THURSDAY, SEPTEMBER 20, 1917.

THE PUBLIC SCHOOLS AND NATIONAL SUPREMACY.

The Public-School System in relation to the Coming Conflict for National Supremacy. By V. Seymour Bryant. Pp. xviii+78. (London: Longmans, Green, and Co., 1917.) Price 1*s.* 6*d.* net.

THE author has done useful service in writing this little volume. It contains a large amount of valuable information, while, of course, it raises a host of controversial points. His statement in the preface that "in the struggle for national supremacy education is the vital factor" will be disputed by few. It is when he comes to laying down the lines on which a reformed curriculum for both the preparatory and the public schools should be constructed that the whole of the forces of conservatism represented by the existing system will unite in a stubborn resistance.

A point Mr. Bryant makes early in the introduction consists in directing attention to the fact, familiar enough to those conversant with the educational world, though generally unappreciated by the public, that the headmasters of our great public schools are, practically without exception, classical scholars. Of the 114 schools represented in the Headmasters' Conference, ninety-two have classical headmasters, ten mathematical, seven jointly mathematical and scientific, four scientific, and one historical. And from the published numbers of boys in the schools 82 per cent. are under classical domination, while only 7½ per cent. are in schools where the head has any academic qualifications in science whatever.

This fact alone is sufficient to explain most of the difficulties encountered in all attempts to obtain more time and attention for natural science studies.

Every Englishman is proud to acknowledge the splendid spirit shown by all the public schools and their boys in connection with the war. It may be true that this is attributable to the conditions of life in the public schools, which favour the development of fine character. The amount of direct evidence for this conclusion is, however, very small, and it may be asked whether, after all, it is not something deep down in the English nature which is the real explanation of these things. Otherwise, how do we account for all the V.C.'s and other distinctions which rightly decorate so many of our brave fellows who have not had the advantage of a public-school education? The fact is sufficient that the boys from the public schools have made a fine show and have quitted themselves like men. But this does not abolish the other fact that the great majority of them when they leave school are very ignorant. How many can speak any language but their own? How many are really familiar with the great classics in their mother tongue? How many clergymen, whose office it is to search the Scriptures daily, are capable of studying the Gospels in the original Greek? Our Ministers and heads of Government departments have been almost to a man trained in the great public schools, but this has not saved them from the grossest kind of mistake in referring to common materials and processes of manufacture.

The public-school system of to-day, which is so largely due to Dr. Arnold at Rugby, owes all its best results to the principle of self-government by the boys themselves. The teaching in every subject and in every respect has improved since his time, but is still open to serious criticism. John Stuart Mill states somewhere that "the source of everything respectable in man is that his errors are corrigible," and that is all that can be said of the teaching in the public schools at this day. It is the prejudice of the headmasters and of the literary members of the staff which in most cases prevents that complete recasting of the time-table which alone will bring satisfaction to those who are interested in the use of scientific method and the sufficient teaching of natural and experimental science. Among other obstacles in the way of reform the author mentions examinations and the subordination of curricula to their requirements, the difficulty of obtaining properly qualified teachers, and the financial waste under the house system. With regard to the last point a great deal might be said. The fault lies primarily with the British parent, who is not willing to pay an adequate fee for his boy's education, but is ready to meet the charges of a comparatively expensive and unnecessarily luxurious kind of hotel. The true duties of a schoolmaster are so important that his pay and prospects ought to be both liberal and secure. But to give him a salary on which he cannot keep a wife and family in comfort and to allow him to compensate himself out of the profits of hotel-keeping is to adopt a system not far removed in principle from that of the Turkish Government, which pays no salaries, but allows extortion and pillage. W. A. T.

USEFUL MATHEMATICS.

(1) *Commercial Arithmetic and Accounts.* By A. Risdon Palmer and J. Stephenson. Part i. Pp. xvi+292+lvi. (1908.) Part ii. Pp. xii+293–514+lvii–cliv. (n.d.) (London: G. Bell and Sons, Ltd.) Price 2*s.* 6*d.* each part.

(2) *Arithmetic for Engineers, including Simple Algebra, Mensuration, Logarithms, Graphs, and the Slide Rule.* By C. B. Clapham. Pp. xii+436. (London: Chapman and Hall, Ltd., 1916.) Price 5*s.* 6*d.* net.

(3) *Practical Mathematics for Technical Students.* Part ii. By T. S. Usherwood and C. J. A. Trimble. Pp. x+565. (London: Macmillan and Co., Ltd., 1916.) Price 7*s.* 6*d.* net.

(1) "THE present treatise on commercial arithmetic and accounts has been written to meet the needs of that great and ever-increasing army of students which is receiving a thorough commercial training in our modern

schools and colleges before entering upon a business career."

Such is the claim put forward by Messrs. Palmer and Stephenson in their preface. But there is a very large other class of pupil for whom it is growing daily more and more necessary to study books of this kind. We refer to the great army of students who do *not* receive a thorough commercial training in our modern schools and who do *not* contemplate entering upon a business career.

The game of keeping boys and girls shut up in stuffy rooms memorising things that will be of no use whatever to them in actual life, simply in order that they may score marks by copying them out in an examination-room, has been carried too far in the past, and we hope that one effect of the war will be to consign to the rubbish heap a large proportion of the waste luxuries of our present academic educational systems, and to replace them by subjects better calculated to develop national efficiency. A sound and thorough training in the principles of business and finance should not be the monopoly of a privileged class of pupils who enter special courses, but should be made available, and indeed compulsory, for every boy and girl who attends a secondary school, and may then go on to the university.

The present book contains exactly the kind of arithmetic which is required by everyone who hopes to earn money or to invest it and receive the interest, and who is compelled to pay rates and taxes. Everything is of the most practical nature possible. There are, in the two parts, sixteen facsimile illustrations of such things as cheques, stock and share certificates, poor-rate demands, receipts and the like, and the only thing wanted to make the collection complete is an income-tax form, which is what probably gives the average citizen more trouble than all the rest put together. But the subject-matter is by no means limited to questions of finance. Elementary mensuration is treated in great detail and applied to doors and windows, dust-bins, flower borders, bookcases, radiators, and other articles. Contracted multiplication and division are well done, although we regret that the authors do not explain how far the processes may be carried with approximate data. The authors also make every effort to introduce into the examples statistics relating to the trade and commerce of the British Empire. Moreover, the book is written in an interesting and stimulating style. Even at the very beginning we have a brief account of the methods of counting and numeration of early history and of savage tribes. It almost makes one wish one were a modern child, so that one could be educated on such a book instead of on the old useless drudgery of algebra and Latin and Greek genders.

When the book goes into a new edition we should ask the authors carefully to consider whether it would not be useful to introduce sections dealing with logarithms and the slide rules. There is unfortunately a widespread superstition among mathematical ignoramuses that it is necessary to repeat some nonsense about indices to every pupil before teaching him the simple rule that to multiply two numbers together you simply have to add their logarithms, but, judging from the present book, Messrs. Palmer and Stephenson appear quite capable of making the subject independent of this silly prejudice.

The insistence on rough checks in arithmetical work is very important, especially in view of the tendency among examination candidates to throw away 100 marks which they might have saved by checking one question in order to scrimmage five marks by starting another. The task of gathering together such enlightening collections of examples as are here found must have been very laborious, and we are surprised not to find Government examinations enumerated among the sources from which they are drawn.

(2) All science students, and, indeed, most other people, require some kind of training in the meaning, use, formulation, evaluation, and interpretation of algebraic formulæ, and their inverse uses involving the solution of equations. This is not the same thing as the addition, subtraction, multiplication, and division of the collections of dry bones hitherto described as "algebra," for the victims of that kind of drudgery often say they never knew these things had any use or meaning. A very fair introduction to what is required may be obtained by taking Mr. Clapham's "Arithmetic for Engineers" and turning to chaps. iii., iv., and v., which deal respectively with "Symbols and their Uses," "Simple Equations," and "Transposition of Formulæ." Here, then, is another instance in which class-distinctions require to be broken down, and the mathematical instruction drawn up for engineering students thrown open to the rank and file of the pupils of our schools and colleges. For nearly twenty years the writer of this review has persistently advocated that algebra should be taught through the *use of formulae,* such as area = length × breadth, the converse use or inversion of the formula leading to the problem of solution of equations, as when the area and breadth are given and the length is the unknown quantity. Although such a method is contemplated in a recent syllabus issued by the Civil Service Commission, Mr. Clapham is the first, or nearly the first, writer to develop this very simple and obvious method consistently. His method of treatment should even suffice to dispel the doubts which a beginner might experience as to the sanity of the mathematicians who use *ab* to denote the result of multiplying, instead of adding, *a* and *b*. Not only is the notation carefully explained, but multiplication and division formulæ take precedence, both in the text and examples, over those involving addition and subtraction, and the practical illustrations show that in dealing with concrete quantities brevity is often of more use in writing products than sums.

The two previous chapters deal with "Vulgar Fractions" and "Decimal Fractions" respectively. Here, again, we are glad to see insistence placed on *rough* checks and approximations, but at the same time the author, by his objection

(p. 50) to contracted methods, leaves the door open for the perpetration of unmathematical inaccuracies in the evaluation of results from approximate data. Thus, in the example on p. 50:—

1670
2·75
8350
11690
3340
4592·50

the final ·50 are wrong, because o and two blanks do not make o, nor do 5 and o and one blank make 5. We do not know what these blanks are, and there is no justification for writing down ·50 as the result of addition of these incomplete columns. If we remember that 2·75 really may mean anything between 2·745 and 2·7549 it will readily be seen that the inaccuracies go further. Of course, if all the data are given and results required to three significant figures, the rule given on p. 50 is applicable, but a lot of superfluous figures will be written down and incorrectly added. Again, on p. 55 (Ex. 46: Divide 231·4 by 1·938) the author puts a lot of zeros at the end of the dividend and also carries down a lot of digits, although there are blank spaces requiring filling above them.

The rest of the book deals with logarithms, mensuration, the slide rule, and graphs. This is all useful and practical work, which may very well be taught to students other than engineers, perhaps with some reduction of the number of examples in mensuration. The majority of the "graphs" considered connect magnitudes of different kinds. Where this is not the case (as in equations of straight lines) we are glad to see that the author *does* represent the variables in their correct relative proportions, instead of perpetrating the distorted figures in which straight lines do not cut at the correct angle.

(3) For those who want the sort of thing that is contained in Part ii. of Messrs. Usherwood and Trimble's "Practical Mathematics," that book undoubtedly provides just the sort of thing they want. It is not the kind of book one altogether likes, and we could not recommend it to students of the academic type, except an occasional candidate reading for the B.Sc. degree in physics without taking mathematics as well. Undoubtedly vector analysis, advanced calculus and differential equations, Fourier's series, and inverted delta (∇) are required by engineering students, and if they can get all this and a little thermodynamics in a book of this size, they will not quarrel about rigorous demonstrations. The result is, however, a formidable mass of symbols and formulæ. Individually, we consider that the binomial, exponential, and hyperbolic functions should not be taught until after the elements of the calculus have been mastered; however, it is quite easy to begin at chap. vi. and take some of the earlier parts afterwards. The attempt to prove the differentiation formula for the sine savours too much of the "we see" or "we may put" of the typical narrow-minded mathematician. On the other hand, in dealing with symbolical notation, the authors make some effort to keep out of the pitfall into which Edwards plunged when he applied to inverse operations formulæ which he had proved only for direct ones. The introduction of thermodynamics in §51 enables the authors to teach some very important theorems in partial differentiation which the average academical student overlooks in his rush and hurry to satisfy the demands of the external examiner.

The examples are distinctly good, and this feature will undoubtedly appeal to teachers of pure as well as applied science.

At the end there is the usual collection of tables, with the usual superfluous duplication of logarithms and antilogarithms, squares and square roots, sines and cosines, and the usual shortcomings in the absence of tables of logarithms of reciprocals, and in the fact that the tables of squares do not give correct results when applied to the squares of integers. G. H. B.

OUR BOOKSHELF.

Steam Turbines. By J. A. Moyer. Third edition, revised and enlarged. Pp. xi+468. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1917.) Price 16*s.* 6*d.* net.

THIS book was first published in 1908; the additions made in the present edition have been mainly in the line of new applications. The book opens with some historical descriptions, followed by a brief section dealing with the elementary theory of heat, including explanations of entropy diagrams. The following chapters take up the design of nozzles and blades, and descriptions of commercial types of turbines.

The treatment of low-pressure, mixed pressure, bleeder, and marine turbines occupies separate chapters. Of these, the section dealing with the marine turbine is least satisfactory; the author's bias towards certain types is apparent here and elsewhere in the volume. Thus no mention is made of the Ljungström turbine, despite its importance, and in the marine section justice is not done to types of reduction gear other than the Westinghouse floating-frame type. Hydraulic transmission is not mentioned, and electrical transmission is dismissed in a few inadequate lines. There is a chapter on steam turbine economics giving information on cost of plant, maintenance and running; this information is of interest and is frequently omitted in British textbooks. Other chapters deal with stresses in rings, drums, etc., and include a few words on the critical speeds of loaded shafts. In describing testing arrangements, power is to be measured by Prony or water brake, or by electrical appliances; shaft-horse-power of marine turbines and its measurement by torsion-meter are not treated. Another chapter gives some information regarding the gas turbine, and might well have been omitted.

The volume has been used as a text-book in the United States, but we do not think that there is any danger of its displacing British text-books in our own colleges. An appendix contains some exercises to be worked by the student, and there are others interpolated in the text and not always easy to find.

Handbook for Rangers and Woodsmen. By J. L. B. Taylor. Pp. ix+420. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1917.) Price 11*s.* 6*d.* net.

THIS is a handbook of pocket size, primarily intended as a vade-mecum on all subjects that may turn up in the course of the multifarious activities of the forest ranger or woodsman in the United States. It contains much information that is only indirectly connected with forestry, and will be useful to travellers and settlers generally in the wilder parts of North America.

The first part, entitled "Equipment," deals with clothing, harness, and provisions. The next part is a guide to the construction of telephone lines, paths, roads, bridges, buildings, and fences, and treats, in addition, of blasting, concrete work, painting, and carpentry. The part called "General Field Work" begins with riding, pack animals, and waggons, and concludes with useful notes on felling timber, fighting forest fires, land-surveying, and field cooking. The next part is concerned with the care of horses, cattle, sheep, and swine, and gives an interesting description of the various methods of identification of stock by branding, ear-marks, etc., and of the curious dodges resorted to by cattle-thieves. Another part deals mainly with human ailments and injuries, reptiles, camp sites, and finding one's way. It is here stated that two species of ant in Arizona and New Mexico throw up mounds, and in nearly every instance leave an opening at the south-east side, presumably in order that the morning sun may warm the runway sooner.

The appendix contains many useful lists and tables, and concludes with a glossary of peculiar words in use in the Far West. The book is clearly printed on strong thin paper, and is illustrated with 243 appropriate figures and diagrams.

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 Audibility of Distant Gunfire.

THE sound of gunfire from northern France might be expected to be audible in Cambridge, for on the occasion of Queen Victoria's funeral the firing at Portsmouth was clearly heard in this neighbourhood, and even further north, near Peterborough, and the distance from the battlefield is not much greater than that from Portsmouth. But I did not become aware of the sound until one day early in May last, when several volleys of guns were audible about midday. The sound was unmistakable for me, as I had heard the Queen Victoria funeral guns at a distance of sixty miles (in Surrey), and thus recognised the phenomenon at once. These particular volleys may have come from a little skirmish at sea, or even from gun practice at Shoeburyness, for I heard no more for several days. However, they led me to listen carefully, and on the very still nights at the end of May I began to hear the gunfire from the battlefield. It was audible only on the south-east side of my house, and there chiefly in a re-entrant angle of the walls.

I soon found (at the beginning of June) that the sound was astonishingly intensified in a garden latrine, which acted as a resonator like Mr. Carus-Wilson's garage (NATURE, September 6, p. 6), although it is but a tiny building, and differs in being built of brick and having a slate roof. Here the explosions were nearly as loud and frequent as I afterwards heard them in Kent. I compared the intensity of the sounds as heard at different windows of my house, and found it greatest at the basement, but only on the south-east side of the house. I could not detect the sounds in a north-east basement room, so apparently the vibrations did not come through the earth. During June and July the explosions became ever more audible, until about July 29 they were evident even indoors at midday, above the murmur of distant traffic. Since the middle of August they have become less distinct and fewer, and now I can hear either none, or perhaps a few faint booms now and then. The sounds have been heard by other persons in and around Cambridge, especially in the villages, and I am informed that they have been detected so far north as Downham Market, in Norfolk.

In July I spent a few days in Kent, visiting in quick succession Rochester, Maidstone, Ashford, Lydd, Tenterden, and Tunbridge Wells. I was unable to detect the sounds at Lydd. They were faint at Ashford and Tenterden, clear at Maidstone, more so at Rochester, and especially distinct at Tunbridge Wells, where they were audible through all street traffic. The spot where the sounds were most intense was the rocky combe at Rusthall, where the hollow, bounded by more or less perpendicular escarpments of rock, acted as a potent resonator.

It is notable that Lydd is on the plain near the sea, Maidstone, Ashford, and Tenterden on the undulating Weald, and Rochester on a north-west slope of the Downs; also that the Tunbridge Wells valley descends to the west, and the Rusthall valley to the north-west. Thus in those places where the sounds were most distinct the vibrations had travelled over high ground and arrived in a descending direction. There was no doubt as to the direction whence the sounds came. Wherever the sounds were audible on open ground, in Kent or in Cambridgeshire, one could discern that they came from the south-eastern horizon, and through the air.

F. J. ALLEN.

Cambridge, September 15.

Unusual Rainbows.

WITH reference to my letter in NATURE of August 30 on the subject of "An Unusual Rainbow," and to the replies which were given on September 6, I should like to mention that the sun's altitude and the angle at which the primary bow met the reflected bow were only rough estimations. At the time when the phenomenon was visible I had unfortunately no instruments at hand. Since then I have calculated the altitude of the sun from a knowledge of the ship's position and the sun's declination and hour angle, and have found it to be about 8° 5′. This gives the angle of intersection of the bows as $24\frac{1}{4}^{\circ}$ approximately, which is more in agreement with my estimation. The surface

of the sea was remarkably calm at the time, and this no doubt accounts for the brilliancy of the bows, which are due to the reflected image of the sun.

I wish to thank the readers of NATURE who have given explanations of the phenomenon, and to say that these explanations have been much appreciated by my brother officers and myself. ALLAN J. LOW.

September 10.

The Convolvulus Hawk-Moth.

AN unusual number of the convolvulus hawk-moth has been noticed in this neighbourhood during the last month, and I venture to ask if a similar occurrence has come to light in other localities. The record, which is by no means exhaustive, extends chiefly some thirty miles along the coast, though some specimens have been captured twenty miles inland. It would be of interest to know whether this is an immigration from overseas or whether any of your entomological readers can advance a reason for their appearance.

C. E. ROBSON.

Hancock Museum, Barras Bridge,
Newcastle-upon-Tyne, September 14.

EXAMINATIONS IN SECONDARY SCHOOLS.

THE valuable Report published in 1911 of the Consultative Committee, of which the Right Hon. A. H. D. Acland was chairman, appointed by the Board of Education to consider the subject of examinations in secondary schools has borne tentative fruit in a series of regulations set forth in a circular of the Board, No. 996, dated May 25. This has now been given practical effect in the appointment of a Secondary-School Examinations Council, with the Rev. Wm. Temple, formerly headmaster of Repton School, as chairman (see p. 58). The council is comprised of representatives of the universities, of the Teachers' Registration Council, of the Association of Education Committees, of the various examination boards, and of the County Councils and Municipal Corporations Associations, but it contains no names *directly* representative of either boys' or girls' secondary schools, or of the Associations of Headmasters and Headmistresses concerned with them, or that of a single headmaster. This fact tends to deprive the Examinations Council of much weight, and of that direct personal association with the problems of secondary-school life which the occasion demands; and it would have been desirable also to include, especially in the present changed outlook and temper of employers, representatives of the great industrial organisations of the country. For some unexplained reasons the provision for nomination by a standing committee of professional bodies has been withdrawn after consultation with them.

It may be remembered that the report of the Consultative Committee reviewed in detail the origin and development of the multiplicity of external examinations of which the secondary schools in England are the subject, including the examinations of such bodies as the College of Preceptors, the Oxford Delegacy, the Cambridge Syndicate, the Public Services, the London and Provincial Universities, and the numerous professions which demand special entrance examinations. It discussed the evil effects of all these diverse examinations on the work and *moral* of the secondary schools, preventing them from realising their true purpose, and instituting aims other than those of the efficient education and training of their pupils. It showed how, for example, the universities and the professions are to some extent defeating their own ends by their demands upon the schools and by their conflicting requirements, reducing the time available for methodical instruction and training, and leading to too early technical training, which lowers the value of the finished product of the school as a whole. Striking figures were given showing the number of pupils who passed to the universities from 371 secondary schools the subject of full inspection by the Board during the school years 1907-8 and 1908-9. Out of 14,789 pupils who left these schools during those two years, only 400 went to the universities, or 2·7 per cent.

A full consideration of all aspects of the question led the committee to the conclusion that, whilst external examinations were necessary and desirable in secondary schools, they must be brought under better regulations, reduced very largely in number, and intimately connected with a well-considered and adaptable scheme of inspection, so as to ensure a sound basis of liberal education free from specialisation. The report suggested that an examination should be instituted for the award of a secondary-school certificate, with due regard to the pupil's school record, open to candidates who have reached a class the average age of which is sixteen, and who have been in attendance at a secondary school for at least three years, and that the only other external examination should be one suitable to the attainments, general and special, of pupils of an average age of eighteen or nineteen in respect of whom a secondary-school higher certificate would be awarded.

These examinations, closely linked with inspection, it was suggested, should be organised by the Board of Education acting through an Examinations Council, which would include representatives of the universities, the professions, the local authorities, the teachers in different types of schools, and other persons with practical experience of industrial and commercial life, as well as of the official experience of the Board itself. It should be entrusted with the necessary powers to carry out the main principles laid down in the report.

In the concluding sentence of the report reference was made to the fact that seven years previously to its issue in 1911, namely, in 1904, this subject of the examinations in secondary schools had been referred to a like Consultative Committee and recommendations made, the main proposals of which were never embodied in practical action, and the committee plaintively urged that it could not contemplate the recurrence of such an unsatisfactory state of things, and

trusted that the Board would see that the necessary reforms were carried out; yet nearly six years have elapsed since this second report was published before anything in the nature of effective measures is taken, due, doubtless, to the energy and enterprise which Mr. Fisher is bringing to his arduous task. It is true that in July, 1914, a circular was issued, No. 849, giving effect to many of the recommendations of the Consultative Committee and inviting criticism and suggestions thereon, but leaving the important matter of finance undecided. The Board, however, announced in a later circular, No. 933, issued in December, 1915, that, in view of the situation caused by the war, its proposals embodied in Circular 849, in so far as they would involve expenditure by the Board, must remain in abeyance, which meant the virtual withdrawal of the proposals for reform.

Recently, however, under the ægis of the present President of the Board of Education, we have the issue of Circular 996, in which the Board definitely stated that it would bring into actual operation, with due financial arrangements, its scheme of July, 1914, Circular 894, on August 1, and that from that date the Board would undertake the functions and responsibilities of a co-ordinating authority for secondary-school examinations with the assistance of a body of persons to be called "The Secondary-School Examinations Council." The circular stated that the council would be comprised of nine representatives of the various university examining boards, four of the local authorities, four of the Teachers' Registration Council, and one of the standing committee which, it was proposed, should be formed from the various professional bodies, with a suggestion that the number might be increased by representatives of other standing committees, such as the chambers of commerce, interested in the council's work. The Board itself will be represented at the council meetings by such of its officers as it may choose to appoint to attend as assessors, who will have the right to speak, but not to vote.

This circular marks an important step in the endeavour to bring order into the chaos which now besets and gravely hinders the work of the secondary school in respect of the numerous and often conflicting external examinations to which its pupils are subject in the endeavour to proceed to the further studies for which it is the necessary preparation, and in so far as it succeeds in this it is a step to be commended. It is now generally accepted by those competent to judge and by all but interested persons and bodies that the proper work of the secondary school is to promote upon the basis of liberal studies the formation of character, the development of the imagination, and the due training of the intellectual faculties. The new Advisory Council does not appoint its own chairman, who is the nominee of the Board. Clauses 7 and 8 define the responsibilities and functions of the council, and give power to the officers of the Board who attend its meetings to require when they think fit that questions of principle or policy shall be referred to the Board.

The importance of this Advisory Council would appear to indicate that the representation of the universities should have been direct and not through the medium of their examination boards, and it would appear that neither in the case of the professional bodies concerned nor in that of the teachers is the representation adequate to the important interests involved. Surely so grave and dignified a body should have been left free to nominate its own chairman with the approval of the Board. The constitution of the new committee would appear to make it largely subservient to the Board and to deprive it of that independent character which the importance of its responsibilities demands.

It is surely worthy of consideration whether the time has not arrived with regard to the secondary schools, of which more than 1000 are approved as efficient by the Board, for a further step to be taken, thoroughly safeguarded by a sound and effective system of inspection, which would have the important effect of tending to extend the school life, now lamentably low, and raising the quality of the instruction. We refer to the introduction of the principle, first, that the school should be recognised by the university within the area of which it is situated as fully complying with a recognised standard as to its staffing, equipment, and the duration and quality of its courses of study; and, secondly, that the scholars passing satisfactorily through its courses year by year shall at the close of the final year be entitled to a certificate and be qualified to proceed to higher and more specialised studies in any university of the United Kingdom in any of its faculties, and shall also be eligible for entrance to the examinations leading up to membership of the various professional bodies and societies.

LOCUSTS.[1]

THE International Institute of Agriculture, Rome, has issued a memoir summarising published and communicated information relating to locusts; this has been compiled by Prof. Trinchieri, not only from literature, but also from information obtained by direct inquiry from countries adhering to the institute. The memoir will be valuable to all who have to do with fighting locusts, and the information collected is put in a form readily accessible and easily consulted. One criticism is possible, and it is one important to working entomologists: the term "sauterelles," or "locusts," has not been clearly defined to mean species that have the habit of migrating in swarms only; and while some countries have included non-swarming "grasshoppers" (*e.g.* all the Phasgonuridæ), others have deliberately omitted all but the real "swarm-migrating" locusts. There are probably not more than six-

[1] "La Lutte contre les Sauterelles dans les divers Pays." (Rome Institut International d'Agriculture, 1916.)

teen species of "locust" on the earth, but the memoir lists 112 of the family Acridiidæ (called Locustidæ). Allowing for this, the memoir provides an excellent summary of habits, life-histories, remedies, and international co-operation.

It is curious that human ingenuity has not succeeded in controlling locusts, or even in understanding why an insect, normally widespread in small numbers, becomes enormously abundant, packs into swarms, and migrates over really enormous distances. One reason is that no single observer in his lifetime can get a long enough experience to be able to estimate the value of the different factors that govern these outbreaks; they are probably so diverse that a very minute knowledge of local conditions is required, and in any one locality there may not be sufficient outbreaks during a single working lifetime. So we still know very little of the conditions producing outbreaks, or the means of anticipating them and preparing for them. The methods in use are most diverse and as a rule extremely simple. In India troops have been turned out to fire volleys of blank cartridge to divert a swarm; while in Morocco cultures of *Coccobacillus acridiorum* have been used with success. These two represent the extremes of simplicity and of scientific achievement; but a perusal of this memoir shows that the locust problem still remains and looks like doing so. As the author says, "Il existe toujours une question des sauterelles," and in the main the pest must be fought in every country with simple, homely methods devised to suit the local circumstances: the arsenic-treacle method succeeds in South Africa, but not in India; the method of "mopping up" hoppers in Bombay with a bamboo frame and bag is useless elsewhere; and there is no one method that stands out definitely as likely to be valuable.

To the economic entomologist, who is probably a member of an agricultural department, locusts present a serious problem, calling for whatever ingenuity he possesses. In 1903 there broke out in Bombay a plague of locusts of unknown habits, which actually flew about for eight months before laying eggs, and then suddenly the entomologist was called on for a means of dealing with hoppers about to hatch from eggs laid over 150,000 square miles of country. Such occasions are crises in the life of the entomologist, and we commend Prof. Trinchieri's summary as a welcome source of inspiration when faced with an outbreak.

In his last section the author discusses shortly the value of international co-operation, a matter that has been prominent since the Phytopathological Conference was held in Rome. Sixteen countries have answered in the affirmative the institute's query as to their willingness to co-operate against locusts. The value of such co-operation lies in the intelligence mutually given as to the occurrence of locusts, and this would be most valuable. It is useless discussing this at present. Locusts do not respect international boundaries or join the Entente; but it is a part of the valuable work done by the institute that we should have these memoirs and be prepared for international co-operation when other circumstances render it possible. H. M.-L.

BIRD MIGRATION IN CENTRAL SWITZERLAND IN RELATION TO METEOROLOGICAL CONDITIONS.[1]

THE relation of bird migration to meteorological conditions has been considered, of late years, an important part of the study of the movements of birds, and various theories have been advanced to explain their interrelations. In the memoir before us Dr. Bretscher deals very fully with the arrival in spring and departure in autumn of the summer visitors to Central Switzerland. In relation to these he treats of bird migration and atmospheric pressure, wind, atmospheric precipitation, temperature, etc., and under each heading he has tables of statistics in support of the statements in the text. By tables 1 and 15 he shows that the position of barometric depressions within the area has, as we should expect, no influence on the arrival of the summer migrants and their departure in autumn. In tables 3 and 4 he discusses the influence of direction and strength of the wind, and concludes that, in Central Switzerland, migration proceeds irrespective of the direction of the wind, and that, unless the force be so great as to be a hindrance, the influence of this, too, may be regarded as a negligible quantity. The fourth section deals with atmospheric precipitation in relation to bird migration; as the author tells us in Switzerland even keen ornithologists stay at home in wet weather, we are not surprised to find that they have few direct records of migration in rain, snow, or fog, and he himself says, further observations on this subject are wanted.

What strikes one as being the most interesting of any of the sections are those on spring and autumn migration in relation to temperature. Dr. Bretscher gives many interesting tables showing the number of observations on the movements of each species under each degree of temperature Centigrade. These indicate the maximum and minimum between which migration takes place, the gradual increase to the most favourable migration temperature, and the decrease after this is reached. Here we see that birds migrate between certain temperatures, which vary according to the species; thus, the blackbird and song-thrush perform their migrations at a lower temperature than the insect-eating warblers. Another aspect is presented on table 9, namely, the duration of the migration period in relation to the average temperature, and the author here comes to the conclusion that the two are not correlated; thus the warmest average temperature does not necessarily coincide with the shortest

[1] "Der Vogelzug im schweizerischen Mittelland in seinem Zusammenhang mit den Witterungsverhältnissen." Von Dr. K. Bretscher. Nouveaux mémoires de la Société Helvétique des Sciences naturelles, vol. li., mém. 2.

migration period, nor does a cold spell mean a lengthening of the time over which the migration extends. Table 10 shows the difference of temperature of the migration day and that directly preceding it, and purports to prove that it is the temperature of the moment, not that which went before, which incites birds to migrate. It seems, however, as if the author had somewhat confused the issue; it cannot be the temperature at the point of arrival which incites the bird to begin its migration in spring. After this we have the various migration dates compared for Switzerland, Hungary, Bavaria, and Württemberg, though as the last has only three entries we think it might have been omitted.

In conclusion, the author indicates his conviction, which is probably shared by most ornithologists, that the real incentive to migration is not to be found in outward circumstances, but must be sought in physiological conditions. The outward conditions, including food, do undoubtedly have some effect upon it, but do not produce the necessary impulse. Though there is perhaps nothing startlingly new in this pamphlet, yet it is a welcome addition to the literature relating to migration; it shows much careful work, and the fact that Dr. Bretscher refrains from drawing more than very tentative conclusions adds to, rather than detracts from, its value. He realises that it is not possible to come to any definite solution of the problem he is studying without observations—and, we would add, meteorological data—made over a much wider field. W. E. C.

CONTRIBUTIONS TO EMBRYOLOGY.[1]

NO money given by Mr. Carnegie for the furtherance of scientific research is likely to yield better interest than that invested in the Department of Embryology in the Carnegie Institution of Washington, D.C. The nucleus of the department was formed by the collection of human embryos assembled by Prof. Mall when he held the chair of anatomy in Johns Hopkins University, Baltimore. It took Prof. Mall ten years to collect his first hundred specimens; five years to collect the second hundred; three years for the third; and two years for the fourth hundred. Since his collection was taken over by the Carnegie Institution four hundred specimens have been gathered each year. The collection of material is now the most extensive and the equipment the best of any embryological department in the world. Specimens are being gathered from all parts for the study of "racial embryology"—an untouched field of research. New technical procedures are being introduced to enable workers to reconstruct the different parts of the embryo with much greater accuracy than had been previously possible.

The two volumes here noticed contain an account of recent researches carried out by workers attached to the department of which Prof. Mall is the director. The director himself contributes two papers—one on the origin of the "magma reticule," which is present in normal embryos, but is particularly abundant, as Giacomini had noted, in pathological human embryos. His second paper is a description of the condition of cyclops as seen in early stages of human development. Mr. R. S. Cunningham describes the development of lymphatics in the lung—a paper which is interesting not only from a theoretical, but also from a practical point of view. Dr. Florence Sabin gives an account of a prolonged series of investigations concerning the origin of blood-vessels, and reaches some unexpected conclusions regarding the earliest blood channels which appear in the head and brain. Certain channels which at first serve as veins appear afterwards to be converted into arteries.

All the papers represent a high grade of workmanship, and no pains or expense have been spared to obtain accuracy and finish of illustration.

A. K.

[1] "Contributions to Embryology." Vols. iv. and vi. (Carnegie Institution of Washington, 1916-17.)

NOTES.

THE succession of M. Painlevé to the Premiership of the French Government ought, even in this country, to excite the interest and friendly sympathy of the scientific world. The new Premier is a member of the Paris Academy of Sciences, and a mathematician of world-wide reputation; besides contributing to the literature of his subject, he has held, until quite lately, two of the most important mathematical chairs in France. To construct a similar case in our own country, we should have to suppose our Prime Minister to be a man like the late H. J. S. Smith, or Sir William Ramsay; could anything more improbable be thought of? Yet the evidence is steadily growing that men of the so-called professorial type may show themselves eminently capable of directing public affairs; President Wilson is a conspicuous example, and as time goes on the number of such cases is certain to increase. We feel that, on behalf of English men of science, we may congratulate, not only M. Painlevé, but even France herself, on this appointment; and we confidently hope that the sequel will justify it, and help to make average citizens understand the value, in *all* national affairs, of a strictly scientific habit of mind.

UNDER the heading of "New German Chemical Discoveries," the *Times* of September 14 quotes from the *Neue Zürcher Zeitung* a review of German activities in technical matters in the field of war economics. It is stated that by the use of liquid sulphur dioxide viscous golden-yellow mineral oils are being extracted from coal; the yield, however, is small, 5 kilos. per metric ton. This is equivalent to about 1¼ gallons per imperial ton, and is a striking commentary on the shortage of such oils in Germany. The refining of petroleum oils by this solvent had already been placed upon a commercial footing under the Edeleanu patents, but the outbreak of the war interrupted the development of the process, which depends on the preferential solvent action of the liquefied gas on certain classes of hydrocarbons and sulphur compounds, enabling the removal of those which give rise to a smoky flame, together with the objectionable sulphur compounds. In a series of Howard lectures (Roy. Soc. Arts, 1916) Prof. Brame suggested the use of this solvent as being the most promising for the extraction of certain constituents of coal in future investigations; it is therefore of some interest to find that commercial application of liquid sulphur dioxide is now yielding these hydro-

carbon oils. A further quotation refers to the production of liquid hydrocarbons from naphthalene by heating under pressure with aluminium chloride. There is little novelty in this, for aluminium chloride has been very largely resorted to in the chemistry of hydrocarbon oils. It is stated also that a process has been discovered by which nearly twice the usual amount of ozokerite can be obtained from lignite distillation, but no indication of the method is given.

THE Deputy-Controller for Auxiliary Shipbuilding, Admiralty, has appointed Lt.-Col. J. Mitchell Moncrieff to be Director of Engineering Work, to deal generally with all civil engineering matters which may arise in connection with his department.

THE Board of Agriculture and Fisheries directs the attention of English nurserymen and other persons to the regulations issued by the Government of the Dominion of Canada which prohibit the importation of all five-leaved species of the genus Pinus, and also all species and varieties of currants and gooseberries into Canada. The importation of all pines and ribes (currants and gooseberries) into the United States of America has already been prohibited.

THE American Museum of Natural History has received a telegram from Mr. Donald B. MacMillan, leader of the Crocker Land Expedition, in which he gives an account of the latest discoveries made by his party. He defines the position of two new islands, and reports important surveys of the coast of Ellesmere Land. Two islands described by earlier expeditions cannot now be found in the positions marked on the charts. There has been discovered an enormous glacier, second only in size to the Humboldt. Mr. MacMillan has named it the American Museum Glacier.

THE seventieth birthday of Prof. S. Hoogewerff, formerly rector of the Technical High School of Delft, was recently celebrated by his friends and pupils. Prof. Holleman briefly reviewed Hoogewerff's work, carried out conjointly with the late Dr. Van Dorp, on the cinchona alkaloids, on *iso*quinoline, and on the production of anthranilic acid from phthalimide. The latter reaction became a step in the manufacture of synthetic indigo. On behalf of a number of Dutch chemical firms, Dr. Van Linge, manager of the Maarssen quinine works, announced that more than 8000*l*. had been subscribed for the foundation of a prize for chemistry at the Technical High School at Delft, in order to commemorate Prof. Hoogewerff's services to this institution and to Dutch chemical industry.

MR. HODGE, Minister of Pensions, stated to a deputation received by him on Monday that he proposed to take immediate steps to seek the necessary funds for the establishment of a National Experimental Laboratory which might ultimately become a national factory for manufacturing limbs. For the present, however, he was opposed to the establishment of a national factory. It was, in his view, essential that the Committee of Management of the National Laboratory should be small, representative of surgeons and mechanical experts, and distinct from any committee managing hospitals for limbless men. The Laboratory Committee would be directly responsible to the Ministry of Pensions, and would be empowered to ensure that the improvements which they recommended should at once be introduced into the manufacture of artificial limbs.

THE Indian Government is often called on to do curious pieces of work in connection with its policy of toleration towards the myriad religions of the Empire. The route to the sacred temple at Badarinath, in the Lower Himalaya, has from time immemorial attracted large bodies of pilgrims. It starts from Hardwar, where the Ganges emerges from the hills into the plains, and is 338 miles in length. The route is also valuable, as it attracts a considerable trade from Gartok over the Niti Pass. The road was so dangerous, partly owing to damage suffered in the great flood caused by the rupture of the dam of the Gohna lake in 1894, that serious loss of life was annually reported. The Indian Government has now intervened, and by a grant from public funds, aided by a subscription from a Hindu merchant of Calcutta, this famous route has been realigned, improved, and provided with iron bridges to replace the former dangerous structures of bamboo ropes. The road is now open for pony traffic, and the new regulations secure the comfort of the pilgrims and proper sanitation.

IN the *Fortnightly Review* for September Viscount Bryce discusses a list of fourteen persons on whom the epithet "great" is usually conferred. He points out that there has been an element of chance in the bestowal of this title; some were second-rate men, and a good many of first rank have not received it. It has been bestowed on men of action rather than on men of thought, and no Shakespeare, Dante, Socrates, Bacon, Kant, Newton, or Leibniz appears in the list. All, except two Popes, have been rulers or conquerors; and moral excellence, nobility of soul, or devotion to duty has had little to do with the conferment of the honour of greatness. "To have founded a nation, as did Washington, to have saved a nation from disruption, as did Lincoln—these are achievements which make renown immortal. The epithet has ceased to be attached to famous names since the death of the last who received it—Frederick William of Prussia. But had it been given to any since his day, none would have deserved it better than these two, George Washington and Abraham Lincoln."

THE *Psychological Bulletin* (vol. xiv., No. 7) gives an account of the problems incident to the war which are of a psychological nature, and outlines the steps taken by a special committee in the United States to assist the military authorities with these problems. Problems suggested by military officers are referred by the committee to appropriate individuals or institutions for immediate attention, and the chief psychological laboratories of the country have been offered for such use as the military situation dictates. It is proposed to appoint a committee on psychology for the National Research Council, while special committees are to be organised to deal with various important aspects of the relations of psychology to the war, *e.g.* the psychological examining of recruits, the selection of men for tasks requiring special skill, psychological problems of aviation, problems of shock, re-education and vocational training, problems of recreation in the Army and Navy, problems of emotional stability, fear and self-control, acoustic and visual problems of military importance. It will be seen that the list is comprehensive, and it is asserted that already a new method of selecting officers devised by a psychologist is in use in many of the officers training camps. It is no longer a problem of inducing the American military authorities to accept methods of psychological measurement, but primarily one of meeting their expressed needs and requests for assistance.

ONE of the remaining unknown regions in tropical Africa was explored in 1915, when Major Cuthbert Christy made a journey along the Nile-Congo watershed on behalf of the Sudan Sleeping Sickness Commission. Major Christy contributes a paper on the subject, accompanied by a new map, to the *Geograph-*

ical Journal for September (vol. l., No. 3). From the Lado Enclave north-westward to about lat. 7° N. the divide proves to be a continuous and more or less level strip of high country, covered with open savanna and in places as much as two miles in width. The fact that it is level and continuous makes this watershed important as a possible railway route, provided only that the unexplored northern part proves to have the same nature as the southern part. There is an ample water supply and plenty of good timber along the route. Major Christy suggests that a line should be built from El Fasher in Darfur, to which the Khartoum-El Obeid line is now being extended, along the Congo-Nile watershed to the Nile at Redjaf or Wadelai, and thence by the rift valley to Lake Tanganyika. This would be a longer but more practical route between Egypt and the lake region than the old project, which would entail almost insuperable difficulties in the sudd regions of the middle Nile. The map accompanying the paper is based on a prismatic compass traverse. No astronomical observations were taken.

It is announced by the *Times* that Sir Arthur Steel-Maitland, Under-Secretary for the Colonies, will be the Parliamentary Secretary of the new department which is being created to improve our commercial intelligence system, and that his successor at the Colonial Office will be Mr. W. A. S. Hewins. The Commercial Intelligence Department will eventually comprise the existing Department of Commercial Intelligence of the Board of Trade and the Foreign Trade Department of the Foreign Office, and will take over such of the staff and records of the War Trade Intelligence and Statistical Departments as may be available and required. The official head of the department will be an officer appointed jointly by the President of the Board of Trade and the Secretary of State for Foreign Affairs, working under the new Parliamentary Secretary. The appointment and control of the Trade Commissioners within the Empire will, as at present, rest with the Board of Trade, and the appointment and control of the Commercial Attachés and Consular Service with the Foreign Office, but the work of the new department will comprise all matters dealing with commercial intelligence, and, so far as is necessary for that purpose, it will give directions to the oversea services and make the necessary arrangements for keeping them in close touch with the commercial classes in this country. The department will be assisted by an Advisory Committee of business men, and it is hoped that it will be possible to arrange for a sub-committee of this committee to meet at frequent intervals in order to advise the department on its current work.

A correspondent of the *Pioneer Mail* of August 11 shows that there are still some unexplored byways in the study of the animals of India. The lion is believed to be now confined to the Gir forest of Kathiawar, but news has been received of the discovery of the skin of an animal supposed to be a lion in Assam. In the Khasia Hills there were said to be animals like small pigs, but with feet like dogs. These have now turned out to be badgers. The one-horned sheep of Nepal was at one time regarded as fabulous, but ten years ago it was found to be a fact, and the writer states that he possessed two specimens, one of which was sent to the experimental farm at Shillong, where it probably may still be examined.

The alertness of the United States Bureau of Fisheries and the thoroughness of its operations are well illustrated in the issue of *California Fish and Game* for July, where Mr. J. N. Cobb directs attention to the wholesale waste of fishery products which could well be turned to profit. In the salmon fisheries of the Pacific coast, he remarks, 140,000,000 salmon were taken during 1913. The preparation of these fish for the market resulted in the loss, in the form of offal, of no fewer than 101,186 tons, all of which could have been "worked up into merchantable products." Millions of pounds of salmon eggs, now run to waste, could, he insists, be converted into caviare. In Siberia during this year no fewer than 259 tons of such eggs were thus prepared, as against 24,000 lb. on the Pacific coast of America. The rest of the offal, he suggests, should be converted into fertiliser and oil. Alaska harbours enormous numbers of trout, representing four species, all of which could be canned, as are the salmon further south. No less neglected, he shows, are various species of the Mollusca and Crustacea. He also advocates the use of whale meat and the skins of hair seals for leather. Finally, he points out, there are great possibilities for the use of the various kinds of seaweed. These we in this country could also profitably adopt.

The gipsy moth, *Porthetria dispar*, was accidentally introduced from Europe into Massachusetts in 1868, and is now widely spread throughout eastern New England, where the caterpillars annually defoliate and kill many broad-leaved trees. The State of Massachusetts has spent more than 1,000,000 dollars in unsuccessful efforts to exterminate this pest, which does so much damage to shade and fruit trees. It has lately invaded the forests, attacking especially oak, aspen, poplar, beech, lime, and birch. It is impossible, on account of the expense, to have recourse in the forests to the spraying methods which are useful in orchards and city avenues. Messrs. G. E. Clement and Willis Munro, in U.S. Dept. of Agriculture Bulletin, No. 484, give the results of their investigations as regards the liability of the various forest trees to attack, and propose certain measures of defence, which depend mainly on the elimination by felling of species sought after by the larvæ, and on the cutting of dead and dying trees generally. In this region the problem is complicated by the presence of two other exotic plagues, the chestnut-bark disease, supposed to have been introduced from Japan, and the white pine blister rust, which was imported with nursery stock from Germany. These two fungoid diseases are so serious as to endanger the continued existence in the United States of two valuable timber trees, the chestnut and the white pine.

The seat of the olfactory sense in spiders, hitherto a matter of speculation, seems to have been determined, at least in the trap-door spiders, by Mr. John Hewitt, who describes his investigations on living spiders in the *South African Journal of Science* for March, which has just reached us. From Mr. Hewitt's experiments with scent-tipped rods there appears to be no doubt that this sense is located in the feet, and more directly, perhaps, in the "scopula"—the pad of fine and specially modified hairs seated on the lower and lateral surfaces of the tarsi. Whether females lack this sense or not is a matter for conjecture. At any rate, they do not respond to the tests which so readily stimulate the males into action. The author suggests that it is by the sense of smell that the males find their mates. If this be so, then it would appear that the females remain odourless during their periods of sexual inactivity, for males used in these experiments showed no sign of response when placed near females. When placed on a tablecloth having a woolly surface males at once adopted the characteristic courting attitude, the appropriate movements being apparently stimulated by the likeness of the fibres of the cloth to the threads set free by the female in her immediate neighbourhood when desirous of mating, at which time the male also

releases threads from the spinnerets. Mr. Hewitt's observations, though briefly stated, are sure to attract the attention, not only of students of the Arachnida, but also of all who are interested in animal behaviour.

MR. G. F. BECKER (United States Geological Survey, Professional Paper 98—N) investigates the "Mechanics of the Panama Canal Slides," and concludes that "a limit is set to the vertical height of a cliff or [of?] any rock." This limit allows a face of 3700 ft. in granite, which is well above that of El Capitan in the Yosemite Valley. When breaks have opened parallel to the rock-face, a horizontal shear has started at the base of the cliff, and outward movement can be checked only by the removal of material and the sloping back of the surface of the unstable mass.

WE have received a copy of a publication of the Carnegie Institution of Washington entitled "A History of Transportation in the United States before 1860." The large volume, which is the work of many authors, has been put together and edited by Miss C. E. MacGill. The development of transportation is traced from the trails of the earliest settlers, through later roads, turnpikes, and canals, to modern railways. The study is mainly historical and economic, but the geographical point is not lost sight of, particularly in the chapters on the early trails and on the canals and waterways. Coloured maps show the navigable rivers of the United States, the canals, and the railways in operation in 1840, 1850, and 1860. There is a bibliography of several hundred entries and a full index.

THE United States Coast and Geodetic Survey celebrated the centenary of its commencement on April 5 and 6, 1916, and the addresses which were then delivered have been recently published by the Survey. These addresses summarise the past work of the Coast and Geodetic Survey in the fields of geodesy, verification of standards, terrestrial magnetism, hydrography, tidal investigations, etc. They give a convenient summary of the work which has been accomplished, and we notice that throughout its history the Survey has always given a prominent place to investigation and research, while the design and improvement of instruments for the execution of the highest class of geophysical operations have been kept in mind, and much has been done in this direction.

WHEN the new Swedish State Museum of Natural History was opened to the public the palæobotanical department was not complete, owing to the illness of Prof. Nathorst. The collection, which, besides fossil plants, contains also the recent Archegoniates, has now been arranged in its new quarters, which are appropriately adorned by busts of A. E. Nordenskiöld and Oswald Heer, as well as by coloured pictures of past floras. The small collections of fossil plants which belonged to Swedenborg, Per Hasselquist, Hisinger, and others are kept together for the sake of their historical interest. The remaining exhibited fossils are arranged in two series. One, in cases along the walls and by the windows, is systematic, and represents the morphological development. The divisions adopted are: Equisetales, Pseudoborniales (a group hitherto found only in the Upper Devonian rocks of Bear Island), Lycopodiales, Filicales, Pteridospermeæ, Cycadophyta, Ginkgogales, Cordaitales, and Coniferales. The other half of the collection is arranged stratigraphically, and occupies several cases in the middle of the hall. The main study-series are in other rooms. Thanks to the energy of Prof. Nathorst, all these series are not only remarkably rich, but also of high scientific value from both the geological and the botanical aspect, and it is needless to add that the department is fully provided with laboratories and all that is required for the care of so important a collection.

IN order to release part of the large quantity of grain used in distilleries and to augment the food supplies of the country a reduction of the amount of potable spirits produced has been enforced. One of the consequences of this restriction was the curtailment of the output of yeast available for bread-making. To meet this possible difficulty Mr. Julian L. Baker was asked by the Royal Commission on Wheat Supplies as to the possibility of using brewers' yeast for the purpose. The results of his investigations are published in the Journal of the Society of Chemical Industry for July 31. The conclusions drawn are: (1) That a mixture of distillers' yeast and brewers' yeast (from any part of the United Kingdom) will effect a satisfactory fermentation of dough, the brewers' yeast being contributory to the fermentation and not merely a diluent; (2) that, using a mixture containing 33 or 50 per cent. of brewers' yeast, the doughing period will be slightly prolonged (about 20 per cent.) if the yeast rate is low; (3) that brewers' yeast alone is useless in the ordinary "quick doughing" process, but with it good loaves can be made of a "slow dough"; (4) that a deficit in the supply of distillers' yeast to bakers could be met by means of brewers' yeast within certain limits; (5) that brewers' yeast alone will produce palatable loaves; and (6) that with the present output of beer 200 to 250 tons of brewers' yeast per week would be available for bakers at a much lower price than that paid for distillery yeast, of which 700 tons are used weekly. In order to avoid the risk of imparting a yeasty and bitter flavour to the bread, the brewers' yeast should be washed with a dilute solution of salt and then submitted to a short, brisk fermentation in a dilute mash-tun wort. Mr. Baker is of the opinion that bakers could use a mixture of equal parts of brewers' and distillers' yeast without any serious inconvenience to their trade or disadvantage to the public.

THAT caustic soda solutions at temperatures in the neighbourhood of 100° C. produce brittleness in soft steel has long been known and has been the subject of several investigations. No satisfactory explanation has yet been reached, and the matter has been recently taken up by Prof. S. W. Parr and further investigated. The account of his work is published in Bulletin No. 94 of the Engineering Experiment Station of the University of Illinois. That the embrittling effect of caustic soda is due to the evolution of hydrogen and its absorption by the steel in the nascent state is generally conceded. The author shows that during the action of the alkali at 100° C. the electrical potential of the steel is considerably raised, and that it extends from the surface into the specimen for a distance of, at any rate, 0·30 in. This increase is also brought about by immersion in dilute acids and by cathodic polarisation. The potential is in all cases higher after treatment of any sort that evolves nascent hydrogen, and this fact points to the occurrence of a molecular change in the steel. This high potential disappears in many cases after a lapse of time, and after heating to from 100° to 200° C. in air, but no relation was established between its presence and the existence of brittleness. Indeed, the author states that the potential increased long before brittleness was manifested. By using sodium dichromate as a depolariser in the caustic soda solutions the author found that the rate of corrosion at 280° C. was much diminished, and that the toughness of the steel, as judged by the repeated bending test, suffered no deterioration. A complete explanation of the cause of brittleness is still to seek.

IN Bulletin No. 95 of the Engineering Experiment Station of the University of Illinois Messrs. Yensen and Gatward describe the results of a research on the properties of iron-aluminium alloys. The alloys were

made in magnesia crucibles heated in an Arsem vacuum furnace by melting pure iron and afterwards dropping in aluminium, the latter being suspended in the form of wire or rod from a very fine wire extended between insulating posts which passed through the cover of the furnace. At the required moment this was fused. In this way alloys containing up to 13 per cent. of aluminium were obtained, and are stated by the authors to be less contaminated with impurities than any previously made. The alloys classed as uncontaminated contain from 0·01 to 0·02 per cent. of carbon. Other alloys containing more carbon are classed as contaminated and are used to show the effects of carbon. Aluminium is a more powerful deoxidiser than silicon and does not commence to combine with iron until all the oxides present have been reduced. It forms solid solutions with iron throughout the range studied. The alloys have been studied chiefly from the point of view of their magnetic properties. Aluminium, like silicon, has a beneficial effect when added in small quantities. The best alloy obtained, containing 0·4 per cent. of aluminium, has a maximum permeability above 35,000 when annealed at 1100° C. The hysteresis loss for B. max.= 10,000 and 15,000 is 450 and 1000 ergs per c.c. per cycle respectively. The specific electrical resistance increases, about 12 microms for each per cent. of aluminium added up to 3 per cent. Above this the rate of increase falls off gradually.

OWING to the shortage of superphosphate prepared in the ordinary way with sulphuric acid various suggestions have been made to supply the deficiency (such as the action of nitre-cake on rock phosphate), or to use what ordinary superphosphate there is available to the greatest advantage. For the latter purpose admixture with insoluble phosphate has been advocated. Concerning this proposal, the results obtained by Mr. G. Scott Robertson (Journal of the Society of Chemical Industry, June 30) are of considerable importance. Mr. Robertson finds that when ordinary superphosphate is mixed with basic slag the greater part of the water-soluble calcium phosphate contained in the former reverts to the insoluble form almost at once by the action of the free lime in the basic slag, whilst on keeping the mixture a slower change in the same direction is observed Thus when a superphosphate containing 26 per cent. of water-soluble calcium phosphate was mixed with an equal quantity of basic slag (containing 1·7 per cent. of free caustic lime), the mixture, instead of containing 13 per cent. of water-soluble phosphate, contained only 5 per cent. immediately after mixing, and only 2·8 per cent. after keeping for fourteen days, after which period the composition altered but slightly. When the basic slag is replaced by an equal proportion of natural rock phosphate there is a much smaller reversion, so that there is no serious objection to such a mixture being used by farmers. A mixture of Gafsa rock phosphate with an equal weight of superphosphate contained 12·7 per cent. of water-soluble phosphate (instead of 13 per cent.) immediately after mixing, and 10·4 per cent. at the end of fourteen days. Gafsa phosphate (which rarely contains more than 0·75 per cent. of calcium oxide in the form of free carbonate) is probably the most suitable for mixing with superphosphate. Then come Egyptian phosphate, Florida pebble phosphate, Makatea Island phosphate, and Tunisian and Algerian phosphates, in order of suitability.

THE Scottish Motor Traction Company, which runs a number of motor omnibuses in Edinburgh and the district, has taken up the use of coal-gas as a substitute for petrol, and a photograph of one of its vehicles appears in the *Engineer* for September 14. The gas-holder consists of a large flexible container, which covers the entire roof of the vehicle, the arrangement being similar to that adopted in other vehicles of this type. The simplicity and low cost of the flexible receiver charged with gas at low pressure warrant careful consideration of the system as a war measure. Although the quantity of gas which can thus be carried is limited, this disadvantage is to some extent compensated for by the ease with which the gas-holder can be recharged. Further, high-pressure receivers are not easy to procure at the present time. Owing to the low pressure—about 0·2 in. of water—a meter delivering into the receiver races unless some form of throttle is interposed. A short length of small-bore piping, or a diaphragm with a suitable aperture, is recommended so as to retain the pressure drop in the meter within reasonable limits.

WRITING in the *Tohôku Mathematical Journal*, vol. xi., 3, Mr. Hastime Tanate discusses the logical foundations for negative and imaginary quantities and expresses the view that the existence of these quantities may be explained independently of any geometrical considerations.

OUR ASTRONOMICAL COLUMN.

DISTRIBUTION OF SPIRAL NEBULÆ.—The distribution of spiral nebulæ has been further investigated by Dr. R. F. Sanford, with the aid of photographs obtained with the Crossley reflector (Lick Observatory Bulletin, 297). The photographs were taken with exposures of the order of twelve hours, the object being to find out whether new nebulæ could be detected in regions of the Milky Way which have hitherto seemed barren of them. They afford no evidence of undiscovered faint nebulæ in the regions where they have not previously been found with shorter exposures. It is shown that there is greater average brightness for the extra-galactic than for the galactic spirals, and that the nebulæ which lie nearest to the Milky Way are on the average of larger angular size than those away from it. F. G. Brown has shown that the larger nebulæ in general are the brighter, but this is not true of spiral nebulæ near the Milky Way, which are large and faint. Thus, if angular size be taken as a criterion of distance, it follows that something cuts off the light from the galactic spirals, thereby letting only the nearer ones be perceptible, and then only with diminished brightness. An arbitrary and general distribution of the spiral nebulæ can be best harmonised with the observed features of the distribution by assuming the existence of an obstructing medium, which is irregularly scattered throughout the galaxy. It is considered probable that the spirals are not only outside our own system, but that they can have no intimate connection with it dynamically.

THE GREAT SOLAR PROMINENCE OF 1916, MAY 26.—A detailed account of the great eruptive prominence of 1916, May 26, which reached a maximum height of half a million miles, and in some parts attained a velocity of 457 km. per second, has been given by Mr. Evershed (Kodaikanal Bulletin, No. 55). One of the most striking results of the measurements of the photographs is to show that all parts of the prominence were moving radially outwards from a point in the chromosphere at the base of the main column. It is considered probable that an eruptive prominence begins as an unusually dense low-lying mass of gas which may persist without much change for several days, and then suddenly become unstable, becoming subjected to a force which tears it to shreds and sends the frag-

ments flying into space with accelerating speed. The dissipating force, as indicated by the great prominence, lies at the surface of the sun, and may be localised in a very restricted area. The main stem consisted of a stream of rapidly moving gas, which was brilliantly luminous when it formed a continuous column, but so soon as the continuity was broken by the stoppage of the supply of gas from the chromosphere, the separate detached masses faded very rapidly. The rapid fading is probably to be explained by the extremely low density of the gas involved. Mr. Evershed argues that the density is so small that the gas can have no temperature in the ordinary sense; its emissive power will thus be dependent only on absorption of photospheric radiation, which is apparently insufficient to maintain luminosity at great heights. A remarkable feature of the great eruption was the practically simultaneous fading of the entire prominence.

COLOURS OF STARS IN GALACTIC CLOUDS.—In continuation of his work on the colours and magnitudes of stars in clusters, Dr. Harlow Shapley has determined the colours and magnitudes of 300 stars in the galactic clouds surrounding the cluster Messier 13 (*Astrophysical Journal*, vol. xlvi., p. 64). A wide range of colour is apparent among these stars, and the distribution of spectral types among the 14th magnitude stars appears to be much the same in this distant galactic region as in the immediate vicinity of the sun. Stars of all colours are included in each interval of magnitude, and so far as colour is an index of intrinsic luminosity, this may be accepted as an indication of considerable difference in the distances of such stars. The wide dispersion in magnitude of both blue and red stars suggests that the extent of the stellar clouds in the line of sight is relatively very great, possibly greater than the distance to the nearer boundary. The cluster Messier 11 proves to be a physical group in the midst of the star-clouds, which on their own part have the general appearance, and some of the properties, of an enormous, but definitely outlined, physical system. There is as yet no certain evidence of the existence of dwarf stars either in the cluster or in the galactic clouds. The cluster stars are probably giants in luminosity, and the distance of the group is of the order of 15,000 light-years.

GERM-CELLS AND BODY IN INHERITANCE.

IN NATURE for March 15 of this year (pp. 55–56) some account was given of a summary of Dr. Raymond Pearl's researches on the progeny of alcoholised fowls. A later and much fuller description of this important work has now appeared in the *Journal of Experimental Zoology* (vol. xxii., 1917, pp. 125–86, 241–310), under the title of "The Experimental Modification of Germ-cells." This paper is divided into three sections, the first of which describes the general plan of the experiments, and the second the effect upon the domestic fowl of the daily inhalation of ethyl alcohol and other substances, while the third discusses the effect of parental alcoholism and certain other drug intoxications on the progeny. The general results of the experiments have already appeared in NATURE (*loc. cit.*). Dr. Pearl alcoholised his fowls by inhalation because the birds refused to drink alcohol, even if highly diluted; Prof. Stockard had previously found it impossible to administer alcohol to guinea-pigs satisfactorily by the stomach, and had therefore also adopted the inhalation method. While the progeny of Stockard's guinea-pigs had been as a rule weakly and deformed, the offspring of Pearl's treated fowls were stronger, though less numerous, than those of his "controls." In the case of the birds the effect of the alcohol on the germ-cells seems therefore to have been selective, whereas with the rodents it was utterly deleterious. A possible cause of the difference, which does not seem to have occurred to Dr. Pearl, may be the great contrast between the respiratory mechanism in birds and in mammals; the residual air in the lungs of the latter might be expected to increase the effect of the inhaled poison. Further, the excessive degradation of the offspring of Stockard's guinea-pigs suggests that the germ-cells of those animals are peculiarly sensitive to adverse influences.

The temptation to argue from these divergent results to the terribly practical problem of alcoholism in the human race is great, and Dr. Pearl does not altogether resist it. Clearly, however, the effect of the inhalation of ethyl alcohol by a Plymouth Rock hen, or even by a guinea-pig, cannot be closely compared with the effect of alcohol swallowed by the whisky- or beer-drinker. The latter effect can be studied elsewhere than in biological laboratories.

Another aspect of the affection of germ-cells is illustrated for plants by Mr. S. Ikeno's "Studies on the Hybrids of *Capsicum annuum*," part ii., "On Some Variegated Races," in a recent number of the *Journal of Genetics* (vol. vi., No. 3). A variegated race of this species appeared in 1913 by mutation, producing, exclusively by self-fertilisation, plants which have always variegated foliage, but which differ widely in the intensity of the variegation. Self-fertilised flowers on green branches of a variegated plant yield variegateds, in the majority of which the variegation is slight. By hybridising variegated with green the degree of variegation in the offspring is diminished. Variegation is transmissible in either the male or the female line, but the transmission "is not through the nucleus, but through the cytoplasm; especially the plastids contained therein may be regarded as organs of transmission," and the author believes that some cytoplasm containing plastids may be introduced by the male gamete into the zygote. Analogous cases of plant-inheritance have been previously discussed by Correns, Gregory and others. Variegation depends upon the presence of plastids which have no power of forming chlorophyll, which may, indeed, be regarded as diseased, so that though the character is due to a kind of infection suffered by the germ-cells, it is not strictly blastogenic.

The same part of the *Journal of Genetics* contains a paper by Dr. R. Ruggles Gates on "Vegetative Segregation in a Hybrid Race of Œnothera (*Œ. rubricalyx* × *biennis*," in which somewhat similar questions are raised. The bud-colour character shows Mendelian segregation, which may reasonably be considered dependent on normal chromosome distribution in meiosis. But in the size of petal there is a range of variation that suggests "somatic variation and segregation . . . determined by diversities appearing in nuclear or cytoplasmic material during somatic mitoses." Here, therefore, we have another example of the necessity for clearing issues in the study of inheritance.

The broader aspects of evolution are discussed by Dr. Raymond Pearl in an article entitled "The Selection Problem" (*American Naturalist*, vol. li., 1917, pp. 65–91). Insisting on the necessity of experimental proof and the determinative action of germinal characters, he concludes that "natural selection is no longer generally regarded as the primary, or perhaps even a major, factor in evolution." Yet, in stating that "natural selection is, from the point of view of modern genetics, a somatic theory," he surely goes far beyond the available evidence, and seems to ignore the principle that characters of selection-value must be re-

garded, by all who believe the Darwinian factor to be operative in organic evolution, as transmissible. In a later number of the *American Naturalist* (vol. li., pp. 250–56) Dr. W. H. Longley has criticised Dr. Pearl's argument, expressing the opinion that "neither genetic research nor studies upon elimination closely limit the possibility that selection has played a very important part in evolution. . . . Recent field studies demonstrate novel facts of common occurrence which must apparently be ascribed to the action of this factor."

G. H. C.

TERRESTRIAL MAGNETISM.

ON the occasion of the centennial celebration of the United States Coast and Geodetic Survey, held in April, 1916, Dr. L. A. Bauer delivered an address on the work done by the Survey in terrestrial magnetism, which has now been separately published. Dr. Bauer was himself in charge of the magnetic work of the Survey from 1899 to 1906, and was largely responsible for its greatly increased activity during the present century. Up to the end of 1915 the Survey had made magnetic observations at 5500 land stations, and its ships had taken many observations at sea, while five magnetic observatories were in constant operation. Magnetic charts of much increased accuracy had been published for the United States, and a reduced copy of the chart for 1915 is included in the publication. Dr. Bauer advocates the erection of a new magnetic observatory in the Panama zone, and the uninterrupted maintenance of the existing observatories for a number of years. He expresses some interesting opinions as to the relative importance of theory and observation, which, coming from a man of his great experience, deserve careful consideration. "All experience," he says, "tends to show that, instead of looking upon the establishment of a theory as the goal of an investigation, it should ever be regarded merely as a means to the goal, the advancement of human knowledge." He speaks with feeling of the "uselessness of empirical formulæ for the purposes of prediction" (of secular change), and his final advice to the superintendent of the Coast and Geodetic Survey is "*continued, unceasing, and intelligent observation.*"

The annual report of the director of the Department of Terrestrial Magnetism of the Carnegie Institution of Washington for the year 1916 extends to fifty pages. It mentions that vol. iii. of the researches of the department is nearly ready, and that it will contain the final results of the ocean magnetic work from 1905 to 1914, and preliminary results of a recent cruise of the survey ship *Carnegie*, extending from March, 1915, to September, 1916. The present publication gives a good many details of this cruise. The *Carnegie* sailed in the first instance from Alaska to New Zealand, then circumnavigated the south polar regions, the track lying mainly between 50° S. and 60° S., and finally returned from New Zealand to San Francisco. Tables give full particulars of the errors observed in the British, German, and American charts on the several journeys. In most areas the errors are less than 1°, but in several they are considerably larger. The largest errors were observed near 59° S., 110° E. They were as large as 10°, or even 12°, in the British and American charts, and still larger in the German. The land work done in the year includes observations in South Africa, South America, China, and Australasia. The department has taken steps for the erection of a magnetic observatory about 100 miles north of Perth, Western Australia. At the end of the report is a series of abstracts of recent scientific publications by the staff of the department, including several dealing with atmospheric electricity.

AMERICAN FOSSIL VERTEBRATE ANIMALS.

A PAUSE in the discovery of strange new forms of extinct vertebrate animals in North America has afforded an opportunity for obtaining more exact knowledge of some species hitherto known only by fragments. It has also given time for a more careful consideration of the habits and affinities of several problematical types which have previously been only hastily discussed. The American Museum of Natural History, New York, has been especially active in furthering such research, and has lately published in its Bulletin four papers of more than usual interest.

It has long been known that at the beginning of the Tertiary period there were very large and stout running birds both in Europe and in America. The greater part of a skeleton of a new species of Diatryma, which was found last year in the Lower Eocene of Wyoming, shows for the first time the true nature of one of these birds. The remains, as usual, are not sufficiently well preserved to exhibit all the features that are needed for an exact systematic determination; but, according to the studies of Messrs. Matthew and Granger, Diatryma is now proved to be more closely related to the South American crane-like bird, Cariama, than to any other known form. It can no longer be associated with the ratite birds, with which the first fragments were compared. The new species, *Diatryma steini*, must have been about 7 ft. high when standing, with a short and massive neck and an enormous head having a high compressed beak. It would, indeed, present much the appearance of the well-known Phororhachos from the later Tertiary formations of the Argentine Republic, which is also generally compared with Cariama. The discovery of such a bird in the oldest deposits of the Tertiary period shows how early must have been the differentiation of the birds into the groups which are familiar at the present day.

Of the Dinosaurian reptiles with hind limbs nearly like those of running birds, much has been learned by the discovery of nearly complete skeletons in the Upper Cretaceous of Alberta, Canada. Prof. H. F. Osborn therefore takes advantage of the opportunity of discussing these in connection with the skeletons of Ornitholestes from the Upper Jurassic of Wyoming, and of Tyrannosaurus from the Upper Cretaceous of Montana. He also publishes many beautiful drawings of osteological details. The forms previously known were obviously grasping flesh-eaters; but the new Struthiomimus has a small toothless skull shaped much like that of an ostrich. Prof. Osborn, indeed, thinks it most probable that this strange reptile had the same mode of life and habits as an ostrich.

Equally great diversity is being met with among the armoured and horned dinosaurs from the Upper Cretaceous of Alberta, but all the remains hitherto described are more or less fragmentary. A nearly complete skeleton of Monoclonius, now made known by Mr. Barnum Brown, is therefore of great interest and value. Compared with the hypothetical restorations of Triceratops, the body is shorter and deeper in the posterior dorsal region, while the feet are more digitigrade with toes turning outwards, the axis of the manus being through the second digit, that of the pes being between the second and third digits. There is no bony exoskeleton, but the epidermis is hardened into low, polygonal tubercles, which do not overlap.

The gigantic herbivorous dinosaurs such as Diplodocus present as many difficulties in nomenclature as whales, and Prof. Osborn, with the help of Mr. Charles C. Mook, is now attempting to decide which characters can best be used for the recognition of

the several species. Taking Apatosaurus as an illustration, Mr. Mook points out the necessity of making allowance for differences of age in the various individuals compared; which differences can generally be recognised by studying the degree of fusion of certain bones and the development of crests and rugosities on them.

As an aid to the study of Prof. Osborn's numerous papers on the fossil vertebrate animals, we welcome the handsome second edition of the Bibliography of his published writings which we have just received. It includes a classified index as well as the usual chronological list, and forms a most useful compendium for the student. It shows not merely where Prof. Osborn has described the various fossils, but also where he has discussed the points of philosophical interest which arise from these descriptions.

A. S. W.

FORTHCOMING BOOKS OF SCIENCE.

AGRICULTURE AND HORTICULTURE.

Cassell and Co., Ltd.—1000 Gardening Hints, H. H. Thomas, illustrated; The Garden: How to Make It Pay, H. H. Thomas, illustrated; Gardening Handbooks for Amateurs, edited by H. H. Thomas: The Allotment; Early Vegetables; The Garden Frame; Pruning Fruit Trees. *Macmillan and Co., Ltd.*—The Vegetable Garden, E. J. S. Lay. *John Murray.*—The Book of the Rothamsted Experiments, issued with the authority of the Lawes Agricultural Trust Committee, originally edited by A. D. Hall, a new and revised edition, edited by Dr. E. J. Russell, illustrated; Cotton and other Vegetable Fibres, Dr. E. Goulding (Imperial Institute Handbooks). *John Wiley and Sons, Inc. (New York).*—Botany for Agricultural Students, J. N. Martin.

ANTHROPOLOGY AND ARCHÆOLOGY.

Constable and Co., Ltd.—Tools and Weapons, illustrated by the Egyptian Collection in University College, London, and 2000 outlines from other sources, Prof. W. M. Flinders Petrie; Scarabs and Cylinders, with names, illustrated by the Egyptian Collection in University College, London, Prof. W. M. Flinders Petrie. *Macmillan and Co., Ltd.*—Folk-Lore in the Old Testament, Sir J. G. Frazer, two vols. *Methuen and Co., Ltd.*—Primitive Ritual and Belief, E. O. James.

BIOLOGY.

Constable and Co., Ltd.—Coniferous Trees, A. D. Webster, illustrated; Profitable Keeping and Feeding of Rabbits, Capt. C. G. Moor. *J. M. Dent and Sons, Ltd.*—The Imperial Studies Series: The Exploitation of Plants, a Series of Lectures Delivered at University College, edited by Prof. F. W. Oliver. *H. Holt and Co. (New York).*—General Zoology, Prof. A. S. Pearse. *Longmans and Co.*—A Handbook of Nature Study and Simple Agricultural Teaching for the Primary Schools of Burma, E. Thompstone. *Methuen and Co., Ltd.*—Secrets of Earth and Sea, Sir Ray Lankester, illustrated. *John Murray.*—The Life and Letters of Sir J. D. Hooker, L. Huxley, two vols., illustrated. *John Wiley and Sons, Inc. (New York).*—Fresh-water Biology, H. B. Ward and G. C. Whipple; Applied and Economic Botany, K. Kraemer.

CHEMISTRY.

George Allen and Unwin, Ltd.—The Treasures of Coal Tar, Prof. A. Findlay. *J. and A. Churchill.*—A Short Account of Explosives, A. Marshall; Allen's Commercial Organic Analysis, edited by W. A. Davis, vol. ix. *Constable and Co., Ltd.*—What Industry Owes to Chemical Science, R. B. Pilcher; Elements of Industrial Chemistry, A. Rogers, illustrated; The Nature of Solution, H. C. Jones, illustrated; Principles of Quantitative Analysis, Dr. W. C. Blasdale, illustrated; The Life and Letters of Joseph Black, the late Sir William Ramsay, with an introduction by Prof. F. G. Donnan. *Gurney and Jackson.*—Supplementary Volume to the Manufacture of Sulphuric Acid and Alkali, vol. i., Prof. G. Lunge; The Chemistry of Linseed Oil, Dr. J. N. Friend (Chemical Monographs). *J. B. Lippincott Company.*—Chemical Analysis of Iron, Blair, new edition. *Longmans and Co.*—The Chemical Constitution of the Proteins, Dr. R. H. A. Plimmer, part i., Analysis, new edition (Monographs on Biochemistry). *Scott, Greenwood and Son.*—Vegetable Fats and Oils, L. E. Andés, new edition; Dyers' Materials, P. Heerman, new edition. *University Tutorial Press, Ltd.*—Senior Practical Chemistry, H. W. Bausor. *John Wiley and Sons, Inc. (New York).*—Laboratory Manual of Elementary Chemistry, H. C. Cooper; Bio-Chemical Catalysers in Life and Industry, G. Effront; An Introduction to Theoretical and Applied Colloid Chemistry, Dr. W. Ostwald; Examination of Water, W. P. Mason, new edition; Colloid Chemistry, R. Zsigmondy and E. B. Spear; Scientific and Applied Pharmacognosy, H. Kraemer; Theoretical and Practical Pharmacy, E. A. Ruddiman; Manual de la Fabricacion de Azucar de Cana, G. L. Spencer; Empirical Formulas, T. R. Running.

ENGINEERING.

Cassell and Co., Ltd.—All About Engines, E. Cressy, illustrated. *Constable and Co., Ltd.*—Industrial Engineering: Its Present Position and Post-War Outlook, F. W. Lanchester; Airfare of To-day and of the Future, E. Middleton, illustrated; With the French Flying Corps, C. D. Winslow, illustrated; Electrical Measuring Instruments, K. Edgcumbe, new edition; The Flying Machine from an Engineering Point of View, F. W. Lanchester, new edition. *Electrician Printing and Publishing Co., Ltd.*—Electrical Measuring Instruments, C. V. Drysdale and A. C. Jolley; Balancers, Carter; and new editions of Wireless Telegraphy and Telephony, Dr. Eccles; Electricity Meters, C. H. W. Gerhardi; Electric Mains and Distributing Systems, Dick and Fernie; Electric Switch and Controlling Gear, Dr. Garrard; Electric Cranes and Hoists, H. H. Broughton, two vols. *Crosby Lockwood and Son.*—The Founder's Manual: A Presentation of Modern Foundry Operations for the Use of Foundrymen, Foremen, Students, and Others, D. W. Payne. *John Murray.*—The Life and Letters of Sir Colin C. Scott Moncrieff, 1836–1916, edited by his niece, Miss M. A. Hollings, illustrated. *Scott, Greenwood and Son.*—Strength of Ships, J. B. Thomas; Strength of Structural Elements, E. H. Sprague; Precision Grinding Machines, T. R. Shaw. *Seeley, Service and Co., Ltd.*—The Romance of War Inventions: An Account of the Destructive Engines and Weapons and Life-saving Appliances used in Modern Warfare, T. W. Corbin, illustrated. *Whittaker and Co.*—Continuous-Current Motors and Control Apparatus, W. P. Maycock, illustrated; Power Wiring Diagrams: A Handbook of Connection Diagrams of Control and Protective Systems of Industrial Plants, A. T. Dover, illustrated; Electric Motors and Control Systems, A. Dover (being a portion of the work on Electric Traction by the same author, with additions and revisions), illustrated. *John Wiley and Sons, Inc. (New York).*—American Engineers' Pocket Book, A. H. Blanchard; Testing for the Flotation Process, A. W. Fahrenwald; Meter Rates for Waterworks, A. Hazen; Ingenieria de Ferrocarriles, V. L. R. Havens; Printing, F. S. Henry; Shore Processes and Shore Development, D. W. Johnson; Hydroelectric Power Stations, E. A. Lof and D. B. Rushmore; Mining Engineers'

Pocket Book, R. Peele; Ordnance and Gunnery, W. H. Tschappat; Technic of Surveying Instruments and Methods, W. L. Webb and J. C. L. Fish; Railroad Structures and Estimates, J. W. Orrock.

Geography and Travel.

Edward Arnold.—On the Eaves of the World, R. Farrer, two vols., illustrated. *Macmillan and Co., Ltd.*—Highways and Byways in Wiltshire, E. Hutton, illustrated (Highways and Byways Series); The Pupils' Class-Book of Geography, Europe, E. J. S. Lay. *John Murray.*—The Life of Sir Clements Markham, Admiral Sir A. H. Markham, illustrated. *The S.P.C.K.*—Voyages and Discoveries, Tales of Queen Elizabeth's Adventurers, retold from Hakluyt, A. D. Greenwood, illustrated.

Geology and Mineralogy.

Seeley, Service and Co., Ltd.—The Marvels of Geology: The Story of the Making of the Earth, with Some Account of Prehistoric Animal Life told in non-technical language, E. S. Grew, illustrated. *John Wiley and Sons, Inc. (New York).*—Practical Instructions in the Search for, and the Determination of, the Useful Minerals, including Rare Ores, A. McLeod.

Mathematical and Physical Sciences.

Constable and Co., Ltd.—Light and Shade and their Applications, M. Luckiesh, illustrated; Photography, A. Watkins, new edition. *Gauthier-Villars et Cie (Paris).*—Œuvres de G.-H. Halphen, tomes ii., iii., iv.; Cours de Géométrie pure et appliquée de l'Ecole Polytechnique, M. d'Ocagne, tome ii.; Cours de Physique, Prof. E. Rothé, III^e Partie, Aérodynamique; Œuvres de Henri Poincaré, tome i. *Longmans and Co.*—The Art of Teaching Arithmetic, J. B. Thomson; Infinitesimal Calculus, Prof. F. S. Carey, in two sections, section ii.; Differential Equations, Dr. H. Bateman. *Macmillan and Co., Ltd.*—A Text-Book of Physics, J. Duncan and S. G. Starling; Mathematical Papers for Admission into the Royal Military Academy and the Royal Military College, edited by R. M. Milne, February–July, 1917. *Methuen and Co., Ltd.*—Housecraft Science, E. D. Griffiths. *Sir Isaac Pitman and Sons, Ltd.*—The Mathematics of Ventilation, Pumping, Haulage, and Winding, F. Birks; Industrial Mathematics, G. W. Stringfellow (Pitman's Mathematical Series). *University Tutorial Press, Ltd.*—Intermediate Text-Book of Magnetism and Electricity, R. W. Hutchinson. *John Wiley and Sons, Inc. (New York).*—The Sun's Radiation and other Solar Phenomena, F. H. Bigelow; Integral Calculus, H. B. Phillips.

Medical Science.

George Allen and Unwin, Ltd.—Three Clinical Studies in Tuberculous Predisposition, W. C. Rivers. *E. Arnold.*—Medical Diseases of the War, Major A. F. Hurst; Malingering and Feigned Sickness, Col. Sir J. Collie, new edition. *Baillière and Co.*—The Camel and its Diseases, H. E. Cross, illustrated; Manual of Physiology, Prof. G. N. Stewart, new edition. *A. and C. Black, Ltd.*—The Edinburgh School of Surgery before Lister, Dr. A. Miles; Radiography and Radiotherapeutics, Dr. R. Knox, two vols., illustrated, vol. i., Radiography, vol. ii., Radiotherapeutics. *J. and A. Churchill.*—Therapeutic Immunisation, Dr. W. M. Crofton; Hygiene for Nurses, Dr. H. C. R. Darling; A Practice of Medicine, Sir F. Taylor, Bart., new edition. *J. M. Dent and Sons, Ltd.*—Dent's Medical Dictionary, edited by W. B. Drummond, illustrated. *O. Doin et Fils (Paris).*—Bibliothèque de Biologie Générale:—Les Phénomènes vitaux; La Cellule (Morphologie et Physiologie), Prof. M. Henneguy; Les Formes larvaires et les Métamorphoses, Prof. C. Peréz; La Reproduction asexuée; La Régénération et la Greffe, E. Bordage; La Sexualité et la Parthénogénèse; Les Corrélations organiques et l'Individualité, E. Guyénot; L'Irritabilité et les tropismes; Les Mutations matérielles dans les êtres vivants (aliment et milieux nutritifs); Les Mutations énergiques dans les êtres vivants (luminosité, chaleur, électricité, etc.); La Biologie des Pigments, Prof. J. Cotte; Ethnologie et Organisation; Commensalisme, Symbiose, Parasitisme; Les Milieux biologiques marins, P. M. de Beauchamp; La Biologie des eaux douces; Les principaux faciès biologuiqes terrestres; La Concurrence vitale; L'Hérédité La Variation; L'Hybridation; L'Espèce; L'Adaptation; La Phylogénie; Les Théories évolutionnistes. *J. B. Lippincott Co.*—Diseases of the Skin: their Pathology and Treatment, Dr. M. B. Hartzell, illustrated; The Internal Ear in General Medicine: The Study of Neurotology Diagnosis of Vertigo by Barany Tests, Dr. I. H. Jones, with an Analysis of Pathological Cases by Dr. L. Fisher, illustrated; Blood Transfusion Hemorrhage and The Anæmias, Dr. B. M. Bernheim, illustrated; Hygiene of the Eye, Dr. W. C. Posey, illustrated; The Spleen and Anæmia: Experimental and Clinical Studies, Dr. R. M. Pearce and others, illustrated. *Longmans and Co.*—The Conduction of the Nervous Impulse, Dr. K. Lucas (Monographs of Physiology). *Macmillan and Co., Ltd.*—Life of Lord Lister, Sir R. J. Godlee, Bart., illustrated; An Enquiry into the Analytical Mechanism of the Internal Ear, Sir T. Wrightson, Bart., with an Appendix on the Anatomy of the parts concerned, by Prof. A. Keith (Science Monographs). *Masson et Cie (Paris).*—"Collection Horizon, Précis de Médecine et de Chirurgie de Guerre":—Plaies de la Plèvre et du Poumon, Prof. R. Grégoire; Troubles mentaux de guerre, Prof. J. Lépine; Blessures de la Moelle et de la Queue de cheval, Drs. G. Roussy and J. Lhermitte; Electrodiagnostic de guerre: Clinique. Conseil de réforme. Technique et interprétation, Prof. A. Zimmern; and new editions of Hystérie-Pithiatisme et Troubles nerveux d'ordre réflexe en Neurologie de guerre, J. Babinski and J. Froment; Formes cliniques des Lésions des Nerfs, Mme. Athanassio-Benisty; Les Blessures de l'abdomen, J. Abadie. *Methuen and Co., Ltd.*—Tuberculosis, Dr. C. Riviere; The Baby, E. A. Saunders; The Health of a Woman, Dr. M. Leslie (Methuen's Health Series).

Metallurgy.

Constable and Co., Ltd.—Methods in Metallurgical Analysis, C. H. White, illustrated. *Scott, Greenwood and Son.*—Hardening and Tempering of Steel, F. Reiser, new edition. *John Wiley and Sons, Inc. (New York).*—Electric Furnaces in the Iron and Steel Industry, Rodenhauser and Schoenawa, translated by C. H. Vom Baur; A Practical Book in Elementary Metallurgy, E. A. Thum; Technical Analysis of Brass, W. B. Price, new edition.

Miscellaneous.

George Allen and Unwin, Ltd.—Scientific Synthesis, Prof. E. Rignano, translated by P. E. B. Jourdain. *E. Arnold.*—The Elements of Coal Mining, D. Burns, illustrated. *Constable and Co., Ltd.*—Britain's Heritage of Science, Drs. A. Schuster and A. E. Shipley, illustrated; Adolescence, Dr. S. Paget; The Problem of the Soul, E. Holmes; Welsh Education, G. P. Williams. *J. M. Dent and Sons, Ltd.*—The Staple Trades of the Empire, by various experts, with an introduction by A. P. Newton (The Imperial Studies Series). *W. Heinemann.*—Essays on a Liberal Education, edited, with an introduction, by Sir E. Ray Lankester, and additional papers by H. G. Wells and

the Master of Balliol. *Longmans and Co.*—Education: Selective, Specific, Compensatory, M. West; The Education of the South African Native, C. T. Loram. *Macmillan and Co., Ltd.*—Problems of the Self: an Essay based on the Shaw Lectures given in the University of Edinburgh, March, 1914, Prof. John Laird; Logic as the Science of Pure Concept, translated from the Italian of Benedetto Croce, by D. Ainslie; The Philosophy of Benedetto Croce: the Problem of Art and History, Dr. H. W. Carr; Brahmadarsanam, or Intuition of the Absolute: Being an Introduction to the Study of Hindu Philosophy, Srî Ananda Achârya. *John Murray.*—Rustic Sounds, and other Studies in Literature and Natural History, Sir F. Darwin. *Open Court Company.*—System of Morals founded on the Laws of Nature, M. Deshumbert. *Seeley, Service and Co., Ltd.*—Modern Whaling and Bear-Hunting: A Record of Present-day Whaling with Up-to-date Appliances in many Parts of the World, and of Bear and Seal Hunting in the Arctic Regions, W. G. Burn Murdoch, illustrated.

PHILOSOPHY AND PSYCHOLOGY.

Methuen and Co., Ltd.—Telepathy, Genuine and Fraudulent, W. W. Baggally, with a preface by Sir Oliver Lodge; The Science of Power, B. Kidd; From the Watch Tower: or Spiritual Discernment, S. T. Klein.

TECHNOLOGY.

Constable and Co., Ltd.—Wool, F. Ormerod, illustrated; Cotton, C. Bigwood, illustrated (Staple Trades and Industries). *Sir Isaac Pitman and Sons, Ltd.*—Glass and Glass Manufacture, P. Marson, illustrated; Gums and Resins, E. J. Parry, illustrated (Commercial Commodities of Commerce Series).

EXPLORATIONS IN THE HAWAIIAN ISLANDS.

PROF. A. S. HITCHCOCK, of the U.S. National Museum, and his son, travelled recently in the Hawaiian Islands, studying the flora, especially with reference to the grasses, making what might be termed a forage survey.

The islands visited were Kauai, Oahu, Lanai, Molokai, Maui, and Hawii. They are all of volcanic origin and composed of lava, except a very small part, which is of coral formation. Kauai, geologically the oldest island, shows the greatest effect of erosion, its deep canyons rivalling the beauty of the Grand Canyon of Colorado. The rainfall on the mountains of the windward side is excessive, that of Waialeale, the highest peak of Kauai, being as much as 600 in. per annum. But the lee side of the islands is arid, the rainfall being often reduced to fewer than 15 in. per annum.

To the south the islands are successively younger, Hawaii, the largest, being even now in a state of volcanic activity. On this island are situated the two highest peaks of the group, Mauna Kea, 13,825 ft., and Mauna Loa, 13,675 ft. in height. There is scarcely any vegetation upon these peaks, above 10,000 ft., especially upon Mauna Loa, which is made up of comparatively recent lava. Much snow covers the peaks in winter, extensive banks persisting throughout the year. The magnitude of the mountain mass is greater than at first appears, because the cones arise from the very floor of the ocean, 18,000 ft. below the surface, thus making the total height more than 30,000 ft. So gradual is the slope from the sea to the summit that the eye is deceived and the great height is not at first fully appreciated. The active volcano, Kilauea (4000 ft.), with its pit of boiling lava, is on Hawaii, while Haleakala, said to be the largest crater in the world, is on Maui, the second largest island of the group.

Important agricultural industries of the island include sugar, live stock, and pineapples. The native Hawaiian population is decreasing, and it is only in the less accessible parts of the islands that the primitive customs still prevail. Here may be found the native grass huts made of a wooden framework filled in with a thatch of grass. The grass used for this purpose is usually pili (*Heteropogon contortus*), an indigenous grass, abundant upon the rocky soil of the lowlands.

The introduced flora is very noticeable near towns, ranches, and plantations, and one must go several miles from Honolulu to find indigenous or native plants. Of sixty species of grasses found on Oahu, about fifty were introduced from foreign countries. One of the introduced trees of great economic importance is the algaroba tree (*Prosopis juliflora*) or kiawe, as the Hawaiians call it. It is found in a belt on the lowlands along the shores of all the islands, and occupies the soil almost to the exclusion of other plants. The pods are very nutritious, and are eagerly eaten by all kinds of stock. Its flowers furnish an excellent quality of honey. The Molokai ranch alone produces 150 to 200 tons of strained honey per year. The prickly pear cactus (*Opuntia tuna*) has become extensively naturalised in the drier portions of all the islands. Two introduced shrubs, Guava and Lantana, now occupy extensive areas, and have become great pests. In the moister portions of the islands large areas have been occupied by Hilo grass, which has little value as a forage plant. The kukui, or candlenut, tree (*Alcurites moluccana*), with its light, almost silvery, green foliage is now a common and rather striking element in the valleys and gorges.

The indigenous flora is highly interesting, though not abundant in species. Two of the commonest trees are the ohia (*Matrosideros polymorpha*) and the koa (*Acacia koa*). The former, also called ohia lehua and lehua, resembles, in the appearance of the trunk, our white oak, but bears beautiful clusters of scarlet flowers with long, protruding stamens. The koa produces a valuable wood much used in cabinet-making. Characteristic of the upper forest belt on the high mountains of Hawaii is the mamani (*Sophora chrysophylla*), a leguminous tree with long, drooping clusters of yellow flowers and long, four-winged pods constricted between the seeds. In the arid regions is found the wiliwili (*Erythrina monosperma*), a deciduous tree with gnarly growth. Its bare branches are conspicuous, as deciduous trees are unusual in the tropics. It has very soft light wood, and bright scarlet seeds. Among the peculiar plants of the islands is the silversword (*Argyroxiphium sandwicense*), a strikingly beautiful composite with glistening silvery leaves, which grows only on the slopes of cinder cones in the crater of Haleakala, and in a few very limited localities on Hawaii. The family Lobeliaceæ is represented by about 100 species belonging to six genera. The numerous arborescent or tree-like species are very peculiar and characteristic. Many of them form slender trunks like small palms, crowned with a large cluster of long narrow leaves, the trunks of some species being as much as 30 or 40 ft. high.

The indigenous grasses of the Hawaiian Islands are not numerous. A tall species of Eragrostis is the dominant grass upon the plain between Mauna Loa and Mauna Kea. Upon many of the summits of the high mountain ridges in the regions of heavy rainfall are found open bogs which support a peculiar and interesting flora. Many species form more or less hemispherical tussocks which rise above the general level of the bog. A showy lobelia with numerous large cream-coloured flowers as much as 3½ in. long, peculiar violets, and a sundew are found there. These boggy areas are devoid of trees, and sometimes occupy

rather extensive areas, the one on Mt. Waialeale covering several square miles.

Three species of tree ferns are found on the islands, and in some places form extensive forests. These plants produce at the base of the stipe a great ball of brownish-yellow wool called pulu by the natives, and used by them for stuffing pillows and mattresses.

HIGHER EDUCATION IN THE UNITED STATES.

THE report of the U.S. Commissioner of Education for the year ended June 30, 1916, has been received from Washington. It consists of two bulky volumes, one running to 692 pages and the other to 663 pages. The first part contains a comprehensive survey of the progress of education in the United States for the school year 1915–16, and also a similar account of educational progress in all those foreign countries from which the U.S. Bureau of Education could obtain sufficient information. The second volume is given up to educational statistics, but owing to the difficulty of compiling such a mass of data and the time absorbed in the task, the numbers provided deal only with the year 1914–15.

The Cost of American Education.

The estimated cost of education in the United States in 1914 was very nearly 160,000,000*l*. An estimate, making due allowances for the time which has elapsed since the date given, would easily bring the current educational expenditure in the States to 200,000,000*l*. Public elementary schools cost approximately 100,000,000*l*.; public high schools, 14,000,000*l*.; private elementary schools, 10,400,000*l*.; private secondary schools, 3,000,000*l*.; universities, colleges, and professional schools, 20,000,000*l*.; and normal schools, 3,000,000*l*.

Gifts and Bequests.

The Bureau of Education periodically publishes tabular statements showing the amounts of gifts and bequests to education. The total for 1914 reached 6,271,490*l*., the greatest ever recorded for a single year. For the academic year 1914–15 the total amount received in this way was 4,062,050*l*.; and of this about 1,997,000*l*. was for increase of plant, 711,300*l*. for current expenses, and 2,153,800*l*. for endowment. Thirty-five universities, colleges, and technological schools reported gifts of more than 20,000*l*., the total amount received by these institutions reaching 2,987,160*l*. The following institutions each received more than 100,000*l*.:—Johns Hopkins University, 271,820*l*.; Wellesley College, 255,585*l*.; Harvard University, 244,000*l*.; University of Pennsylvania, 234,700*l*.; University of Chicago, 228,876*l*.; Yale University, 193,160*l*.; Princeton University, 157,909*l*.; and Massachusetts Institute of Technology, 155,453*l*.

The generous benefactions received for education in the States during 1914 were distributed among the various classes of educational institutions as follows:—

	£
Universities and colleges	5,334,010
Schools of theology	311,660
Schools of law	40,610
Schools of medicine	299,150
Public normal schools	121,490
Private normal schools	23,260
Private high schools	141,310
	£6,271,490

For the forty-four years from 1871 to 1914 inclusive the grand total of gifts and bequests to American education reaches 116,883,616*l*.

Number of Students.

For the year ending June, 1915, the U.S. Bureau of Education received reports from 563 universities, colleges, and technological schools in the different States. States and municipalities control ninety-five of these institutions, and private corporations control 468. There were 237,168 students in the collegiate and resident graduate departments of these institutions, and of this total 84,861 were women.

In the year 1915, 29,608 baccalaureate, 4140 graduate, and 883 honorary degrees were conferred. The degree of doctor of philosophy was conferred on examination by forty-three institutions on 486 men and 60 women.

Agricultural and Mechanical Colleges.

The institutions commonly known as "agricultural and mechanical colleges," or "land-grant colleges," are dealt with in a separate chapter of the report. In some States, it should be remembered, the agricultural and mechanical colleges form parts of the State universities, and in such cases the statistics respecting such universities concern themselves also with the activities of these departments.

During 1914–15 particulars respecting sixty-nine agricultural and mechanical colleges were collected by the bureau. In the fifty-two institutions for white students there were 9742 instructors of various grades, and in the seventeen institutions exclusively for coloured students there were 529 instructors. The total number of students in these institutions was 125,075.

The total income of these colleges for 1915 was 6,392,353*l*., of which 3,601,221*l*. was State and the remainder Federal aid. In addition, the colleges received the following grants for the year:—U.S. grant for experiment stations, 273,858*l*.; State grants for experiment stations, 225,942*l*.; State grants for extension work and farmers' institutes, 215,001*l*.; and U.S. grant for extension work, 98,248*l*. The distribution, according to source, excluding the experiment station funds and the extension and farmers' institute funds, was Federal government 11 per cent., State 56 per cent., and private funds 33 per cent.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

THE inaugural address for the session 1917–18 of the London (Royal Free Hospital) School of Medicine for Women will be delivered by Dr. L. Garrett Anderson, C.B.E., on Monday, October 1, at 3.30 p.m. The subject will be "Ambition."

MENTION was made in NATURE of May 17 (p. 238) of a bequest by the late Mrs. E. D. Denning, of South Norwood, of property for the application of modern scientific knowledge to educational needs. It is now announced in the *Times* (September 18) that Mrs. Denning left estate of the gross value of 169,719*l*., the net personalty being 78,581*l*. By her will she bequeathed "to the Public Trustee all her freehold property in trust for a 'Frank Denning Memorial' for the advancement and propagation of education in mechanical science in any part of the United Kingdom, with preference to those persons who reside in the Borough of Croydon."

A SECONDARY-SCHOOL Examinations Council has been constituted by the President of the Board of Education to assist the Board in the co-ordination of the examinations to which secondary schools now submit their pupils. The council is to consist in the first instance of the following representative members, with the Rev. William Temple, formerly headmaster of Repton School, as chairman:—Oxford and Cambridge Schools Examination Board, Mr. P. E. Matheson; Oxford Delegacy for Local Examinations, Mr. H. T. Gerrans;

Cambridge Syndicate for Local Examinations, Mr. J. H. Flather; University of Bristol, Sir Isambard Owen; University of Durham, Dr. W. H. Hadow; University of London, Dr. R. M. Walmsley; Northern Universities Joint Matriculation Board, Sir Alfred Dale, Prof. B. M. Connal, and Miss S. A. Burstall; County Councils Association, Mr. H. Mellish, C.B., and Dr. H. Lloyd Snape; Association of Municipal Corporations, Mr. Councillor Dawson and Mr. J. G. Legge; Association of Education Committees (not yet appointed); Teachers' Registration Council, Mr. P. Abbott, Miss F. M. Gadesden, Miss E. S. Lees, Mr. G. Sharples, and Mr. A. A. Somerville. For the present Mr. Christopher Cookson and Miss M. Kennedy, H.M. Inspector, will act as secretary and assistant secretary. All communications on the subject of secondary-school examinations should be addressed to the Secretary, Board of Education, Victoria and Albert Museum, Exhibition Road, South Kensington, London, S.W.7, and the envelope should be marked "Examinations Council."

WE have received a syllabus of the evening technological courses offered by the Leeds University, together with a list of scholarships and fellowships held in the University. The technological courses include civil and mechanical engineering, electrical engineering, coal-mining, textile industry, colour chemistry and dyeing, leather industry, and geology applied to sanitary and civil engineering. The courses are co-ordinated with those of the City Council's evening classes, and students under twenty-two years are required to have taken a preliminary course in a technical school and to have reached a certain standard of proficiency before entering the University. The object is to ensure that they shall derive full advantage from the more advanced teaching. In all the courses practical instruction forms an essential feature, and is carried out in buildings specially designed and equipped for the purpose. Of the scholarships, the value of which varies from 20*l*. to 40*l*. a year, tenable for two or three years, twelve in arts, science, or technology are awarded on the result of the examination of the Joint Matriculation Board, and about the same number by special examination or selection, in addition to which the local authority provides a number of scholarships in different branches of study. Among those specially allotted to technology are the Corbett Woodall scholarship in gas engineering (50*l*); the William Cooke and Co. in mining (21*l*.); the William Walker exhibition in fuel and leather (70*l*.–90*l*.); the Craven scholarship in engineering (25*l*.); and a number of Clothworkers' scholarships in the textile industry.

THE President of the Board of Education is delivering a series of addresses in various provincial towns with the object of explaining the Government's intentions in introducing the new Education Bill in the House of Commons. On September 14, at York, Mr. Fisher insisted that we cannot get good education without good teachers, and we cannot get these teachers unless we are prepared to pay for them; and to this end a large additional sum of money has been recently voted by Parliament for elementary education. In proceeding, he explained that it is proposed to extend the facilities for obtaining education. A full-time education up to the age of fourteen is to be insisted upon, and part-time day continuation classes for all young people except those who have obtained full-time secondary education up to the age of sixteen, or are otherwise under instruction. The Bill, the President went on to say, provides for very great elasticity and adaptation to local requirements. The education authorities will be expected to prepare schemes, and will be given a liberal allowance of time for their preparation, but will be required to consult the industrial interests of their localities. On September 15, at Sheffield, Mr. Fisher again referred to the education of boys and girls from fourteen to eighteen years of age. It would, he said, be a disgrace if the country came to the conclusion that some form of education for its adolescents was a good thing, but it was not prepared to disburse what is spent in thirty hours of war. The war has taught us that the nation is rich enough and powerful enough to pay for anything that it really wants. The Education Bill also, he pointed out, contains a large number of clauses devoted to the subject of physical and social education; for the first time it provides for a national system of physical training for young people. He expressed the belief that if the Bill passed into law it would prove to be one of the most powerful instruments ever invented for the furtherance of national health and physique.

THE Headmasters' Conference this year held its annual meeting in the summer holidays on September 12 and 13 at the City of London School. Dr. David, of Rugby, presided, and the first subject discussed was the report of the Royal Commission on the Public Services in India, as a result of which the following resolution was adopted unanimously:—"That this conference regrets, on educational grounds, the recommendation of the Royal Commission on Public Services in India that the age limits for the examination be lowered from twenty-two to twenty-four to seventeen to nineteen. If, however, the Government decides to lower the age, the conference strongly urges that in the educational interest of the candidates, and of other boys taught with them, no candidate be admitted to the examination under the age of eighteen, nor without a 'school certificate' or some similar qualification." Another resolution dealt with the new Secondary-School Examinations Council, on which no headmaster of a secondary school has yet been appointed. The resolution stated "That this conference is of opinion that the representation of teachers in schools should be not less than that of universities on the proposed Secondary-School Examinations Council." The age at which pupils may be transferred from one secondary school to another was discussed. It was generally agreed that a group of schools may with advantage specialise on particular groups of subjects for higher study, so that a boy destined for an advanced and specialised course may, at a later age, be taught in classes not too small. But it was thought to be essential that the change of school should be made at or before the age of fourteen. It was agreed "That the regulations of the Board of Education (Explanatory Note, Section III.) need modification or supplement, in so far as they seem to suggest transference of pupils at or about sixteen from one secondary school to another, experience having already shown that such transferences, unless made at a considerably earlier age, involve great educational loss to the pupil." Papers were read on the teaching of science in secondary schools, and the increase of epidemic disease in boarding-schools was among other subjects down for discussion.

SOCIETIES AND ACADEMIES.

NEW SOUTH WALES.

Royal Society, July 4.—Dr. A. L. du **Toit**: The problem of the great Australian artesian basin. The artesian waters are regarded as composite—residual, plutonic, and rainfall of an earlier epoch. The bulk of the residual water (Mesozoic) is considered to have been replaced by alkaline waters fed in at the sub-basaltic outcrops as well as from below, being evolved by, or derived from,

plutonic masses from which the younger Tertiary basalts—alkaline, trachytes, etc.—were derived. They permeated the Jurassic beds, and the reservoir became charged with waters of fairly uniform composition, carbonate of soda predominating over chloride—in the west. In the east the denudation of the basalt from the intake beds, accompanied by rainfall conditions in early Pleistocene, led to the accession of surface water which is not only displacing earlier accumulations, but also carrying salts downwards from the actual outcrop. The meteoric supply is considered to be the predominant, and the plutonic supply the subordinate, at the present day. Various lines of further inquiry are pointed out, and it is strongly urged that the Government may realise the extremely important and complex nature of the problem, and should sanction some scheme for its thorough study.—T. W. **Keele**: The Sydney water supply. The author relies upon the present catchment area of 350 square miles, on which there are seven available sites for storage reservoirs, together with the Woronora catchment area of eighty-five square miles, on which there are two sites for reservoirs, together with fifty-five square miles on the cap of the mountain range at Wingecarribee, on which there are two sites for reservoirs; the total storage capacity, including Prospect Reservoir, amounting to 116,337 million gallons, to meet the requirements of Sydney for the next twenty years, or up to the end of 1937, when, he estimates, there will be a population of 2,082,000, with a consumption per head per day of 63 gallons, the total estimated daily consumption being 131,207,000 million gallons.

PARIS.

Academy of Sciences, September 3.—M. J. Boussinesq in the chair.—G. **Humbert**: Some properties of binary indefinite quadratic forms.—G. A. **Boulenger**: The classification of fresh-water fishes.—G. **Rémoundos**: The classification of the transcendental points of the inverse of integral or meromorphic functions.—P. **Dejean**: The classification of nickel and manganese steels. Steels containing less than 25 per cent. of nickel, giving a critical point at different temperatures on heating or cooling, and usually classified as irreversible, should be divided into two classes: from 0 to 10 per cent. of nickel, the perlitic steels, pseudo- or quasi-reversible, and from 10 to 25 per cent. nickel, martensic, and truly irreversible. The classification of manganese steels is also considered and some modifications suggested.—C. **Galaine**, C. **Lenormand**, and C. **Houlbert**: The economic utilisation of the peats of Chateauneuf-sur-Rance (Ille-et-Vilaine). The turf is submitted to a hydraulic press giving pressures of 50 to 100 kilograms per square centimetre, and the briquettes thus formed contain only 60 per cent. of water. These are heated in an autoclave for twenty-five minutes to a temperature of 160° C., and on leaving the autoclave are in a condition permitting of rapid air drying down to 25 per cent. of moisture. A recuperative arrangement for the drying is suggested.—A. **Cochain**: An attempt at an explanation of some peculiarities in the tectonics of the Alpine system.—J. **Mascart**: The winter of 1916–17.—A. **Goris**: The utilisation of *Esculus hippocastanum* (horse chestnut).

BOOKS RECEIVED.

Proceedings of the London Mathematical Society. Second Series. Vol. xv. Pp. liii+454. (London: F. Hodgson.)

A Critical Revision of the Genus Eucalyptus. By J. H. Maiden. Vol. iv. Part 1. (Sydney: W. A. Gullick.) 2*s.* 6*d.*

Ulugh Beg's Catalogue of Stars. Revised from all Persian Manuscripts existing in Great Britain, with a Vocabulary of Persian and Arabic Words. By E. B. Knobel. Pp. 109. (Washington: Carnegie Institution.)

Department of Marine Biology of the Carnegie Institution of Washington. Papers from the Department. Vol. xi. (Washington: Carnegie Institution.)

The Beginner's Psychology. By Prof. E. B. Titchener. Pp. xvi+362. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd.) 6*s.* net.

Human Physiology. By Prof. L. Luciani. Translated by F. A. Welby. Vol. iv., The Sense Organs. Pp. x+519. (London: Macmillan and Co., Ltd.) 21*s.* net.

Artificial Dye-Stuffs: Their Nature, Manufacture, and Uses. By A. R. J. Ramsey and H. C. Weston. Pp. ix+212. (London: G. Routledge and Sons, Ltd.) 3*s.* 6*d.* net.

Refractory Materials: Their Manufacture and Uses. By A. B. Searle. Pp. xii+444. (London: C. Griffin and Co., Ltd.) 15*s.* net.

A Concordance to the Poems of John Keats. Compiled and edited by D. L. Baldwin and others. (Washington: Carnegie Institution.)

General Types of Superior Men. By O. L. Schwarz. Pp. 435. (Boston, Mass.: R. G. Badger.) 2.50 dollars net.

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