As a preliminary, the necessary tables are given to enable the manures used to be standardised to ensure uniformity of treatment so far as possible, and the method of noting and reporting the results is clearly outlined. It is recommended that the attention of farmers should be devoted to the improvement of the various classes of grassland on different types of soil, and particulars are given for the manuring of meadow hay, "seeds" or rotation hay, and pastures of different grades. Emphasis is laid on the value of liming experiments, which should be carried on at the same time as the manurial tests.

The attention of agricultural colleges and institutes is directed to the need for various experiments other than manurial trials. Grazing trials properly carried out would provide valuable information as to the best methods of dealing with pasture land, and mechanical operations are suggested to show the effect of mole-draining, cultivation, breaking, and reseeding. In addition, it is suggested that a good deal of attention might profitably be directed to a consideration of the seeds used for sowing down, with regard to the permanence of different varieties, the most suitable mixtures for leys and for renovating permanent grass, and to the possibility of harvesting supplies of seed.

The pamphlet is so suggestive and so broad in its scope that it should find its way into the hands of all interested in grassland, and it is much to be hoped that the official nature of the publication will not prevent it from reaching the general farming public.

W. E. BRENCHLEY.

Levelling Errors.[1]

A DEPARTMENTAL paper lately published by the Survey of Egypt contains an interesting investigation of a systematic error which has been found to occur in the levelling carried out in Egypt and in the Sudan. The effect of this error, which has the same sign over all kinds of ground, acts in the direction of making the backstaff reading systematically too small and the forestaff reading too great. Movement of the staves or level and other sources of error having been eliminated, the author draws the conclusion that the effect of refraction is not wholly removed by keeping the distances between the level and the staves equal in the conditions under which the work is done. Precise levelling in Egypt is carried out in the winter months and during about three hours after sunrise and three hours before sunset. Experiments have shown that at sunrise a temperature lapse-rate of the order of 1° C. to 2° C. per metre often exists, the air being colder near the ground than higher up. In two or three hours this lapse-rate has disappeared, and a little later becomes reversed, so that with hotter air near the ground setting up convection currents, unsteadiness of the staff-image sets in, preventing further work. In the afternoon the ground cools very slowly, so that the change in the temperature lapse-rate, and consequently in the refraction, is then very gradual.

The error is, therefore, traced to the very rapid change in refraction during the early morning hours, of which the effect is noticeable in observations taken at a few minutes' interval. To eliminate it, all staff readings are now taken with as little delay as possible, and the observer reads alternately the backstaff first and the forestaff first—a procedure which has very materially reduced the systematic error, not only in precise levelling, but to a much greater degree in second-order levelling, where the time taken between successive readings is much longer.

1 "Systematic Error in Spirit Levelling." By J. H. Cole. Survey of Egypt Departmental Paper No. 35. (Cairo, 1919.)

It has been recognised for some time that a systematic error may be caused by such a temperature inversion when levelling over sloping ground, but in the present report the rapid change of the temperature lapse-rate from a maximum value to zero is indicated as a cause which may be expected to operate even on level ground in any region where hot days follow clear, cold nights with effective radiation. In the last annual report of the Ordnance Survey such a systematic error, almost invariably of one sign, is referred to as being still unexplained. It would seem that here also local temperature inversions near the ground may be concerned to some extent.

H. G. L.

University and Educational Intelligence.

BIRMINGHAM.—Sir John Cadman is resigning his post as professor of mining at the end of the current session.

CAMBRIDGE.—On May 19 the degree of Doctor of Law *honoris causa* was conferred upon Lord Plymouth, Admiral of the Fleet Lord Jellicoe, Field-Marshal Lord Haig, Rear-Admiral Sir W. R. Hall, M.P., the Abbé Henri Breuil, Institute of Human Paiæontology, Paris, and Sir John Sandys, Orator Emeritus.

LEEDS.—At a meeting of the University Council held on May 19, it was resolved that a chair of physical chemistry should be instituted, and Dr. H. M. Dawson was selected to be the first occupant of the chair. Since 1905 Dr. Dawson has been lecturer in physical chemistry at the University, and has carried out extensive researches in various branches of physical chemistry—in particular, investigations bearing on the constitution of solutions and on the mechanism of chemical change.

LONDON.—The degree of D.Sc. (Engineering) has been conferred on Mr. B. C. Laws, an external student, for a thesis entitled "Elasticity and Distribution of Stress in Thin Steel Plates," and other papers.

From the report of the Principal Officer (Sir Cooper Perry) for 1919–20, it appears that the University can look forward to a period of unprecedented development. Admissions by all channels in 1919–20 amounted to 12,608, almost double the corresponding number for 1913–14. Candidates for first degrees were 936, comparing with 1636, reflecting the diminished numbers of those who matriculated "during the lean—the honourably lean—years of the war." It is of interest to note that of the 1086 candidates for all degrees, 613 were internal and 473 external. This is gratifying evidence that the "private" student is tending to disappear, or, rather, to study under more favourable conditions. The list of benefactions to the University and its colleges is most encouraging. The outstanding gift is from the trustees of the Sir Ernest Cassel Educational Trust of 150,000*l.*, and 4000*l.* a year for five years. New University chairs have been established in aeronautics, modern Greek, Portuguese, Imperial history, Dutch, bacteriology, physiology, pathology, and physics. The question of hostel accommodation is being considered by a special committee. The report concludes on "a justified note of congratulation." The duty of the universities is plain; their province, though extensive and varied, is defined; their way is illuminated; "into the universities the nation looks in a unique degree for hearts and minds fitted to enrich the blood of the race—for the constant supply of men and women of trained insight and enlarged sympathies, aot for the higher offices of citizenship. This is our peculiar duty—to

conduct the Lampadephoria of the inspiration of humanity, and to guard and develop the most precious and enduring aspects of the most comprehensive of all the arts—the art of Life itself."

THE new building of the Department of Applied Statistics and Eugenics (including the Galton and Biometric Laboratories) at University College, London, will be opened by Dr. Addison, Minister of Health, on Friday, June 4. The Vice-Chancellor of the University will preside.

TWO lectures on Factors in the Froth-flotation of Minerals will be given at the Sir John Cass Technical Institute, Aldgate, E.C. 3, by Mr. H. Livingstone Sulman, on Wednesdays, June 2 and 9, at 5.30 p.m. The chair at the opening lecture will be taken by Mr. F. Merricks, president of the Institution of Mining and Metallurgy.

THE Glasgow Technical College is preparing for its entrance hall a monument in bronze and marble to the 612 students and members of its staff who gave their lives in the war. To show the quality and quantity of the war work of the 3218 members, students, and past students of the college who served in the Army or Navy, or on special national duty, the college has issued, in a volume of 211 pages, a list of their names and services. The preface, by Sir George Beilby and Mr. Stockdale, the director, summarises the contributions of the college to research on fuels and explosives, the testing of war materials, and the training of munition workers. The normal classes had to be maintained for the thousands of evening students as well as for the many foreigners and refugees, for whom most of the day classes had to be continued in spite of the reduction in the staff. The successes enumerated include three awards of the Victoria Cross and 336 orders and crosses. Amongst the ranks attained, one student became colonel, fifteen were lieutenant-colonels, and seventy-seven majors. The letters quoted from the Government Departments express high appreciation of the research work conducted at the college. Of its contributions, both of men and mind, to the national strength, the college and science may well be proud.

THE recently issued report on the war work of the College of Technology, Manchester (faculty of technology in Manchester University), gives an interesting account of the services rendered by members of the college in his Majesty's Forces—particularly in connection with the Royal Engineers and the technical branches of the Royal Navy—and in the many fields of scientific research opened up by the war. The greater part of the report is concerned with college war work other than that of supplying men. It appears that before the war was over the college was by no means large enough to undertake all the work which the military authorities—including the Air Board as well as the Admiralty and the War Office—were anxious to entrust to it. The mechanical and electrical engineering departments of the college were intimately concerned with the work of the Lancashire Anti-Submarine Committee, which had its headquarters in the college, and produced and developed several instruments, including, in particular, a deep-sea hydrophone for detecting and combating enemy submarines. The same departments helped to solve certain problems relating to the fitting of wireless apparatus to aeroplanes; for instance, a high frequency alternator, designed and manufactured in the college, was largely adopted for both naval and military 'planes. A new type of gas furnace designed in the college led to important improvements in the heat treatment of machine tools, involving an increase of 30 per cent. in the speed of the machining of shells and other munitions. The same research enabled the college to supply the Admiralty with special blades for cutting mine mooring cables, and when the demand for these blades was greater than the college could supply, the Admiralty required its manufacturers to employ the method of heat treatment devised in the College of Technology. An improved cast iron of high tensile strength, produced under the direction of the metallurgical department of the college, was usefully employed in the manufacture of gas shells. The college departments of applied chemistry and textiles carried out a number of investigations upon fabrics used in aircraft manufacture. A thorough investigation of the structure and scouring of airship fabrics led to the development of a process which was afterwards applied to all R.N.A.S. fabrics. The giant airships R33 and R34 were treated with a special dope produced at the college before starting on their long-distance flights. The chemical laboratories were also engaged during the war in investigating processes for the manufacture of explosives, pharmaceutical products, dyestuffs, rubber derivatives, and foodstuffs.

Societies and Academies.

LONDON.

Royal Society, May 13.—Sir J. J. Thomson, president, in the chair.—Dr. A. D. **Waller**: Demonstration of the apparent "growth" of plants (and of inanimate materials) and of their apparent "contractility." In Sir J. C. Bose's original demonstration an amputated leaf was fixed up in connection with a crescograph, at a magnification stated to be $\times 10^7$, and the indicator was shown to be moving in a direction and at a speed that were stated as representing the growth of the petiole. Alternating currents were now sent through the leaf, causing a sudden reversal of the movement of the indicator, *e.g.* in the demonstration that the present author witnessed at the Royal Society of Medicine the indicator (a spot of reflected light) moved to the right at what he judged to be something like 1 metre per sec. in the direction of elongation (by growth?), and flew off scale in the opposite direction, at least ten times as fast, as soon as the buzz of the exciting coil was heard ("degrowth"). The demonstration was, in Dr. Waller's opinion, illusory. The movement to the right (indicating an elongation of petiole=0·1 m. per sec.) was indeed consistent with "growth," although its rate was surprisingly high under the conditions of experiment. The elongation might, however, have been due to, or modified by, many accidental variations of conditions—heat, moisture, handling of plant during preparation, etc.—and was precisely similar to the gradual elongation that takes place in a damp fiddle-string under similar conditions. The second part of the experiment, when the "excited" plant shortened and caused the indicator to fly off to the left, is held to afford conclusive proof of fallacy. The fact belonged to the familiar phenomena of heat contraction aroused by electrical currents in all kinds of (doubly refracting) moist conductors, whether living or dead, to the study of which attention was directed by Engelmann in his Croonian Lecture of 1895. These are demonstrable with a low-power crescograph ($\times 10^3$), and play a part in masking or simulating physiological changes when a high power ($\times 10^7$) is employed.—W. N. F. **Woodland**: The "renal portal" system (renal venous meshwork) and kidney excretion in vertebrata. The first three parts of this memoir contain, in the first place, proof that the assumption, commonly made in physiological literature, that the venous blood "supplied" to the kidneys of lower vertebrata mixes with