) WITH special reference to present and imminent problems, Mr. J. Herbert Parsons makes a plea for the more strenuous and widespread study of psychology—"the Cinderella of the Sciences"—as a basis for clear thinking and progressive action. He sketches the evolution of behaviour, the ascent of man, the development of the individual mind, the growth of social consciousness, and the general trend of human history. With this impressionist survey as a background, he proceeds to show how the results of analytical and genetic psychology may be utilised towards an increasing understanding and an improved organisation of education, industry, and politics. To control effectively we must first of all understand the facts of the case, and we are handicapping our understanding by paying too little heed to psychology. Between biology on one hand and sociology on the other, psychology has a *rôle* of essential importance. Mr. Parsons states his case temperately and clearly, and we heartily recommend his timely volume to all interested in reconstruction and reorganisation. It is not for learned just persons, who need no repentance, but it will be useful to humbler people who wish to face the facts. It would be valuable to biologists of the materialistic school, who think that the psychological aspect is an efflorescence that does not count, and also to politicians who, while recognising that ideas have hands and feet, do not think a resolute study of social psychology necessary.

(2) Mr. Downing's excellent introduction to the study of heredity is an encouraging sign of the times. It is one of the "constructive studies" included in "The University of Chicago Publications in Religious Education," the editors of which are convinced that "faith must not operate apart from knowledge." We read in the editors' preface that "nothing can be more important in religious education than to train young people to use the careful methods of science in ascertaining the facts upon which their conclusions, not less in morals and religion than in other fields, are always to be based." The book has been prepared for young people's classes, and it would serve effec-

tively in the highest form in schools. It is with genuine appreciation of the success Mr. Downing has achieved that we join with the editors in recommending this little book, high-priced for its size, "to the reading of ministers and laymen who are desirous of obtaining in untechnical language the results which scholars have arrived at in this modern attack upon the problem of evolution." The author is a competent biologist with a keen educational sense. From data drawn from trotting horses and distinguished human families he shows that race counts. Which is the more potent, environmental nurture or hereditary nature? "Such a question is about as sane as whether wind or water is the more important in the production of the waves that surge in along the ocean shore." From mandrake flower and frog's spawn the fundamental facts of reproduction and development are illustrated; the import of Mendelian inheritance and of the selection of mutations is made clear; the question of the transmissibility of individually acquired somatic modifications is dealt with wisely and practically, and the inheritance of good and evil qualities in mankind is illustrated without exaggeration. The book expresses a clear mind, a well-balanced judgment, a eugenic ideal, and a belief in education. We wish for it a great success, which it well deserves.

OUR BOOKSHELF.

A Map showing the Known Distribution in England and Wales of the Anopheline Mosquitoes, with Explanatory Text and Notes. By W. D. Lang. Pp. 63. (London: British Museum Natural History, 1918.) Price 2*s*. 6*d*.

THE map deals with the distribution of the anopheline mosquitoes (*Anopheles maculipennis, A. bifurcatus, A. plumbeus* (*nigripes*)) previously recorded as indigenous and proved to convey malaria. The text contains records relating to the distribution of these mosquitoes, and, like the map, is modelled on the publications of Nuttall, Cobbett, and Strangeways-Pigg (1901), "Studies in Relation to Malaria: i., The Geographical Distribution of Anopheles in Relation to the Former Distribution of Ague in England," *Journal of Hygiene*, vol. i.; and Nuttall (1905), *ibid.*, vol. v., a considerable number of additional data being supplied from records hitherto unpublished. The statement made by the earlier authors that Anopheles are likely to be found in suitable waters anywhere in this country is confirmed. The features whereby the species may be identified are described, and a brief account is given of their life-history. Taken in conjunction with the earlier papers cited and those by Nuttall and Shipley (1901–3), "Studies in Relation to Malaria: ii., The Structure and Biology of Anopheles," *ibid.*, vols. i.–iii., readers will find in these sources most of the information that is obtainable regarding the insects. Their importance is fully appreciated now that indigenous cases of malaria have arisen more frequently owing to the return to England of soldiers with malaria, there being no reason why malaria should not become re-established and more widely distributed in this country if adequate precautions are not taken.

Wayfarings: A Record of Adventure and Liberation in the Life of the Spirit. By W. J. Jupp. Pp. 234. (London: Headley Bros., Ltd., n.d.) Price 6*s*. net.

THIS autobiographical study will interest many who have lived through the period of intellectual transition which had its keynote in the evolution-idea. It tells frankly, sometimes naïvely, of the author's "advance from the credulities of Calvinism to that liberty of open-mindedness which permits the continual readjustment of belief to the ever-widening experience of life." Greatly influenced by Wordsworth, Emerson, Thoreau, and Walt Whitman, he reached, after many wayfarings and much discipline, a serene faith in the orderliness, rationality, progressiveness, and purposefulness of the cosmic process. "The Universe must needs care for all its creatures." "The Spirit of the whole must surely be present and effective in all its parts." "The Creative Spirit of Life must be continually present and effective in all forms of its activity, in all creatures through which it lives and has its being." But what gives the book a special interest for us here is its disclosure of what the beauty of Nature—even in its most familiar expressions—may come to mean to a busy man in the way of "refreshment and inspiration and consoling grace." In the quietness of old age he went to a garden-city and continued to make his soul and to find "this world, with all its strangeness and apparent failure, a very homelike, habitable place." In the autumn, though he did not strain to listen, he heard the voice of spring. To many readers, especially of patient years, "Wayfarings" will give much pleasure.

Mathematics for Engineers. Part i., including *Elementary and Higher Algebra, Mensuration and Graphs, and Plane Trigonometry.* By W. N. Rose. (The Directly Useful Technical Series.) Pp. xiv+510. (London: Chapman and Hall, Ltd., 1918.) Price 8*s*. 6*d*. net.

THIS book contains a course on algebra, mensuration, and plane trigonometry for engineering students; the calculus, vector analysis, spherical trigonometry, differential equations, etc., being reserved for part ii., which is to appear shortly.

It is to be feared that a beginner may be somewhat confused by the arrangement adopted; thus Cardan's solution of the cubic occurs on p. 67, the rule for finding the area of a triangle on p. 79, and the definition of a circle on p. 90. Even the practical portions of the book are in places rather misleading: it must surely be easier to add logarithms vertically than horizontally. But doubtless the teacher will find the book a valuable mine for examples likely to interest the future engineer, as bearing on problems connected with his practical work.

Birds—Economic value

LETTERS TO THE EDITOR.

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

The Value of Insectivorous Birds.

WHILE I cordially agree with Dr. Collinge's protest in NATURE of July 25, p. 407, against the indiscriminate destruction of small birds, I think he overrates the extent of the mischief that has been and is being done. No doubt the owners or tenants of market-gardens and orchards are not careful to distinguish between hurtful and beneficent species, but there are vast tracts of country where nobody dreams of killing song-birds, though schoolboys have been, are, and, I fear, will continue to be, incorrigible nest-harriers.

Dr. Collinge denounces the Wild Birds' Protection Act of 1880 and the amending Acts as "practically dead letters." Doubtless they share in the imperfection of all human legislation; but if they are inoperative in any district, the fault lies with the local authority. I had charge of two of the amending Acts in their passage through the House of Commons, and was strongly urged to prepare a schedule of species for universal application. I declined to do so, thinking it better to leave county councils to provide protection for such birds as local conditions rendered desirable. A schedule that might be suitable for Sussex would be grotesquely inapplicable to Caithness, and *vice versa*.

I will cite the goldfinch as illustrating good results from the Acts. It is not an insectivorous bird, but, whereas it subsists exclusively on the seeds of such weeds as thistle, charlock, coltsfoot, and the like, it must be reckoned among the farmer's and gardener's most diligent allies. It is more easily taken by decoy than almost any other song-bird, and is eagerly sought for by bird-catchers because of its popularity as a cage-bird. Owing to the nefarious industry of these gentry goldfinches had practically disappeared from Scotland when Lord Avebury passed his Act in 1880. About the end of last century they began to reappear. Here, in Galloway, the bird-catchers set to work with them at once, but a note to our Chief Constable put the police on the alert, and the mischief was stopped at once. Now we have plenty of these beautiful and beneficent finches, thanks entirely to the county council's powers under the Acts.

While I do not understand why Dr. Collinge describes the kingfisher and the dipper as "most beneficial," I am surprised that he does not mention the lapwing, an insatiable insect-eater. It is the only one of our wild birds of which both the carcass and the eggs are habitually offered for sale and eaten. Little harm is done by taking the early laid eggs, most of which would, if left on the ploughland, be destroyed in the process of sowing and harrowing, but to kill the birds should be constituted an offence.

Starlings have increased in numbers a hundredfold in my own recollection, and probably no single species of small bird accounts in this country for insects in the same quantity as they do. It must be owned, however, that ripening fruit crops require protection from starlings.

While I am very far from differing from Dr. Collinge on the importance of the subject of his paper, I venture to think that more good might be done by stimulating the activity of county councils in the matter of bird protection than by finding fault with the Acts enabling them to provide it.

Monreith. HERBERT MAXWELL.

WITH reference to Sir Herbert Maxwell's comments on my article in NATURE of July 25, I think he has overlooked one of the causes I mentioned in connection with the present scarcity of our insectivorous birds, viz. the severity of the winter of 1916–17 and, to a smaller extent, of that of 1917–18. I should like, therefore, to direct his attention to a recent and valuable report on the subject by Messrs. Jourdain and Witherby (*British Birds*, 1918, vol. xi., pp. 226–71; vol. xii., pp. 26–35), wherein they point out, as the result of a very careful and prolonged inquiry, the enormous mortality that has taken place, in some cases to the extent of 80–90 per cent. in certain counties.

The kingfisher and the dipper I regard as beneficial because both species consume a large quantity of injurious insects. In the case of the former species, an investigation upon which I am at present engaged shows that much of the food is of a neutral nature, and that any harm it does is more than counterbalanced by the good. I did not mention the starling, as I do not think that it requires any protection at present; indeed, in many parts of the country it is so numerous as to call for repressive measures.

I fully agree with Sir Herbert Maxwell's remarks on the lapwing, and would point out that under the name of peewit this bird is included in the schedule of the Act of 1880. Of the 106 local authorities out of 120 in England and Scotland that have put into force the amending Act of 1894 (57 & 58 Vict., c. 24), which prohibits the taking or destroying of wild birds' eggs, only eight Scottish authorities have placed this bird upon their list, and the ten English counties which protect the eggs of all wild birds (*cf.* Oke's "Game Laws," 1912, and Marchant and Watkins, "W.B.P. Acts," 1897). Why have the remaining eighty-eight authorities been waiting nearly a quarter of a century before doing the same? Again, only twenty-three authorities afford protection to the eggs of the skylark, 36·5 per cent. of the food of which is beneficial as against 13 per cent. injurious and 50·5 per cent. neutral. Numerous other instances might be quoted.

Whether one regards the Act of 1880 from the point of view of the ornithologist, farmer, fruit-grower, forester, or fisherman, it is unsatisfactory (i) in the number and species it affords protection to, (ii) in the penalties it imposes, (iii) in the absence of any provision for revision at stated periods, and (iv) in its lack of precision. Moreover, in entrusting the additions and general administration of the Act to the county councils it has proved largely ineffective.

WALTER E. COLLINGE.

The University, St. Andrews.

Preparing "Palates" of Mollusca.

PROLONGED cooking in a strong solution of soap is a much more satisfactory method of cleaning these interesting objects than the commonly recommended method with caustic potash. The plan which I have tried with success is to place the materials in the soap solution in a small phial, which is enclosed in a sand-bath, and then left on a hot part of the kitchen range. In a few hours all the surrounding tissues, or even the whole of the rest of the animal, is as completely disintegrated as it would be with the *liquor potassae* method, and the teeth all stand out bright and clear, but there is not the same risk of the so-called "palate" becoming disintegrated or curling up and becoming brittle. G. H. BRYAN.

STATISTICAL STUDIES OF DIETARIES.[1]

THE matter which is essentially new in this interesting and valuable report by Viscount Dunlace and Capt. Greenwood is a statistical study of the diet of workers fed in hostels and canteens attached to various factories under the Ministry of Munitions. The document also contains an independent analysis of available figures relating to working-class dietaries before the war, and it is prefaced by an exceedingly interesting appraisement of the practical significance which is attached to the results of modern experimental work on dietetics.

A careful study of food consumption under the conditions of canteen feeding must yield a valuable document. When, as in the majority of cases dealt with in this report, the whole nourishment of the individual is derived from an official food supply, the data become more trustworthy than those of most statistical studies, and there is the additional merit that individual consumption is not forced or otherwise affected by a predetermined ration such as exists in the Army. A further advantage is that the work done by various sections of the community, though not actually measured, nor perhaps measurable, is at least of a recognisable order of severity.

The average daily consumption "per man" of some 20,000 munition workers during the spring and summer of 1917 was found to consist of 115·7 grams of protein, 141·3 of fat, and 408·4 of carbohydrate. The average Calorie value of the food was 3463, a figure very near to the standard so generally accepted for a man doing moderately severe work. All the figures refer to food "as purchased."

The statistical method applied to nutritional studies has obvious limitations as a guide to practice, especially if guidance be sought when, as now, the national conditions are exceptional. Its results display the influence of appetite limited chiefly by economic conditions. If the latter are unfavourable, statistics of consumption do not guarantee the measure of an efficient diet. If conditions are favourable, the statistics may offer no guidance for economy. In this connection, however, the above data are perhaps more than usually trustworthy. The munition workers were well paid, but in the earlier months of 1917 there was an atmosphere tending to check extravagance, though as yet there was no feeling that the individual should go actually short. It is interesting to find, therefore, that the energy consumption was so closely similar to that of the working classes before the war. The average figure for the latter, as re-calculated by the authors from the Board of Trade returns, was 3571 Calories.

The dietaries of munition workers were, however, in a qualitative sense, abnormal, especially in the very high proportion of fat eaten. In this respect they cannot serve as a model for the present or for the immediate future. This high consumption of fat resulted from the circumstance that at the time when the statistics were being collected an acute shortage of potatoes co-existed with a vigorous "eat less bread" campaign. In one hostel, where the "voluntary" weekly bread ration of 4 lb. was literally accepted, the fat consumption rose to 214 grams a day! As the authors remark, this is a sufficiently instructive instance of what happens when the nutritional habits of the population are disturbed by force of circumstances or otherwise.

There is great difficulty in choosing a final expression for the results of statistical studies on the diet of a community. The demands of men, women, and children respectively have to be brought to some common denominator. This is usually done by expressing them all in terms of "man value." To take a woman's demands as eight-tenths of a man seems justified by the best data available. Much less satisfactory, however, are the factors hitherto used when growing boys and girls are concerned. To take the requirements of boys at thirteen as being 0·6, and of boys at fifteen as 0·7, of a man's (Atwater and Bryant) is certainly an error. The measurements of basal metabolism made and collected by Dubois, for instance, show that the requirements are proportionately high at these ages, so that a boy of thirteen wants little less food than his father, if the latter be a moderate worker. F. Gephard found, indeed, that the consumption at a large boys' school in Concord, New Hampshire, was nearly 5000 Calories per head per day.

This question is not fully discussed by the authors of the report, who, following the Food Committee of the Royal Society, used the Atwater factors. They show, however, in an appendix, to what an important degree the recognition that the demands of children are larger than was thought will affect current statements as to consumption "per man" when family budgets are dealt with. For example, taking the normal family of man, wife, and four children, the man value usually taken is $1 + 0·8 + 4 \times 0·51 = 3·84$. Taking the factor for children as 0·7 instead of 0·51, the man value becomes 4·6, and the *per caput* man consumption is reduced to 83·5 per cent. of its usually tabulated value. At any rate, a proper recognition of the requirements of children is of immense importance in budgeting for the nation.

Unfortunately, statistical studies do not tell us what at the moment it is so desirable to know. How far can the customary diet of a community be reduced without reducing its output of work? If reduction in food merely means inconvenience or even a degree of suffering, the nation will not fear it. What it has to fear is a consequential diminution in productiveness.

Even experimental studies have not yet given a satisfactory answer to the above important question. We know that if an individual under favourable conditions of nutrition will accept with equanimity a certain loss of body-weight, he may considerably reduce his consumption without

[1] "An Inquiry into the Composition of Dietaries, with Special Reference to the Dietaries of Munition Workers." Medical Research Committee; Special Report Series No. 13.

obvious loss of health, and, to judge from the work of Graham Lusk, his "efficiency" in the technical sense will not be affected. Work actually done will apparently be done at the same cost in Calories. We have, however, no certain knowledge as to how far that reduction can go (if it can occur at all) without affecting his ultimate capacity for work.

The review of modern experimental investigations with which the report opens well repays perusal as coming from authors highly qualified to appraise it from an independent point of view.

In connection with the experimental measurement of Calorie requirements, they do well to emphasise the point which Dr. Leonard Hill has recently made so clear—namely, that estimations made upon a man in a calorimeter at uniform temperature and in still air must not be applied in practice without proper qualifications. Vary the conditions, lower the external temperature, and especially increase the movement of air to which a resting man is exposed, and the demand goes up. It may be enormously increased.

Our knowledge concerning the energy requirement for the performance of external work is fully and very ably reviewed and appraised. It is shown that such data as those obtained by Benedict and Cathcart enable us to state with fair accuracy the increase in the demand for energy which goes with a given increase in work. This, however, applies only to work done within comparatively narrow limits. We have, for instance, no satisfactory data bearing on the cost of the more sedentary occupations.

In discussing the protein question the authors seem to be less at home. They do wrong, for example (though the point is perhaps of no great importance), in associating our modern conception of the metabolism of protein, involving, as it does, important chemical, as well as energetic, considerations, with the name of Rubner, who has given attention only to the all-important details of protein nutrition under compulsion born of other people's work. The authors justly pillory in the course of their historical discussion the vice of quotation at second hand; but it is just as bad to over-emphasise quotation from one particular original source unless its authority outweighs all others. On the protein question much more illuminating work and discussion have come from America and this country than from Germany.

The work embodied in this important document was carried out under the supervision of the Food Investigation Committee appointed by the Ministry of Munitions.

THE AFFORESTATION QUESTION IN BRITAIN.

IN a previous article the present and future positions of the timber supplies of this country were considered. The afforestation question will now be briefly dealt with. Lord Selborne, in the House of Lords, recently asked whether the Government was in a position to announce its decision on the report of the Forestry Sub-Committee of the Reconstruction Committee, mentioning the pressing necessity for replanting which existed throughout the country. Lord Peel replied that the Government had accepted the report of the Forestry Sub-Committee, and that a central authority for the United Kingdom would be set up and planting be proceeded with with the least possible delay. This announcement will be greeted with approbation by all acquainted with the urgent importance of the afforestation problem. Differences of opinion on administrative questions exist, but these are trivial compared with the main object in view—the afforestation of the waste lands of the country. Forestry in its general aspects is a branch of economic industry of which the British public has known very little in the past. It is not surprising that it should have remained in ignorance of its importance. For we have no forests in Britain in the sense in which the word is understood in Europe and elsewhere in the world. Ours are pretty woodlands. In the future it will be necessary to grow commercial woods, for the war has demonstrated unmistakably that, as a mere matter of safety in the case of emergency, we must have a reserve supply of timber and pit wood in the country.

It has been already shown that we have to face the probability of all our commercially exploitable woodlands being cut out either during the war or in the years immediately following the peace. In 1914 we had 3,000,000 acres of woods in Britain. On a rough estimate half of these will disappear, and the areas occupied by them be replanted. This work is more a matter for the proprietors, who have received a high price for material which in many cases was almost unsaleable before the war. In some instances Government assistance may prove necessary. These fellings will not be all to the bad, since considerable areas, commercially worthless in pre-war days, owing to the poor methods on which they were grown, will have been cut out.

But these $1\frac{1}{2}$ million acres do not affect the main afforestation problem before the nation. Since the outbreak of war, Ministers and others have been wisely preaching thrift and conservation of the national resources. There are some $16\frac{3}{4}$ million acres of mountain and heath land in Great Britain, much of it bringing in a very small return per acre, from *2s. 6d.* down to a few pence.

Some of this land is above the limit in elevation of tree growth; other parts may prove reclaimable for agriculture. Land which is utilisable for the production of food should not be afforested. But there remains, so far as an estimate can be formed, at least some 3,000,000 to 5,000,000 acres which can be made to produce, in the national interests, a higher return both in money and general utility when placed under tree crops. Moreover, on these large areas of waste land—for, in the sense that they are not being put to their best use in the interests of the community, they are waste lands—it will be possible to demarcate blocks of a size capable of being worked on a commercially profitable scale, with systematic fellings which will guarantee a continuity in supply of material, reduce the cost of extraction of the material, cover the cost of upkeep, and yield a profit. Such areas of forest will maintain a larger population on the land, since forests require more people to look after them than the pasturing of sheep. They will also result in the employment of a considerable head of population in industries which arise in a wooded country—*e.g.* saw-mills, pulp-mills, furniture and box factories, etc.

The afforestation of these lands is not going to prove easy. The rich layers of soil they previously possessed have been long since dispersed, and the young plantations, bereft of shelter, will have to stand considerable exposure. We must be prepared for small crops during the first rotation. But even these should give a higher return than much of the land is at present yielding. Its afforestation will then be making a better use of the wastes, provide our descendants with a necessity for their industries, and give them a reserve for an emergency.

The land is at present in private ownership. An Act will doubtless be necessary in order to give the State the powers to acquire, in the public interest and at its marketable value, such land as it may deem necessary for reclamation for agriculture or for afforestation. But so far as afforestation is concerned it is unlikely that Government would be obliged to have recourse to the Act to effect the purpose in view. The acquisition of land by Government is undesirable if only on account of the friction it might give rise to. The better method of procedure will be by way of leasing areas from proprietors for a rotation (seventy years) or two rotations (140 years). The Development Commissioners have drawn up schemes on these lines. They offer to take over land from a proprietor on an ordinary lease and plant it up from their own funds (in conjunction with the Boards of Agriculture), the proprietor being given a small share of the proceeds from the woods, in addition to his annual rental; or, as an alternative, the proprietor to forgo any rental for his land, which will be planted up with money provided by the Commissioners, the two parties dividing the profits on a basis fixed by the amount of outlay incurred by each in the business. These offers appear to be mutually advantageous, and should result in the land required being obtained.

The selection of the land to commence operations upon can be left to the Forestry Advisers. These officers have the whole country divided up between them; they have been at work several years, and will be acquainted with the most favourable areas in their respective districts.

Now as to the cost of the undertaking. All figures have at present a problematical ring. But an all-round sum of 3*l.* per acre for the planting of the felled-over areas ($1\frac{1}{2}$ million acres), and 4*l.* for the waste land (rabbit netting is not included, as rabbits will have to be exterminated in the planting areas), should be near the mark; or 24,000,000*l.*, some 1,500,000*l.* to 2,000,000*l.* being provided by the proprietors. The amounts payable on the leases and upkeep, as also the more difficult problem of compensation for the removal of sheep stock in some cases, will be additional. Questions of space render it impossible to go into these matters. But they are details, though important ones, of the broad general scheme.

This area of $6\frac{1}{2}$ million acres should give, under skilled management, 455,000,000 cubic feet of all classes of timber, or about three-fourths of the 1913 imports. It will only prove a safety margin, for our pre-war consumption was increasing annually, and available imports, at a reasonable price, will decrease in the future.

E. P. STEBBING.

AGRICULTURAL EDUCATION IN SOUTH AFRICA AND AUSTRALIA.

THE *South African Journal of Science* for December last contains two articles on the organisation of agricultural education in South Africa and Australia respectively which deserve some notice, if only on account of the contrasts which they bring into prominence. Whereas in Australia the organisation seems to be complete from the bottom to the top of the ladder—from the elementary school to the university and research station—in South Africa, on the other hand, the conditions approximate to those existing in this country, where we have sporadic agricultural colleges catering more for the teacher of agriculture than for the farmer, and no effective link with the organisation of education generally.

In Australia the provision of what may be described as intermediate agricultural education appears to have reached a remarkable pitch of efficiency. The "colleges" there, which we should describe as "farm schools," aim at fully equipping the young farmer for the business of his life in a new country. Among the subjects taught are carpentry, saddlery, butchery, engineering, etc., and the writer of the article speaks of inspecting horseshoes, chisels, cultivator tines, complete sets of saddlery, all made by the students themselves. When we learn further that the lands of one of these "colleges" extend to 3500 acres, that upwards of 2000*l.* worth of stock is sold annually, and that 130 horses are maintained, we can form some idea of the seriousness of purpose with which the technical training is pursued.

Scientific progress is not neglected. In New South Wales alone there are fifteen State experimental farms, where the special problems of Australian agriculture are being systematically attacked. One result of considerable scientific interest may be noticed. It appears to have been established that, generally speaking, Australian conditions do not demand the use of nitrogenous fertilisers, and in a Government publication is found the remarkable statement that the Australian soil is "self-nitrogenating." Phosphatic manures, on the other hand, appear to be beneficial. Another feature of interest in Australian developments is the growth of farmers' institutes or bureaux, as they call them. In this country a remarkable and parallel development is now in progress (as an outcome of the war) in the shape of women's institutes. The guiding motive in both cases is the stimulation of interest in the problems of rural life through the agency of what modern sociologists would call "herd" instincts, for it seems possible to stimulate in a meeting intellectual interests which remain dormant in the home!

But in regard to agricultural science, Australia is, above all, fortunate in the number of special problems which, as a "new" country, it provides; the investigator finds numberless questions awaiting solution; he is not hampered by age-worn traditions and practices and the habit of mind which they engender; and he has not only a virgin field on which to demonstrate the efficiency of the new weapons which the scientific method has forged, but also, if we may judge from what is recorded, a population ever willing to hear, and even to adopt, some new thing. B.

NOTES.

THE British Scientific Products Exhibition, organised by the British Science Guild, is being opened by Lord Sydenham at King's College, London, as we go to press. The exhibition has aroused wide public interest, and there is no doubt that it will be decidedly successful in stimulating that close union between science and industry upon which progressive prosperity depends. Since the advent of the war much more intelligent attention has been paid to the co-ordination of these national activities than was given in earlier years. The spirit of distrust which existed between scientific workers and manufacturers has been largely dispelled, and an alliance is being formed which should go on increasing in strength for the benefit of each. The man of science formerly confined himself too closely to an academic atmosphere, and did not trouble to understand the problems of industry; while the manufacturer neglected to avail himself sufficiently of the potential industrial developments represented by the rich stores of scientific knowledge accumulated in the laboratory. During the last four years, however, science and industry have been brought into closer relationship, and some of the results of this *entente cordiale* are shown in the British Scientific Products Exhibition. Much yet remains to be done before we can recover all the ground lost by inactivity and unwise legislation; but by giving an indication of what has been achieved, a new spirit will be created which should lead to further progress.

WE much regret to see the announcement of the death on August 10, at seventy-eight years of age, of Prof. O. Henrici, F.R.S., emeritus professor of mechanics and mathematics in the Central Technical College of the City and Guilds of London Institute.

THE *Times* announces that Mr. W. M. Crowfoot, of Beccles, Suffolk, who died on April 6 at eighty years of age, bequeathed a collection of exotic butterflies and moths to his wife for life and then to the Natural History Museum, University College, Nottingham; a collection of shells from the Paris basin, his crag-shells, and other fossils to the Norwich Museum; a collection of shells from the Italian Pliocene basin and a collection of marine, land, and fresh-water shells to the Ipswich Museum.

AN association of chemists engaged in the oil and colour and allied trades has been formed for the purpose of considering and discussing the many complex points which are continually met with in the course of their work. The need for this association has been felt for a long time, and the work undertaken by the chemists of the paint trade on the linseed-oil substitution products has been the foundation on which the association has arisen. The first president is Dr. F. Mollwo Perkin, and the secretary Mr. H. A. Carwood, 53 Groombridge Road, London, E.9.

THE autumn meeting of the Institute of Metals will be held in the rooms of the Chemical Society, Burlington House, on September 10 and 11. Among the communications to be submitted are:—The Resistance of Metals to Penetration under Impact, including a note on The Hardness of Solid Elements as a Periodic Function of their Atomic Weights, Prof. C. A. Edwards; Grain Growth in Metals, Dr. Z. Jeffries; Rapid Recrystallisation in Deformed Non-ferrous Metals, Mr. D. Hanson; The Influence of Impurities on the Mechanical Properties of Admiralty Gunmetal, Mr. F. Johnson; and A Peculiar Case of Disintegration of a Copper-Aluminium Alloy, Dr. R. Seligman and Mr. P. Williams.

THE MINISTER OF MUNITIONS has issued an Order prohibiting the purchase, sale, or delivery of any radio-active substances, luminous bodies, or ores without a permit, and providing that such returns of stocks, etc., shall be made as are from time to time prescribed. The Order applies to all radio-active substances, including actinium, radium, uranium, thorium, and their disintegration products and compounds, luminous bodies in the preparation of which any radio-active substance is used, and ores from which any radio-active substance is obtainable, except uranium nitrate and radio-active substances which at the date of the Order form an integral part of any instrument, including instruments of precision or for time-keeping. Applications in reference to this Order should be addressed to the Controller of Optical Munitions, Ministry of Munitions, 117 Piccadilly, W.1.

PROF. STEPHEN FARNUM PECKHAM, who has died at Brooklyn at the age of seventy-nine, was director of the chemical department of the U.S. Army Laboratory during the Civil War. He held successively the chairs of chemistry in Washington and Jefferson Colleges, Maine Agricultural College, Buchtel College, and the University of Minnesota. In 1898 he was appointed director of a laboratory of the Commissioner of Accounts of New York, and later of the Department of Finance of that city. He had been State assayer to Maine, Minnesota, and Rhode Island. He was the author of an elementary book on chemistry as well as of a report on the production, technology, and uses of petroleum and of a treatise on solid bitumens.

THE death is announced, in his sixty-seventh year, of Dr. Richard Rathbun, the acting director of the Smithsonian Institution at Washington. On graduating at Cornell University in 1875, he was appointed assistant geologist to the Geological Commission of Brazil. In 1879 he was for a short time an assistant in zoology at Yale. He was scientific assistant on the U.S. Fish Commission from 1878 to 1896, having charge of the scientific inquiries subsequent to 1887, and from 1892 to 1896 he was the U.S. representative on the joint commission with Great Britain relative to the preservation of fisheries in waters contiguous to the United States and Canada. Dr. Rathbun was appointed curator of the U.S. National Museum in 1880, assistant secretary to the Smithsonian Institution in 1897, and had been in charge of the U.S. National Museum since 1899. He had written largely on palæontology, marine invertebrate zoology, and the administration of fisheries and museums.

THE death in Paris is announced of Prof. Richard Norton, son of Mr. Charles Eliot Norton, professor of fine arts at Harvard. Richard Norton was director of the American School of Classical Studies in Rome from 1899 to 1907. He came of good English stock, and was related, on the English side, to the Sidgwicks and the Darwins. He was at once a trained archæologist, an excellent classical scholar, a critic of fine art, and an adventurous explorer. He worked in Greece with Waldstein, with Boni in Rome, with Hogarth in Egypt, and on his own account in Cyrene. At the beginning of the war he organised the American Volunteer Motor Ambulance Corps, and during the Champagne battle in October, 1915, he disclosed the fact that the German gas apparatus captured dated so far back as 1908, thus proving that the barbarous methods of the enemy had been long premeditated. He received the Order of the French Legion of Honour and the Croix de Guerre for gallantry under fire, and was awarded the British Mons medal.

THE position of this country as regard the supply of optical glass at the outbreak of war is often not clearly understood. We are glad, therefore, to correct any misapprehension which may have arisen from an incidental reference to the subject in an article on the British Scientific Products Exhibition in NATURE of August 1. Optical glass has been manufactured in this country since 1848 by Messrs. Chance Bros. and Co., Birmingham. When the supply of German glass was cut off in 1914, the experience gained by this firm became an important national asset, and through it an acute situation was saved. Messrs. Chance have supplied nearly the whole of the optical glass required for instruments used by our Forces during the war, and also much of the requirements of our Allies, without any assistance from the formulæ determined by the Glass Research Committee of the Institute of Chemistry. This committee rendered invaluable aid to the manufacture of scientific and heat-resisting glassware, but the needs of optical-instrument makers were met independently by Messrs. Chance, whose output since the outbreak of hostilities has increased twenty-fold. Without their seventy years' experience it would have been very difficult to have produced the supply of optical glass imperatively demanded by conditions of war.

As is well known, the Germans were anticipated by some savage tribes in the use of poisonous gas for war purposes. In a paper entitled "Palisades and Noxious Gases among the South American Indians," by Mr. Erland Nordenskiöld, in *Ur Ymer, Tidskrift utgiven av Svenska sällskapat för Anthropologi och Geographi* (Arg. 1918, H. 3), he quotes authorities, such as Staden, Oviedo y Valdés, and Thevet, to show that tribes like the Tupinambá and Guaranis of the Brazil littoral and on the Rio Parana used poisonous gases in attacking fortified villages. Men went in front of the attacking party, each holding a pan with embers in one hand, and ground red pepper in the other; when the wind was against the Spaniards they sprinkled the pepper on the embers. This was also done in attacks on the Spaniards in Venezuela. In the same way pepper was largely used in exorcising demons and evil spirits. The use of this pepper, known as Aji, would soon be discovered by these Indians, who cultivate the plant extensively. It was only necessary for someone to upset a basin of Aji into the fire, and a hut would soon be cleared of its occupants. The use of the smoke in warfare would be a natural development.

THE entrance of the United States of America into the war has prompted Mr. A. Hansen to write to *Science* pointing out that the States possess no national floral emblem. France has its fleur-de-lis, England the rose, Scotland the thistle, but America has no flower with which it is associated in people's minds. Mr. Hansen points out the various characteristics required for a national flower, and comes to the conclusion that the columbine, which is in flower from April to July, is probably the most suitable for the purpose. The correspondence of the generic name Aquilegia with the Latin name of the eagle is also considered to be a point in its favour. Colorado has already adopted the columbine, which is native throughout the States; and though the flowers are somewhat fugitive, no other flower seems to be as suitable. In a later contribution to *Science*, by Mr. F. L. Sargent, it is pointed out that the national flower question was considered so long ago as 1895, and a history of the matter is given in Trans. Mass. Hort. Soc., part 1, 1898. It was then considered that the columbine was the most suitable flower, and its use for the purpose is strongly advocated by Mr. Sargent. Another writer, however, suggests the golden rod (Solidago), a common plant in the States, which has previously been advocated, but does not seem so suitable for national purposes as the more elegant and beautiful columbine.

THE future of the Hevea rubber industry in the Federated Malay States and the East generally is a matter of serious consideration and some anxiety. Not only is *Hevea brasiliensis* attacked by various parasitic fungi, such as Fomes, pink-rot, and Phytophthora, some of which have received careful investigation from mycologists, but there are also questions connected with the soil and other conditions of the plantations which also need careful attention. All who are in any way interested in the future of the rubber industry should make a careful study of Prof. J. B. Farmer's address on "Science and the Rubber Industry," delivered before the Royal Society of Arts, and published in the society's Journal for June 21 last. The picture he draws, though somewhat gloomy, is none the less true. Possibly the hope of the future lies in breeding varieties of rubber immune to disease, but this will scarcely be possible until we have a fuller knowledge of the true function and precise chemical composition of the latex of *Hevea brasiliensis*. Moreover, despite the chairman's (Sir Edward Rosling's) remark that there was no direct evidence of a great variation of yield of rubber amongst different trees, there is, as Prof. W. Bateson pointed out, a very large body of evidence that there are wide differences, and of such any breeding experiments will have to take due account. It is much to be hoped that there will be no delay in taking steps to safeguard adequately the true interests of the rubber industry and its future prosperity.

THE British occupation of Jerusalem has already, in one important respect, conferred upon the inhabitants the benefits of sanitation. Within the short space of four months, despite difficulties of transport and unfavourable weather, a scheme of water-supply has been devised, executed, and put into commission.

The antiquated and germ-infected method of purveying water in leathern bags through the agency of the water-carrier is now superseded by a series of standpipes at various points in the city, fed by a main leading from an untainted source in the hills, where there is a group of springs yielding some 14,000 gallons per hour, which was previously running to waste. During the long period of Ottoman misrule, with its characteristic indifference to health and cleanliness, no attempt had been made to deal with this fundamental question of water-supply. Domestic requirements were met, in a haphazard fashion, from underground cisterns, replenished during the winter rains, most of them polluted and encrusted with dirt, and some even in a ruinous condition. Pending further developments, the British authorities have arranged to refill these domestic reservoirs as often as may be necessary on the preliminary stipulation that they shall be thoroughly cleansed and put in order; a British sanitary officer takes good care to see that this requirement is rigidly observed. The inhabitants can have as much water as they need, and the consumption is stated to be ten times as great as it was last year. The hospitals receive a supply direct from the main.

THE fine series of Maori burial-chests in the Auckland Museum, with a few isolated specimens in other collections, are described in *Man* for July by Dr. W. H. R. Rivers and Mr. H. D. Skinner. The chests were used in secondary burial, the bodies being first placed in trees and the desiccated bones collected for re-interment. The custom of placing the dead or their bones in caves is widely spread in Oceania, but neither elsewhere in New Zealand nor in any other part of Polynesia do we know of such chests. Receptacles, often in human form, are, however, used in Melanesia, notably in the Solomon Islands, to preserve the skull or skeleton. In the case of the New Zealand chests, similarity with Melanesian culture comes out in the nature of the chests themselves. In many respects in which the carving departs from the usual characteristics of Maori art it approaches that of Melanesia; and it is noteworthy that the part of the northern island of New Zealand where these chests have been found is characterised by the prominence of negroid or Melanesian characters in the physical features of the inhabitants.

A VIVID description of caribou hunting in Newfoundland appears in the *Brooklyn Quarterly* (vol. v., No. 2). The author, who signs himself "R. H. R.," is chief taxidermist to the Brooklyn Museum, and recounts his experiences during a trip undertaken for the purpose of providing six specimens for the museum. Incidentally, he has some hard things to say of the professional hunter. "These men who hunt for meat are a bloodthirsty lot. They do not hesitate to kill in excess of their legal allowance of three caribou. The wholesale butchery . . . in Newfoundland is a revolting sight." This state of affairs calls for immediate measures if the extinction of the herds is to be prevented. The author fears that they will go the way of the bison if the present rate of destruction is not speedily checked.

MR. R. C. MURPHY, in *Sea Power* for June, gives a brief but illuminating account of the whale fishery of South Georgia, and the part it has played in furnishing glycerine for the manufacture of high explosives. Even before the outbreak of war the humpback whale had been dangerously reduced in numbers, and the announcement in this article that the oil of this animal is particularly rich in glycerine gives occasion for grave forebodings as to the fate of this particular species. But the exigencies of the times have also demanded a very heavy toll on the rorquals of Antarctic waters. This much is apparent from the statement that by the beginning of 1917 no fewer than 660,000 barrels of whale-oil had been dispatched to British ports. For the sake of the future of the whaling industry, not only in these waters, but also at the Cape—for the one depends upon the other—we trust that the issue of whaling licences will be thoroughly revised on the advice of scientific experts, who, until now, have not been consulted in the matter, which has been administered entirely by the Colonial Office.

THE improvement of the natural indigo industry is a subject which is receiving much attention from scientific workers in India, and one aspect of the question is dealt with by Mr. C. H. Hutchinson in a paper entitled "The Importance of Bacterial Action in Indigo Manufacture" (Calcutta: Thacker, Spink, and Co., 1917, pp. 11). The yield of indigo from a given weight of indigo plant is found to depend upon the intervention of bacteria during the steeping process, and while some bacteria operate beneficially, others are detrimental. In the absence of the former the yield is reduced, and the author considers that the presence of these beneficial forms could be secured by artificial inoculation. Some alterations in the shape of the steeping-vats are also suggested in order to bring the bacteria normally present in the walls of the vats into closer connection with the indigo plant.

KEW Bulletin Nos. 2 and 3 were published together, mainly because they contain a valuable paper by Sir David Prain on the genus Chrozophora (Euphorbiaceæ), one species of which is a Languedoc plant, the source of one of the litmus dyes known as turnesol. Both the history of the genus and careful accounts of all the species are given. The paper occupies some seventy pages, but is much too technical for a brief review. In the same Bulletin there is an interesting account of experiments which have recently been made in breeding the West African oil-palm *Elaeis guineensis*, both on the Gold Coast and in the Seychelles. The object in view in these experiments was to see if the soft-shelled variety of the oil-palm would breed true, but it has been found that this is far from being the case under the conditions of the experiments. Palms grown from soft-shelled seed have yielded both hard- and soft-shelled nuts even in the same bunches of fruit, and it is clear that no decisive results can be obtained until care is taken to hand-pollinate the flowers of a soft-shelled tree with pollen from a tree of similar character and to protect the flowers, as cross-fertilisation must be of constant occurrence. Not only is it desirable to produce nuts with thin shells easy to be cracked, but it is also necessary to breed varieties of palms which shall be prolific bearers of fruit yielding the finest quality oils. Hitherto the oil-palm has only been a wild crop, but it is of interest to note that recent attempts to cultivate it on the Gold Coast have met with remarkable success, the yield from palms grown in tilled soil at fair distances apart being more than three times as large as that from palms under native conditions. The establishment of plantations in the Federated Malay States and the Seychelles may therefore lead to far-reaching results, and under these more favourable conditions the oil-palm may so flourish that the native industry, unless properly cared for, may collapse and disappear.

ON October 1, 1917, a disturbance, evidently due to an air-wave, was reported at certain places on the Dutch coast. Doors flew open and shut, pictures swung on the walls, and windows clattered. The

Meteorological Institute at De Bilt attributed the disturbance to an explosion which occurred at a munitions factory in the North of England. Accepting this explanation of the phenomenon, a writer in *Oesterreichische Flug-Zeitschrift* for January, 1918, regards it as evidence of a strong current from north-west in the upper air. This current is identified with the one that carried the German airships over France when returning from a raid in England last October, and is referred to as the summer monsoon prolonged into the autumn.

THE Germans are greatly troubled in finding a satisfactory substitute for platinum. Now, however (according to *Metall und Erz*, May 22), they have found that for certain purposes an alloy of nickel and iron may replace platinum. The alloy—called "platinite"—may be used in electric lamps. Nickel-chromium is sufficiently resistant to chemical action to make it a fairly good substitute for platinum for laboratory purposes. Cobalt stands up to strong acids even better than nickel. The low melting-point of gold makes it unsuitable for some purposes, but the melting-point may be raised by adding palladium. The Bureau of Standards (U.S.) has recently tested this latter alloy (known as "palau"), and found it to be superior to platinum in some respects, though inferior in others.

THE April Bulletin of the Bureau of Standards contains a study of the electromagnetic moving-coil galvanometer for alternating currents by Mr. E. Weibel. After obtaining the equations of motion of the coil, he shows that the deflections are proportional to the component of the electromotive force applied to the coil in phase with the excitation of the laminated magnet. The period is shortened by inductance and lengthened by capacity of the external circuit. The intrinsic constants of the instrument are easily determined by experiment, so that the behaviour of the instrument under specified conditions is readily foretold. The instruments which have been constructed on the lines laid down in the paper have a sensitivity at low frequencies much greater than the telephone, greater than the vibration galvanometer, and about equal to the best direct-current instruments. At high frequencies of the order 2000 many precautions must be taken to ensure accuracy; amongst others, the moving coil and circuit near it should be enclosed in a metal shield kept at the same potential as the coil.

A TIMELY article on "Planning a Research Laboratory for an Industry," by Dr. C. E. K. Mees, of Rochester, New York, appears in the July issue of the *Scientific Monthly*. The research laboratory, for example, of a textile-dyeing business with an annual turnover of 200,000*l*. per annum should cost about 2000*l*. and the equipment about 1000*l*. It should have, to begin with, a staff of four with salaries totalling 2000*l*. per annum. The organisation should be on the departmental system—that is, there should be a head of the laboratory and three heads of departments of physics, chemistry, and biology respectively. As the laboratory justifies itself, additions to the staff of each department will become necessary, and these additions will be responsible to the heads of departments, although with further growth provision should be made for their becoming heads of new departments. The great object of the firm should be to get hold of a capable man for the head of the laboratory, as success or failure depends on him. If such a man is available it is best to leave the organisation in his hands, for there is no evidence for the belief that an investigator is not a good administrator.

To the *Biochemical Journal* for June Dr. J. C. Drummond contributes an account of further work on what has been called the "water soluble B," or water-soluble accessory growth-promoting substance (compare NATURE, March 21, p. 52). The influence of the substance upon the nutrition and nitrogen metabolism of the rat was studied. The food consumed by rats fed upon a diet deficient in the water-soluble accessory substance seems to be reduced to that sufficient to supply the calorific requirements of maintenance, and, although the consumption may be increased by the addition of flavouring agents (*e.g.* meat extract) to the diet, no growth is observed unless the agent contains the water-soluble substance. Addition of an extract of the latter to the inadequate diet causes a greatly increased food intake, immediately followed by growth, and the amount of growth is proportional, within certain limits, to the amount of accessory substance added. Evidence was obtained that the length of time a rat can maintain its body-weight upon a diet deficient in the water-soluble substance is directly proportional to the age at which the restriction is imposed. The only apparent deviation from the normal nitrogen metabolism by rats fed upon the deficient diet was the appearance of creatinuria, accompanied by a slow wasting of the skeletal muscles. The cause of the fatal decline which inevitably follows a deficiency of the water-soluble substance was not discovered, but symptoms of nerve disorder were observed before death in three cases. Actively growing animal tissues (embryos, tumours), desiccated pituitary gland, thyroid, thymus, testicle, and ovarian tissues are deficient in the "water soluble B."

THE New York State Barge Canal, which it was anticipated would be opened to navigation in the early part of this year, is the subject of an interesting article in the *Engineer* of July 19. It is the development of a network of antique waterways dating back, in part, to the beginning of last century. The principal member of the system is the old Erie Canal, linking up Lake Erie with the River Hudson; this was begun in 1817 and completed in 1825. As originally constructed, it had a depth of 4 ft. and a width of about 42 ft. Similar and adjacent enterprises followed, but the advent of the locomotive and the development of railway construction exercised a deterrent influence, so that ultimately several of them failed and had to be shut down. The canals which survived, although enlarged from time to time to meet the growth in size of vessels, gradually lost influence and declined into relative obscurity. In 1882 the Erie Canal had a depth of only 7 ft., and the largest boat carried was of 240 tons burthen. The scheme just completed provides a minimum depth of 12 ft., and minimum widths of 94 ft. in rock cuttings and 125 ft. in earth excavation respectively. The project has, in fact, been so designed as to render it possible to accommodate boats up to 3000 tons, though for the present the bulk of the craft using the canal will scarcely exceed 1500 to 2000 tons. As yet there is a lack of boats of a suitable type, and opinion is much exercised on the matter; possibly the solution of the problem may lie in the adoption of reinforced-concrete construction. There are fifty-seven locks on the new waterway, each 328 ft. long and 45 ft. wide. As the dimensions of a 1000-ton barge recently built—the first of a fleet of such boats for service on the canal—are 152 ft. long and 22 ft. beam, there is evidently ample margin for future expansion. All the locks are operated electrically. The lock at Little Falls, with a range in level of 40½ ft., is notable in that its range is greater than that of any single lock on the Panama Canal. The syphon lock at Oswego, with a range of 25 ft., is the first of its type to be constructed in the United States, and is believed to be the largest of its kind in the world.

WE have received a copy of a paper by Mr. K. J. J. Mackenzie and Dr. F. H. A. Marshall, of Cambridge, on "The Inheritance of Mutton Points in Sheep." The paper is published in the Transactions of the Highland and Agricultural Society, 1917, and consists of an account of Mendelian cross-breeding experiments upon merino and Shropshire sheep, carried on over a number of years at Cambridge, and involving three generations of animals. The points dealt with ("over the shoulder," "behind the shoulder," "loin," and "top of leg") show a marked degree of segregation among the cross-bred sheep.

THE special feature of the July issue of the "Readers' Guide," just issued by the Norwich Public Library Committee (post free 2*d.*), is a section devoted to the work of Mr. A. H. Patterson, whose valuable collection was recently presented to the Norwich Public Library. A short account of this well-known naturalist's life and writings, by Mr. Geo. A. Stephen, the city librarian, is followed by an annotated bibliography (extending to five pages) of his writings, arranged under the following headings:—Manuscripts, Books and Pamphlets, and Principal Articles. The bibliography, which shows that Mr. Patterson is a prolific writer, should be of much interest and use to naturalists.

OUR ASTRONOMICAL COLUMN.

BORRELLY'S COMET.—This periodic comet, which was observed in 1905 and 1911, has been detected on its return by M. Fayet, director of the Nice Observatory, the position on August 7·6205 G.M.T. being R.A. 3h. 39m. 52s., S. decl. 16° 14'. M. Fayet, who obtained a very extensive series of observations in 1911–12, had previously computed the first order perturbations by Jupiter and Saturn, and obtained the following elements for 1918 (Marseilles Observatory Circular, No. 29):—

$$T = 1918 \text{ Nov. } 16{\cdot}3484 \text{ G.M.T.}$$

$$\left.\begin{aligned} \omega &= 352^\circ\ 23'\ 29{\cdot}44'' \\ \Omega &= 76^\circ\ 55'\ 52{\cdot}86'' \\ i &= 30^\circ\ 29'\ 27{\cdot}28'' \end{aligned}\right\} 1918{\cdot}0$$

$$\phi = 37^\circ\ 57'\ 5{\cdot}78''$$

$$\log a = 0{\cdot}5593451$$

$$\log q = 0{\cdot}1448107$$

The observation indicates that the true value of T is near November 16·62.

The following ephemeris (for Greenwich midnight) is computed with the uncorrected value of T:—

	R.A. h. m. s.		S. Decl. ° '
Sept. 3	4 40 36	...	13 37
7	4 49 20	...	13 10
11	4 57 57	...	12 41
15	5 6 28	...	12 9
19	5 14 51	...	11 33
23	5 23 6	...	10 54
27	5 31 13	...	10 11
Oct. 1	5 39 10	...	9 22

Values of $\log r$, $\log \Delta$: September 3, 0·20980, 0·08128; October 1, 0·17291, 9·96205 respectively.

THE AUGUST METEORS.—These phenomena appear to have returned this year under a more brilliant and abundant aspect than usual. Mr. Denning writes from Bristol that he made observations on July 30, August 2, 5, 6, 8, 9, and 10, and that the number of meteors visible increased with the time. On August 9 forty-nine meteors were seen in $2\frac{1}{2}$ hours' watching, and on August 10 forty-eight were observed in $1\frac{3}{4}$ hours. On the former date twenty-five Perseids were included in the total, and on the latter thirty-one. The position of the radiant point exhibited the usual displacement from night to night to the north-east. The character of the radiation this year seems to have been more dispersed or diffused than is sometimes the case, and, far from being "a point," the radiant formed an area extending over a diameter of six or seven degrees.

Several fine Perseids were observed, and their positions, as seen from Bristol, were as under:—

Date	G.M.T. h. m.	Mag.	Path From ° °	Path To ° °
August 5	13 54	♀	269 $+84\frac{1}{2}$	230 +65
8	12 47	♃	320 +82	256 $+70\frac{1}{2}$
9	10 33	3×♀	332 −13	326 −23
	10 56	♀	$17\frac{1}{2}$+48	$5\frac{1}{2}$+40
	11 6	♃	293 +3	284 −12
10	10 4	5×♀	33 +84	245 +83
	11 42	♃	20 +20	18 $+12\frac{1}{2}$

On August 10 a 2nd mag. meteor was seen at 9.54, which had a very long flight of 75° from 62°+77° to 257°+28°.

The night of August 11 was much overcast at Bristol, and all that could be seen was an occasional brilliant meteor in openings of the clouds.

On August 12 the sky was splendidly clear, and an attentive watch, amounting to $2\frac{3}{4}$ hours in the interval between 9h. 45m. and 13h. 45m. G.M.T., revealed 120 meteors, of which ninety-six were Perseids. The shower was quite brilliant and abundant, though the maximum had probably occurred on the previous night. A magnificent Perseid was seen at 12h. 41m. G.M.T. shooting from 28°+46° to $18\frac{1}{2}$°+35°, and leaving a bright streak. These August meteors have furnished an unusually fine display this year.

THE FUTURE OF THE IRON AND STEEL TRADES.

ON July 31, 1916, Mr. Walter Runciman, the then President of the Board of Trade, appointed a Committee to consider the position of the iron and steel trades after the war, especially in relation to international competition, and to report what measures, if any, are necessary or desirable in order to safeguard that position. The Committee consisted of representatives of employers, employed, and those engaged in technical practice. At its first meeting it decided to address to the manufacturers' and workmen's associations in the trades and to the trade Press a circular letter indicating the nature of the inquiry upon which it was engaged, and inviting assistance and co-operation. In reply a number of detailed statements were received, which in the great majority of cases were supplemented by oral evidence.

The Committee states that it has endeavoured to approach the question of the future of the position of the iron and steel industries with a mind free from preconceived political views and economic theories, and that its purpose has been, not to test abstract doctrines, but to establish an ordered plan of action. Political existence, it says, must be founded on commercial and industrial strength, and the problem to which it has attempted to find a solution is:—"To give to the nation industrial resources which in time of peace shall preserve the prosperity of Great Britain, and in time of war shall give her full command of resources adequate to the defence and safekeeping of the Empire."

The scope of the inquiry was so wide that it was decided to treat various subjects separately, and a number of interim reports dealing with special subjects have been issued. These are incorporated in the general report, which was presented to Sir Albert Stanley in June, 1917. It will be seen, therefore, that the Committee completed its labours in about eleven months, and that a year has elapsed between the presentation and publication of its report. The latter is divided into fourteen sections, in regard to which limits of space permit reference to only two. It should be stated, however, that, generally speaking, the Committee failed to reach unanimity on most of the points discussed. Nearly all the interim reports are either signed with very decided reservations by certain members, or else accompanied by a minority report emphasising fundamental disagreement. It is true that the general summary of recommendations is signed by each member of the Committee, the numbers of which were reduced to nine by the death of Mr. Colville in December, 1916; but three of these, in doing so, direct attention to various dissenting statements of theirs in the body of the report. Sir Hugh Bell evidently came to very different conclusions from those reached by his brother employers, and has expressed them in a series of minority reports.

As regards what may be called the future position of labour in the industry, which is one of the most fundamental aspects of the problem, the sectional report is signed by five members, and more or less dissented from on three separate grounds by the remaining four. In the succeeding section, dealing with "Protection," the same five members recommend that the industry should be protected by the imposition of customs duties "upon all imported iron and steel and manufactures thereof," that a specific duty should be levied in each class of commodity, and that there should be maximum, general, and minimum tariffs. Messrs. Gavin and Hodge, while agreeing with this, consider it imperative that safeguards should be provided by the Government against the raising of prices unduly against the consumer and to the disadvantage of labour. On the other hand, Sir Hugh Bell and Mr. Davidson in their dissenting statement say:—"We entirely disagree with the foregoing report, which proposes to inflict on the community Protection in its most unmitigated form. Neither the grounds on which this course is recommended nor the means which it is proposed to adopt to accomplish it are, in our judgment, justified by the facts of the case. . . . A country of which the exports of iron and of the ultimate products of the manufacture of iron amount to more than one-third of the total value of the iron trade itself, and to something like one-quarter of the total export trade of the country, can by no stretch of language be described as not being self-sufficing." It will certainly not be easy to legislate on the basis of this report.

H. C. H. C.

NEW X-RAY TUBES.

THE war has brought about an activity in the production of the "Crookes" or X-ray tube that has become decidedly to our advantage. At the commencement of hostilities a certain amount of anxiety was felt as to how the great demand that was immediately created could be met; not only was the manufacture of these tubes rapidly falling into German hands, but we were also entirely dependent upon that country for the supply of the peculiar glass necessary for their construction. Happily the difficulties have now been overcome. The production of tubes of higher efficiency and excellence than was ever reached before the war has been achieved, and at the present time all the demands both for military and home needs can be met. This success is not confined to British manufacturers, but is shared by both our American and French Allies.

The invention by Dr. Coolidge in America of the ionic discharge tube has placed in the hands of the radiologist a highly efficient tool that will produce a volume of X-rays of any desired power of penetration. These tubes are supplied in England by the British Thomson-Houston Co., of Upper Thames Street.

Messrs. Watson and Sons, of Great Portland Street, W., are the sole agents for a very complete series of tubes produced by M. Pilon in France. These have been specially designed to meet military needs, and are beautifully constructed pieces of apparatus; some thousands of them have been supplied to the Allied Armies. There are also many excellent tubes of home construction that are being produced in London as rapidly as the present restricted labour conditions will allow. Of these we may mention the series known as the "Zenith" tubes, manufactured by Messrs. A. E. Dean and Co., of Holborn. In these tubes the new glass devised for the purpose by Sir Herbert Jackson is used, and they are London-made throughout.

Many other British-made tubes are on the market, so that there is thus every hope that another important industry has been saved from becoming a German monopoly.

THE POSITION OF UNIVERSITY AND HIGHER TECHNICAL EDUCATION.

I.—SUPPLY AND OUTPUT OF STUDENTS.

TWO of the chief subjects dealt with in the report of the Government Committee on the position of natural science in the educational system of Great Britain, of which a summary was given in NATURE of April 18, are (1) the need for concerted efforts to increase the number of students at universities and higher technical institutions with the view of securing a larger supply of trained scientific workers required for industrial and other purposes, and (2) that increased grants of public money are required to equip the universities for their work in pure and applied science, and to enable a substantial reduction of fees to be made. Few particulars are given in the report to show how the position of Great Britain as regards university and higher technical education compares with those of countries like Germany and the United States, though the evidence which such a comparison affords strengthens greatly the case presented. It may be worth while, therefore, to bring together some facts which accentuate the need and urgency of action in the directions indicated by Sir J. J. Thomson's Committee.

The first report (1915–16) of the Advisory Council for Scientific and Industrial Research pointed out that the prime condition of success for its operations was a largely increased supply of competent researchers. "Before the war," the report remarks, "the output of the universities was altogether insufficient to meet even a moderate expansion in the demand for research. The annual number of students graduating with first- or second-class honours in science and technology (including mathematics) in the universities of England and Wales before the war was only about 530, and of these but a small proportion will have received any serious training in research. We have frequently found on inquiry that the number of workers of any scientific standing on a given subject of industrial importance is very limited. . . .

"The responsibility for dealing with the grave situation which we anticipate rests with the education departments of the United Kingdom. We shall be able to do something to encourage a longer period of training by the offer of research studentships and the like; but that will not suffice. It is useless to offer scholarships if competent candidates are not forthcoming, and they cannot be forthcoming in sufficient numbers until a larger number of well-educated students enter the universities. That is the problem which the education departments have to solve, and on the solution of which the success of the present movement, in our opinion, largely depends."

Sir J. J. Thomson's Committee confirms the statement of the Advisory Council for Scientific and Industrial Research that the total annual output of the first- and second-class honours men in science and engineering for all the English universities is little more than 500. The total number of full-time men students who entered the universities and university colleges of England and Wales (excluding the medical schools) in the year 1913–14 was no more than 4400, and of these some hundreds were foreign students. It is estimated that nearly half this number were from the public schools, from which about 5200 leave annually at sixteen years of age or above, and 25 to 30 per cent. proceed to the universities. In the case of the State-aided secondary schools, the number leaving at sixteen years of age or above is approximately 8800; and the Government Committee estimates that from 12 to 15 per cent. pass to a university. This estimate is, however, probably too high, not more than about 10 per cent. of such students proceeding to universities. As a rule, the State-aided secondary schools devote more attention to science and other modern studies than do the public schools; and it is to them that we must chiefly look for an increased supply of university students to be trained as scientific workers.

In order to determine the position of the United Kingdom as regards education of a university standard in comparison with those of the United States and Germany, the conditions existing in the academic year 1913–14—that is, immediately preceding the opening of the war—have been analysed. The results show that much remains to be done to increase the number of university students from whom the supply of research workers must chiefly be drawn. The number of full-time students at the universities of the United Kingdom in 1913–14 was nearly 27,000, distributed as shown in Table 1.

1.—*Full-time Students at Universities of the United Kingdom*, 1913–14.

	Universities	Students
England	10	15,550
Scotland	4	7,550
Ireland	3	2,470
Wales	1	1,140
	18	26,710

In comparing the number of students attending universities and technical institutions of like rank in different countries, it is necessary, of course, to take population into account. Also, in making any exact comparison, the standard of the work at each university should be known. It is very difficult to derive these particulars from any published reports, but sufficient facts are available to enable a general comparison to be made. Table 2 shows the number of university students per 10,000 of population in the United States, Germany, and the United Kingdom. Students at technical institutions of university rank are included; and in the case of the United States only students in the seventy-two universities, colleges, and technical schools on the accepted list of the Carnegie Foundation for the Advancement of Teaching. If all students taking four-year courses at these institutions in the U.S.A. were included, the number and rate per 10,000 would be doubled.

2.—*Full-time Students at Universities and Higher Technical Institutions, and Ratio to Population.*

	Population	Students in Universities and Technical Institutions	Rate per 10,000
United States ...	100,000,000	100,000	10
Germany	65,000,000	90,000	13
United Kingdom ...	45,000,000	29,200	6
England	34,000,000	17,000	5
Scotland	4,800,000	8,000	16
Ireland	4,400,000	3,000	6
Wales	2,000,000	1,200	5

The number of students in universities and technical institutions of like rank may be taken as a rough index of national regard for intellectual equipment and high technical training. Judged by this standard, England and Wales occupy the lowest position among the countries represented in the foregoing table. Both in the United States and Germany there has been in recent years an increase in the number of university students far in excess of the increase of population, whereas before the war the reverse was the case in England and Wales. While industrial prosperity has been accompanied by an increase in the proportion of university students in the United States and Germany, the rate of increase of such students in England and Wales has diminished.

The number of collegiate and resident graduate students in universities and other institutions of university rank in the United States in 1913–14 was 210,500, made up of 139,400 men and 71,100 women. The number annually completing four-year courses and receiving bachelor degrees is about 26,000. In addition, in 1913–14 there were conferred 5250 graduate degrees and 520 doctorates of philosophy by examination.

The number of students in the twenty-one universities of Germany in 1913–14 was about 68,000, 58,000 of whom were matriculated students. The distribution of the students in the different faculties is shown in Table 3.

3.—*Number of Students in German Universities*, 1913–14.

	No. of Student
Faculty of Theology	5,840
,, ,, Jurisprudence, etc. ...	10,290
,, ,, Medicine	16,300
,, ,, Philosophy	25,780
Total matriculated students ...	58,210
Non-matriculated students ...	9,900
Grand total	68,110

In regard to the number of students receiving technological training of an advanced kind, the position of England and Wales is even worse than that shown by the proportion of university students. At the Imperial College of Science and Technology there were, in 1913–14, 700 such students; at Cambridge the number of candidates who presented themselves in the Natural Sciences Tripos, the Mechanical Sciences Tripos, and various special examinations in other branches of science was about 500; at Oxford the number of students of Natural Science was about 300; and at the Manchester College of Technology, 285. Most of the technical colleges in England and Wales are connected with the universities of their respective areas. Others provide technical institution courses approved by the Board of Education for students above seventeen years of age. Such provision for full-time education in applied science is, however, as the Board has pointed out, regrettably small in bulk compared with the needs for the industrial development of the country. In the year 1913–14 there were, in the twenty-six technical institutions recognised by the Board, fifty-four technological courses in engineering, chemistry, and subjects connected with the building, mining, textile, and leather trades, many of which were also attended by some students preparing for degrees; and five scientific courses mainly in provision for professional qualifications. The number of students taking the full courses was 1236, of whom 539 were in their first year, 374 in their second year, 269 in their third year, and 54 in later years of their courses. The numbers of full-time students of science and technology in all these universities and colleges are shown in Table 4.

4.—*Full-time Students in various Faculties of Science and Technology (excluding Medicine) in Universities and University Colleges in Receipt of State Grants* (1913–14).

	England	Wales
Pure science	1,620	234
Engineering, including naval architecture	1,085	44
Technology, including mining, metallurgy, and architecture ...	459	34
Agriculture, horticulture, and dairy work	221	58
	3,385	370

There are fifty-two agricultural and mechanical colleges for white students in the United States. These may be regarded as comparable with our technical institutions, and most of them are incorporated in universities. In these cases the students are included in the numbers given for universities. The number of undergraduate students in four-year college courses in the United States colleges of agriculture and mechanic arts in 1914 was 40,000; and the chief groups are shown in Table 5.

5.—*Students in Colleges of Agriculture and Mechanic Arts, U.S.A.*

	No. of Students
Agriculture, horticulture, and forestry ...	14,250
General science	4,360
Mechanical engineering	4,100
Civil ,, ...	3,480
Electrical ,, ...	3,280
General ,, ...	2,610
Chemical ,, ...	780
Mining ,, ...	680
Chemistry	610
	34,150

The number of degrees conferred in 1914 in agricultural and mechanical sciences were:—

	Agricultural Science	Mechanical Science
Bachelor degrees	1,900	1,960
Advanced ,, ...	150	150
	2,050	2,110

There are eleven technical high schools in Germany having the power of granting degrees. The number of students in these schools in 1913–14 was nearly 17,000, of whom 11,600 were fully qualified. It is not possible to make any exact comparison between the German technical universities and our technical institutions or the applied science faculties and departments of British universities. The matriculation for fully qualified students at the German technical high schools is the completion of the full nine years' secondary school course at a classical, semi-classical, or modern secondary school, and is practically equivalent in standard to a pass B.A. degree at one of our universities.

In our own technical institutions the standard and age of admission are much lower, and if we count all the students at these institutions as well as those in applied science departments of universities the number is less than 5000, to compare with the 17,000 students in German technical high schools. In addition to these schools there are four agricultural high schools with 1750 students; five veterinary high schools with 1570 students; four forestry academies with 300 students; three mining high schools with 800 students, as well as other special schools; and in all these the educational qualifications for entrance are the same as at the technical and older universities.

Dr. F. Rose, a few years ago, made a detailed report to the London County Council upon technical education in the United Kingdom and Germany; and he showed that there are few technical institutions in the United Kingdom which can be compared with any of the great German technical universities. Good technical colleges and departments in England appear to be on a level with the best technical schools in Germany rather than with the technical universities. "Looked at," said Dr. Rose, "from the basis of the German standard of previous education and practical work, length, extent, and variety of the courses taken, and the number of diplomas granted, it will probably be found that there are insufficient students in the whole country to fill one of the large German technical universities"

II.—FINANCIAL PROVISION.

A comparison of the financial provision made for university and advanced technical training in the United Kingdom with what is available in the United States and Germany reveals our deficiencies just as decidedly as does that of the number of students. With the exception of Oxford and Cambridge, all the universities and university colleges in England and Wales participate in Parliamentary grants, the amounts of which, as well as other sources of income, are shown in Table 6.

6.—*Incomes of Universities and University Colleges in Receipt of Exchequer Grants* (1913–14).

	England (18 Institutions) Amount	Percentage of Total	Wales (4 Institutions) Amount	Percentage of Total
Fees	£190,300	28·1	£17,600	27·2
Endowments ..	100,300	14·8	4,200	6·5
Donations and subscriptions	20,700	3·0	2,100	3·3
Annual grants from local authorities ..	108,500	16·0	3,800	5·9
Parliamentary grants ...	230,100	34·0	35,700	55·3
Contributions from hospitals, etc., for services rendered ...	1,500	0·2	—	—
Other income .	26,200	3·9	1,200	1·8
	£677,600		£64,600	
Grand total ...	£742,200			

It will be seen that the income from endowments of the eighteen universities and university colleges of England and Wales in receipt of Exchequer grants amounts to about 100,000*l*. Manchester receives about 23,000*l*.

annually from endowments, or 27·5 per cent. of its total income, whereas King's College, London, receives only 620*l.*, or 1·6 per cent. of its income. Manchester University, Liverpool University, and University College, London, together have nearly half the total income from the endowments of the universities and university colleges in England which participate in the Exchequer grant.

In general, it may be said that these institutions derive about one-third of their total incomes from Parliamentary grants; the percentage of income from other sources varies so greatly that no general statement other than the averages given in the above table can be made.

In addition to the universities and university colleges in receipt of Exchequer grant, a number of medical schools and a few other institutions received in 1913–14 Parliamentary grants amounting to about 33,000*l.*, or one-quarter of the total incomes. The total of the annual Parliamentary grants to these universities, colleges, and medical schools in England and Wales is about 300,000*l.* The grants are made up as shown in Table 7. Twenty-four institutions in all participate in the grant for technological and other professional (including medical) work, and ten of them are also in receipt of portions of the Exchequer grants to universities and colleges.

7.—*Heads under which Incomes from Parliamentary Grants are derived by Universities, University Colleges, and Medical Schools.*

	England	Wales
Exchequer	£170,000	£31,000
Board of Education, in respect of technological and other professional work	46,890	430
Board of Education, in respect of training of teachers	19,910	4,730
Board of Education, other grants	20,440	250
Other Government departments	19,560	4,780
	£276,800	£41,190

The financial provision made by the State for university, medical, and higher technical education in the United Kingdom is about 500,000*l.* annually. Of this amount England and Wales receive about 300,000*l.*, Scotland about 84,000*l.*, and Ireland about 100,000*l.* The total annual income of all the universities and university colleges in the British Isles, including the Universities and Colleges of Oxford and Cambridge, is about 2,000,000*l.*; that of universities and colleges in the United States is 20,000,000*l.*, and of universities in Germany 1,800,000*l.* Particulars of the incomes of institutions in the United States are given in Tables 8 to 12.

8.—*Income of Universities, Colleges, and Technological Schools of the United States* (1913–14).

	Amount	Percentage of Total
For tuition and other educational services	£4,500,000	22·5
From invested funds ...	3,500,000	17·5
Donations and subscriptions	2,700,000	13·5
Grants from State or city ...	6,000,000	30·0
United States Government grant	1,000,000	5·0
Other sources	2,300,000	11·5
	£20,000,000	100·0

The incomes of individual universities in the United States are very high in comparison with those of most of our universities. Seventeen universities have each an annual income equal to, or in excess of, the total Parliamentary grants to universities and colleges of England and Wales, and nine have incomes equal to, or in excess of, the total Parliamentary grants to university and higher technical education in the whole United Kingdom. The incomes of these United States universities are shown in Table 9.

9.—*Annual Incomes of Seventeen Universities in the United States*, 1913–14.

University	Income
Cornell University	£1,300,000
Columbia ,, ...	1,300,000
Harvard ,, ...	860,000
Chicago ,, ...	660,000
Minnesota ,, ...	600,000
Wisconsin ,, ...	600,000
Illinois ,, ...	560,000
California ,, ...	500,000
Yale ,, ...	500,000
Michigan ,, ...	440,000
Northwestern University	300,000
Wellesley College, Mass.	300,000
Missouri University	300,000
Washington University, Missouri ...	300,000
Princeton University	300,000
Ohio State ,, ...	300,000
Pennsylvania ,, ...	300,000

Five States of the U.S.A., four of them with populations of about two millions each, gave grants to universities in 1913–14 exceeding the total Parliamentary grants to universities and colleges of England and Wales. These are shown in Table 10.

10.—*State Grants to Five Universities in the United States.*

State	Population	Grant
Minnesota	2,000,000	£500,000
Illinois	5,600,000	400,000
Wisconsin	2,300,000	400,000
California	2,400,000	300,000
Michigan	2,800,000	300,000

The benefactions to universities and colleges in the United States are similarly far in excess of those devoted to such institutions in the United Kingdom. The total amount of gifts and bequests to universities and colleges in the United States in the year 1913–14, excluding grants by the Federal Government, different States, and municipalities, was more than 5,000,000*l.* Of this amount nearly 4,000,000*l.* was for endowment, giving in a single year, if invested at 5 per cent., an increased endowment income of 200,000*l.*, or double the income derived from all the endowment funds of the whole of the modern universities and university colleges of England and Wales. The chief gifts in 1913–14 are shown in Table 11. In addition, forty-five universities, colleges, and technological schools each received gifts above 20,000*l.*

11.—*Private Benefactions to Universities of the United States*, 1913–14.

University	Benefactions
Cornell University	£800,000
Harvard ,, ...	400,000
Chicago ,, ...	300,000
Yale ,, ...	200,000
Washington ,, ...	200,000
Columbia ,, ...	200,000

The gifts and bequests to universities and colleges in the United Kingdom in the year 1913–14 amounted to about 200,000*l.*

The incomes of the colleges of agriculture and mechanic arts in 1913–14, excluding the grants for experiment stations, amounted to 7,000,000*l.*, made up as shown in Table 12.

12.—*Incomes of Agricultural and Technical Colleges, U.S.A.*

Sources	Amount	Per cent.
From States	£3,600,000	52
Federal Government ...	700,000	10
Tuition fees and endowments	2,700,000	38
	£7,000,000	100

The total income of these technical colleges is thus nearly ten times that of the whole of the universities and colleges in England and Wales in receipt of Exchequer grants; and 60 per cent. is derived from State or Federal grants in comparison with 40 per cent. from Parliament and local authorities combined in the case of universities and colleges of England. It may be added that the normal State expenditure per annum on higher agricultural education in England and Wales is about 20,000*l.*, and 35,000*l.* for agricultural research, or not much more than a single State in America receives for similar purposes.

The incomes of twenty-one German universities in 1913–14, not including the technical high schools, amounted to nearly 1,800,000*l.*; and of this the State provided 1,500,000*l.*, or more than 80 per cent. of the total. The universities with incomes approaching 100,000*l.* or more are shown in Table 13.

13.—*Incomes of Eight German Universities.*

University	Income	State grants	Per cent.
Berlin	£246,000	£205,000	81
Leipzig ...	231,000	190,000	82
Breslau ...	112,000	82,000	73
Halle	111,000	74,000	67
Bonn	100,000	75,000	75
Kiel	99,000	65,000	66
Göttingen ...	94,000	50,000	53
Königsberg ...	92,000	72,000	80

Some of the points brought out by the foregoing tables may be stated as follows:—

(1) In proportion to population, the United States has more than twice as many students of university standard as are in England; Scotland has more than three times as many; and Germany nearly three times as many.

(2) There are only 5000 full-time students of science and technology in the United Kingdom in comparison with nearly 17,000 in Germany and 34,000 in the United States.

(3) The total income of universities in the United States amounts to about 20,000,000*l.*, and that of Germany to nearly 1,800,000*l.* The total income of all the universities of the United Kingdom is about 2,000,000*l.*

(4) Eighty per cent. of the total income of German universities is derived from State grants, in comparison with 34 per cent. contributed in Parliamentary grants to the modern universities of England and Wales.

(5) Thirty per cent. of the income of universities in the United States is derived from invested funds and donations, in comparison with 15 per cent. in the modern universities of England and 6 per cent. in those of Wales.

(6) The tuition fees at universities of the United Kingdom form a much higher percentage of the total income than they do in the United States and Germany.

(7) Nine universities in the United States have individual incomes exceeding the total amount granted annually by Parliament to universities and institutions of like standard in the United Kingdom.

(8) Five States of the United States give grants to their universities exceeding the amount of the Parliamentary grants to universities and colleges of England and Wales.

(9) Private benefactions to universities and colleges in the United States amount to more than 5,000,000*l.* annually; in the United Kingdom they do not average one-twentieth that sum.

(10) The colleges of agriculture and mechanic arts in the United States have a total income of 7,000,000*l.*, or ten times that of the whole of the modern universities of England and Wales.

(11) The University of Berlin receives annually from State funds a grant nearly equal to the total annual Parliamentary grants to the universities and colleges of England and Wales.

It will be evident from these facts that in the domain of higher education the United Kingdom compares very unfavourably with the United States and Germany. No doubt one reason for this is that in America and Germany there has been a greater demand for highly trained men than in the British Isles, where posts for such men have been few, salaries low, and prospects poor. Conditions are, however, improving; and the industrial research associations being formed in connection with the Department of Scientific and Industrial Research, as well as associations established on the lines suggested by the Whitley Report, need for their successful operation the employment of men capable of undertaking research. The conditions of industrial development and the competition of other countries make it essential to secure an adequate supply of trained workers of this type.

Increased grants to universities and technical institutions are needed to enable the tuition fees to be reduced and to ensure that the staffs are paid salaries commensurate with the high qualifications demanded. The present aid given by Parliament is in no way adequate to modern needs, and compares very unfavourably with what is available in the United States and Germany. The grand total of all Parliamentary grants to universities and technical colleges of university rank in the United Kingdom is about 500,000*l.*, whereas the Federal and State grants in the United States amount to 7,000,000*l.*, and in Germany to nearly 2,000,000*l.* The provision made by Parliament for higher education is thus obviously not that which should be expected of a State which intends to maintain its position among leading Powers. R. A. GREGORY.

SCIENTIFIC ORGANISATIONS OF THE ALLIED NATIONS.

AT the invitation of the Royal Society, a conference between representatives of the Allied nations will be held in London on October 9 to discuss the future conduct of scientific organisations. It is expected that representatives from the academies of Paris, Rome, Tokyo, and Washington, as well as nominees of the Governments of Belgium, Portugal, and Serbia, will attend. A memorandum proposed by a committee of the Royal Society points out that international scientific organisations and conventions may be divided into four groups, according to their objects and methods of procedure. A first group consists of those important agreements which fix the standards of measurements, and are essential not only in purely scientific investigations, but also in the development of many industries. A second group contains associations definitely formed for the investigation of scientific problems in which co-ordination of observation is essential. A third group, which hitherto has not been large in numbers, but presents some special features, embodies the efforts to organise undertakings that might be carried out in one locality, but is more economically dealt with by a division of work. The most prominent example of this type is the arrangement made between eighteen observatories to form a photographic chart of the heavens. The organisation dealing with the "International Catalogue of Scientific Literature" may also be included in this group. In the fourth group is placed the large number of congresses called together by workers in some one department of science, and mainly intended to foster friendly personal relationships between those who pursue similar aims in different countries. There is, finally, in a group by itself, the International Association of Academies, which aims at co-ordinating the activities of international undertakings, and organises work for which special permanent bodies do not exist and are not required. The council of the Royal Society will submit the following questions as subjects for discussion at the forthcoming conference:—(1) Is it desirable for the Allied nations to establish organisations for scientific co-operation among themselves? (2) If this be agreed upon, what should be the particular forms of organisation to be aimed at in geodesy, seismology, meteorology, etc.? (3) Should particular academies be asked to submit proposals on those undertakings in which they have taken the leading part, such as: (*a*) The Académie des Sciences on the Commission Métrique and the Bureau International des Poids et Mesures; (*b*) The Royal Society on the International Catalogue of Scientific Literature? (4) What representations should be addressed to the Governments with regard to those organisations which have hitherto received their support? The conference at present is intended to deal only with scientific subjects, but similar questions no doubt also arise on the literary side.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

WE learn from the *Times* that Prof. J. J. Findlay, professor of education in the University of Manchester, has accepted the invitation of the Y.M.C.A. Universities' Committee to become its director of education in Salonika, where it is hoped that an extensive system of classes and lectures will be developed during the autumn and winter. Prof. Findlay will leave for Salonika in September. To the work on the lines of communication in France which Sir Henry Hadow has undertaken for the committee will now be added similar service among the British troops in Italy.

THE governors of the Royal Technical College, Glasgow, have appointed Dr. C. H. Desch to the chair of metallurgy in the college, rendered vacant by the resignation of Prof. A. Campion. Dr. Desch received his scientific training at the Finsbury Technical College, at Würzburg University, and at University College, London, under the late Sir William Ramsay. After eight years' practical experience as chemist in a chemical works, he was for five years research assistant to the professor of metallurgy in King's College, London; for the last ten years he has been Graham Young lecturer in metallurgical chemistry in Glasgow University.

THE Education Act received the Royal Assent on August 8, and is now, therefore, on the Statute-book. The following is a summary of the main changes in the provision of public education in England and Wales as given in the *Times* of August 9:—(1) No exemptions from attendance at school shall be granted to any child between the ages of five and fourteen. (2) Local authorities may increase the age of compulsion by by-law to fifteen. (3) Compulsory day continuation schools shall be established for all young persons, unless they are being otherwise educated, up to the age of sixteen, and after seven years from the appointed day up to the age of eighteen. (4) The minimum number of hours of attendance at continuation schools shall be 280, and after seven years 320. (5) No child under twelve shall be employed. (6) No child between twelve and fourteen shall be employed for more than two hours on any Sunday, or on any school day before the close of school hours, or on any day before 6 a.m. or after 8 p.m. Exceptions may be made by by-law, provided that no child may be employed for more than one hour before school, and if so employed, for more than one hour in the afternoon. (7) Local authorities may make provision for the supply or maintenance of holiday or school camps, centres for physical training, school baths, swimming baths, and other facilities for social and physical training. (8) Provision is made for the medical inspection and treatment of pupils in secondary and continuation schools. (9) Local authorities may establish nursery schools for children between the ages of two and five. (10) Special schools are to be established for physically defective children. (11) Fees in public elementary schools are abolished.

REPRESENTATIVES of the various Government Departments at Washington have recently held a number of conferences to consider, in response to the numerous requests of school officials, what American schools should do to render the utmost service of which they are capable during the war emergency. The conclusions and recommendations resulting from these conferences are now published in the form of a leaflet for distribution to American teachers by the Washington Bureau of Education. So far as elementary schools are concerned, the representatives decided that there appears to be nothing in the present or prospective war emergency to justify curtailment in any respect of the sessions of these schools, or of the education of boys and girls under fourteen years of age, and nothing which should serve as an excuse for interference with the progressive development of the school system. It is suggested, however, that school activities with an educational value might be introduced, designed to connect the schools with the ideals of service and self-sacrifice actuating the American people. In the case of secondary schools it is suggested that much valuable service could be rendered by selecting and training boys to assist in meeting the need for agricultural labour. It would be helpful in industrial communities if, for secondary-school pupils above fourteen, definite courses could be introduced looking towards a co-operative half-time plan of school attendance and employment throughout the year. Boys and girls should be urged, American teachers are being told, to remain in school to the completion of the high-school course, and in increasing numbers to enter upon college and university courses, especially in technical and scientific lines, to meet the great need for trained men and women.

SOCIETIES AND ACADEMIES.

EDINBURGH.

Royal Society, July 8.—Dr. J. Horne, president, in the chair.—Dr. R. **Kidston** and Prof. W. F. **Lang**: Old Red Sandstone plants, showing structure, from the Rhynie chert bed, Aberdeenshire. Part ii. Additional notes on *Rhynia Gwynne-Vaughani,* Kidst. and Lang; *Rhynia major,* n.sp.; and *Hornea Lignieri,* n.gen. et sp. In this paper the species of Rhynia, which were included under one name in a former account, are distinguished as *R. Gwynne-Vaughani* and *R. major.* The latter plant is larger in all its parts, and lacks the adventitious branching found in *R. Gwynne-Vaughani*; but its morphology is essentially similar. Both plants are rootless and leafless. They have a subterranean rhizome with a simple stele, erect branched cylindrical shoots, and terminal sporangia. Another plant of similar organisation is named *Hornea Lignieri*, and is united with Rhynia in the family Rhynaceæ. It also had neither roots nor leaves. The subterranean rhizome was protocormus-like, and from it erect dichotomous stems arose. At the tips of some of these were developed sporangia, which differed from those of Rhynia in having a columella of sterile tissue, making the spore-sac dome-shaped.—A. G. **Ramage**: Notes on mirage observed on the Queensferry Road. Under the conditions of a strong sun and not too strong a breeze, apparent reflections of grass and passing vehicles were observed in the highly heated surface of the bitumenised road. It was necessary to stoop so as to bring the mirage phenomenon over the surface into view. Sometimes a silvery streak was observed. The author did not find the usual theory of mirage sufficient, and suggested the reflection from a swarm of small particles as a *vera causa*.—Dr. W. W. **Taylor**: (1) The rotatory commutator method of determining electric conductivity, and an improved form of MacGregor's drum. This drum is a double reversing key, reversing the current continuously so as to make it alternating through the electrolyte, and readjusting it so as to make it continuous through the galvanometer. It is well known that with the usual form of drum the apparent resistance varies with the conditions, such as the rate of rotation, and differs slightly from the value obtained by the Kohlrausch method. These defects are due to the construction of the drum, and by a simple modification the defects have been overcome. (2) The solubility of "insoluble salts" and of silver oxide. There are large discrepancies between the solubility of these substances as determined by chemical analysis and physical methods, the latter depending on the determination of the concentration of an ion. The chemical methods give always the greater values, owing to the presence of "sols" of the substance in addition to the true solution. In the case of silver oxide a yellow-brown solution was on one occasion obtained; yet its total amount was less than in a similarly prepared colourless solution. In like manner, the increased solubility of insoluble salts in presence of substances like starch is to be attributed to the protection of the sol by the emulsoid, and not to adsorption at the interface. (3) The electric conductivity of sols. A series of determinations of the electric conductivity of Kohlschütter's silver sol led to the conclusion that the small limiting conductivity is dependent on the electrolyte "impurity" derived from the substances employed in the preparation of the sol. (4) The titration acidity of urine. The estimation of the acidity of urine by titration with alkali and phenolphthaleins: potassium oxalate is added "to remove the calcium which interferes with the end-point." Experiments show that the end-point is the same in the absence of the oxalate, though perhaps it is not quite so easily fixed. The addition of neutral calcium chloride is found to increase the acidity to a certain definite extent, and this increased acidity is removed by neutral potassium oxalate. It has not yet been ascertained to what constituent of the urine this is due.—R. A. **Fisher**: The correlation of relatives on the supposition of Mendelian inheritance. The general conclusions of this mathematical investigation are:—(1) The facts of biometry do not contradict, but in many cases positively support, the theory of cumulative Mendelian factors; (2) if the theory is correct, a sufficient knowledge of the correlation coefficients for any one feature, between different pairs of relatives, would enable us to analyse completely and estimate numerically the percentage due to heritable factors; (3) a provisional examination of the existing data shows it to be quite unlikely that more than 5 per cent. of the variance of the physical measurements of man is due to non-heritable causes.

PARIS.

Academy of Sciences, July 22.—M. P. Painlevé in the chair.—G. **Bigourdan**: The observatory of the Luxembourg. An account of Delisle's work and instruments, 1712–15 and 1722–25.—H. **Douvillé**: Are the foraminifera unicellular? From the evidence given it appears that certain foraminifera are in the first phases of their quadri- or bi-cellular development.—E. **Leclainche**: Serotherapy in gas gangrene. Historical account of the use of polyvalent sera against gas gangrene in France.—W. W. Campbell was elected a correspondant for the section of astronomy in succession to the late Dr. Auwers, and G. Lecointe a correspondant for the section of geography and navigation in succession to the late Dr. Helmert.—R. **Jonckheere**: Discovery of the periodic comet of Max Wolf. This was found at Greenwich on July 9 as a small nebulosity about 9″ diameter and of the 15th or 16th magnitude. The difference between the calculated and actual positions of the comet was much greater than was the case with previous appearances.—J. **Renaud**: Deep ports on French ocean and Channel coasts. Approaches to ports should be at least twelve metres deep at low water. Positions satisfying this condition are rare on the French coasts, but exist at Brest, Pallice, and Cherbourg.—P. **Girault**: A particular case of distribution of the current between transformer coils coupled in parallel.—L. **Tschugaeff**: The acid function of osmium tetroxide. Osmium tetroxide gives a series of well-defined compounds with the hydroxides of potassium, rubidium, and cæsium of the general formula $2MOH.OsO_4$. This is in opposition to the current view that osmium tetroxide is devoid of acid properties.—A. **Valeur**: A new volatile alkaloid from the broom. This was isolated from the mother-liquors from the recrystallisation of commercial sparteine sulphate. The name "genisteine" is proposed for the new base, and methods of separating it from sparteine are described. Its composition is $C_{16}H_{28}N_2$, and the properties of its hydrate, picrate, chloroplatinate, and chloroaurate are given.—M. **Stéphanidès**: Greek fire or the "liquid fire" of the Byzantines. The view is put forward that Greek fire was a crude petroleum.—H. **Hubert**: Geology of the north of the Senegal.—P. **Garrigou-Lagrange**: The general movements of the atmosphere. An application of the kinematograph to the study of meteorological charts.—F. **Maignon**: Comparative study of the influence of carbohydrates and fats on the nutritive power of alimentary proteids. Experiments on white rats show that albumin is better utilised with fat than with starch. It follows from these experiments that fats play an important part in the utilisation of proteid materials.—J. **Legendre**: The biology of *Eleotris goboides*.—V. **Galippe**: New researches on the presence of living elements in normal muscular tissue (normal parasitism and microbiosis).

WASHINGTON, D.C.

National Academy of Sciences (Proceedings, vol. iv., No. 1), January, 1918.—H. P. **Armsby**, J. A. **Fries**, and Winfred W. **Braman**: The basal katabolism of cattle and other species. The results show that the basal katabolism of different species is substantially proportional to their body-surface.—F. H. **Seares**, A. van **Maanen**, and F. **Ellerman**: The location of the sun's magnetic axis. In extension of the work of George E. Hale, a large number of observations were undertaken to determine the position of the sun's magnetic axis, which is found to lie near the axis of rotation at an inclination of about 6°, and to revolve about the axis of rotation in about thirty-two days.—J. T. **Tate** and P. D. **Foote**: Resonance and ionisation potentials for electrons in cadmium, zinc, and potassium vapours. The results agree within the limits of experimental error with the values as calculated from the quantum relation $h\nu = eV$, where ν is the frequency of the single radiation in the case of resonance potentials or the limiting frequency of the series of radiations in the case of ionisation potentials.—E. H. **Hall**: The validity of the equation $P = dv/dT$ in thermo-electricity. The equation is known to be unverified experimentally. The author gives a brief, critical discussion of the validity of some theoretical proofs by which the equation has been deduced.—C. **Barus**: The equations of the rectangular interferometer. A discussion under the headings of: Auxiliary Mirror, Rotating Doublet, Ocular Micrometer, and Collimator Micrometer.—S. **Hatai**: The brain-weight in relation to the body-length, and also the partition of non-protein nitrogen in the brain of the grey snapper (*Neomaenis griseus*).—F. G. **Pease**: The rotation and radial velocity of the central part of the Andromeda nebula. The radial velocity −316 km. is found. The change of rotational velocity with distance from the centre seems to be linear.

(Proceedings, vol. iv., No. 2), February, 1918.—G. N. **Lewis**, E. D. **Eastman**, and W. H. **Rodebush**: The heat capacity of electro-positive metals and the thermal energy of free electrons. The experiments go to indicate that in the metals considered the difference between the heat capacity observed and that calculated may be regarded as representing the actual heat capacity of the more loosely bound electrons in these metals.—E. H. **Hall**: Thermo-electric diagrams on the P-V-plane. An analysis of the electromotive force of a thermo-electric circuit on the assumption that the "free" electrons within the metals are the only ones moving progressively in the maintenance of a current, and the only ones taking part in thermo-electric action.—G. **Stromberg**: A determination of the solar motion and the stream motion based on radial velocities and absolute magnitudes. The stream motion is probably a local effect caused by a preferential motion of the stars in both directions around the centre of the stellar system. There appears to be a tendency towards smaller values of the declination of the sun's apex for the intrinsically faint stars.—L. R. **Jones**: Disease resistance in cabbage. In every case the selected head-strains transmitted in considerable degree their resistant qualities, and certain of them did so in high degree. A discussion of the results in their general significance is also given.—L. **Page**: Is a moving star retarded by the reaction of its own radiation? An extended analysis of the forces acting upon the electron leads to the conclusion that the moving electron, and hence any moving matter, suffers no retardation through its motion.—S. J. **Barnett**: Electromagnetic induction and relative motion. II. The experiments appear to support the hypothesis for the existence of the æther, and to be inconsistent with the principle of relativity.

(Proceedings, vol. iv., No. 3), March, 1918.—F. **Payne**: The effect of artificial selection on bristle number in *Drosophila ampelophila* and its interpretation. There are at least two factors for extra bristle number, one of them located in the first and one in the third chromosome.—A. W. L. **Bray**: The reactions of the melanophores of Amiurus to light and to adrenaline. The melanophores in the skin of the Amiurus react to direct stimulation by adrenaline, and are subject to nervous control mediated through the eye.—J. **Loeb**: Further experiments on the sex of parthenogenetic frogs. The frogs produced by artificial parthenogenesis can develop into adults of full size and entirely normal character.—E. **Dershem**: The resolving powers of X-ray spectrometers and the tungsten X-ray spectrum. The theory of resolving power is given with the results of experiments on tungsten, in which the endeavour was made to obtain as high a resolving power as possible.—C. **Barus** and M. **Barus**: Note on methods of observing potential differences induced by the earth's magnetic field in an insulated moving wire. A simple apparatus is described, and an elementary estimate first given. The apparatus was then modified, producing intensification, and new observations were made.—C. D. **Perrine**: Dependence of the spectral relation of double stars upon distance. There is an indication that some external cause is operating in more or less definite regions of our stellar system upon the conditions which produce spectral class.—C. D. **Perrine**: Hypothesis to account for the spectral conditions of the stars. The spectral condition of a star depends chiefly upon its size and mass, and the external conditions of density of cosmical matter and relative velocities of star and matter.

BOOKS RECEIVED.

Australasian Antarctic Expedition, 1911–14. Scientific Reports. Series C. Zoology and Botany. Vol. v., Part 2. Brachyura. By M. J. Rathbun. Vol. v., Part 3. Copepoda. By Dr. G. S. Brady. Vol. v., Part 4. Cladocera and Halocypridæ. By Dr. G. S. Brady. (Sydney: W. A. Gullick.) 1*s*. each.

Ingots and Ingot Moulds. By A. W. and H. Brearley. Pp. xv+218. (London: Longmans and Co.) 16*s*. net.

CONTENTS.

Editorial and Publishing Offices:

MACMILLAN AND CO., LTD.,

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

Advertisements and business letters to be addressed to the Publishers.

Editorial Communications to the Editor.

Telegraphic Address: PHUSIS, LONDON.

Telephone Number: GERRARD 8830.