aggregate a large amount of useful work has been accomplished. By their own efforts and with the aid of the colleges of agriculture and the State boards or commissioners of agriculture, the stations are bringing their work home more closely to the farmers through publications, farmers' institutes, agricultural associations, home reading courses, and the Press. It is becoming evident that farm practice in the United States is being materially affected by the work of the stations, and they are more and more relied upon by our progressive farmers for advice and assistance.

The wisdom of Congress in making the Hatch fund a research fund is every year becoming more apparent. This Department is therefore disposed to more strongly insist on a strict interpretation of this act in this direction, and to hold that it is not only in accordance with the obligation, but also to the interest of the States, to devote the Hatch fund to investigations in agriculture and to supplement this fund as far as may be necessary to promote the interests of agriculture in other lines.

The movement for the improvement of courses of agriculture in the colleges with which the stations are connected is steadily growing. The past year has witnessed many changes for the better as regards specialisation of the work of instruction and the development of courses suited to the varied needs of students. More than ever before, the colleges are reaching out beyond their class rooms and are carrying useful instruction to the farmers through farmers' institutes, correspondence courses, and other forms of so-called university extension. As this outside work becomes better organised it is more apparent that it belongs to the college rather than the station.

As the work of both college and station grows in extent and complexity, it becomes more apparent that in order to perform the most efficient service the station should be organised strictly as a separate department of the institution with which it is connected, and that it should have an organisation so compact that its work may proceed in accordance with a schedule carefully planned and energetically administered. To secure this end, experience shows that it is quite desirable that the station should have a competent executive officer, who can devote his time very largely to planning and directing its operations, managing its general business, and representing its interests before the public. It is encouraging to observe that in several States during the past year these considerations have led to the more complete separation of the business of the station from the general business of the college, and to the appointment of a director of the station as a separate officer.

From the very first the stations in the United States have been largely engaged in the inspection of commercial fertilisers, and this work has been so efficiently and usefully conducted that from time to time additional inspection duties have been laid upon the stations. The movement for the establishment of different kinds of inspection service under authority of the National and State Governments is growing apace, and it is very important that the relations of this work to the other functions of the stations should be clearly understood. Soon after the establishment of the stations under the Hatch Act this Department ruled that the funds appropriated under this Act could not be legitimately applied to pay the expenses of the inspection and control of fertilisers. The same principle holds good with reference to other forms of inspection service demanded of the stations. While the methods and usefulness of inspection in any particular line are still problematical, it may be justifiable for a station to take up this work to a limited extent, but as soon as it becomes a matter of routine business the State should provide funds for its maintenance. If it seems expedient that any part of the inspection service should be performed by the station under State laws and at State expense, the matter should be so arranged as not in any way to interfere with the investigations of the station. It is a great mistake to divert the time and energy of a competent investigator to the toilsome routine work of inspection service.

The number and importance of the experiments which the stations are conducting in cooperation with practical farmers and horticulturists have greatly increased of late. Thousands of such experiments are now annually conducted in the United States. These range all the way from simple tests of varieties of plants to special experiments in the management of farm or horticultural crops, live stock, or particular operations, such as tobacco curing. It is coming to be more clearly recognised that the field operations in agriculture or horticulture conducted on the station farm need to be supplemented by similar work in a considerable number of localities in order to be of general usefulness to the State. By going into different localities, as the needs of its work demand, the station can make itself more useful to the State as a whole. Without doubt cooperative experiments need to be very carefully planned and thoroughly supervised to be successfully conducted, and their success depends on their quality rather than their number. It is encouraging to observe that more careful attention is being given to this important matter by station officers, and it is believed that this work may be made much more economical and useful than the permanent substations as ordinarily managed.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—In consequence of the death of Sir John Conroy, a tutorial fellowship in chemistry and physics, to be held in conjunction with the Bedford Lectureship, is announced at Balliol College. The fellow elected will be expected to supervise the whole science teaching of the College and to give instruction in chemistry and elementary physics. Applications, with the names of three persons to whom reference may be made, must be sent to the Master on or before April 18.

Profs. E. A. Minchin and A. Sedgwick have been appointed public examiners in zoology.

Scholarships in natural science are announced for June 18 at Merton College, New College, and non-collegiate students.

CAMBRIDGE.—The Smith's Prizes are awarded to Mr. G. H. Hardy and Mr. J. H. Jeans, of Trinity College. Mr. P. V. Bevan, of the same College, receives honourable mention. The prizemen were second and fourth wranglers respectively in 1898. Mr. Bevan was fourth wrangler in 1899.

Mr. L. Doncaster, of King's College, is nominated to the University table at the Naples Zoological Station.

Miss Meyer has presented to the Geological Museum the valuable collections made by her brother, the late Mr. C. J. A. Meyer.

THE senate of Glasgow University has resolved to confer the honorary degree of LL.D. upon Prof. A. W. Rücker, Sec. R.S., at the graduation ceremony on April 23.

THE council and senate of University College, Liverpool, has passed a resolution "that any measure dealing with the organisation and control of secondary education should provide for the direct representation of Universities and University colleges in the local authorities which such Bill may establish."

THE chair of natural philosophy in the University of Edinburgh will become vacant on April 29, in consequence of Prof. Tait's resignation. The patronage of the chair is vested in the curators. Applications, with relative testimonials, should be lodged with Mr. R. Herbert Johnston, secretary to the curators, at 4, Albyn Place, Edinburgh, on or before June 1.

THE annual general meeting of the Association of Technical Institutions, adjourned in consequence of the death of the Queen, will be held at the Fishmongers' Hall, London, on Tuesday, April 16, when the president, Sir Swire Smith, will take the chair and the president-elect, the Right Hon. Sir William Hart Dyke, M.P., will deliver an address.

FROM the ninth annual report of the Technical Instruction Committee of the City of Liverpool we derive the following facts as to valuable scientific instruction and work assisted by the committee. A course of four lectures was given on "Electric Vibrations," by Prof. O. J. Lodge, F.R.S., and a course of five lectures on "Oceanography," by Prof. Herdman, F.R.S. Both courses proved very successful in achieving the main object for which they were designed, viz., to bring before teachers of schools and classes some of the results of the progress of modern science, and to illustrate the methods and lines upon which this progress is proceeding. Admission to the courses was free to teachers of schools and classes in Liverpool. In 1900 the committee again renewed their grant (of 100*l.*) in aid of the scientific work carried on by the Lancashire Sea Fisheries Joint Committee. A permanent Sea Fisheries Laboratory in the Zoological Department of the University College, under the direction of Prof. Herdman, is partly supported by this grant; and trained assistants are constantly at work in this laboratory investigating fisheries' questions they may arise in

connection with the local industries. One of the rooms of the Zoological Museum at the University College of Liverpool is devoted to a permanent fisheries collection, illustrating the local fishing industries. The committee has thus proved that success attends the co-operation of the work of men of science in University Colleges with that of technical instruction, and their action should lead to the development of a similar policy in other cities.

SCIENTIFIC SERIALS.

Symons's Meteorological Magazine, February.—The pressure of the wind, by R. H. Curtis. In this paper the author deals with the wind-pressure from the point of view of the engineer and its effect upon structures, rather than from a purely meteorological standpoint. After the time of the collapse of the Tay Bridge, in December 1879, a good deal of attention was paid to this subject, and a committee was appointed to consider the question of wind force on railway structures. It estimated that the greatest pressure likely to be experienced over a large surface was 56 lbs. per square foot, but that, to ensure safety, bridges and similar structures ought to be built to withstand four times that pressure. This conclusion has probably led to an extravagant expenditure of money, as the records of improved and well-exposed anemometers have recently shown that this estimated pressure of 56 lbs. was greatly in excess of anything likely to be experienced. It is true that an Osler's pressure anemometer at Liverpool Observatory registered the extraordinary pressure of 90 lbs. on the square foot in March 1871. But this exaggerated record must have been due to a succession of impulses upon the pressure plate, as a wind force of less than 60 lbs. per square foot would, in all probability, have sufficed to carry away the anemometer itself. The author has paid much attention to this subject and will continue his interesting discussion.—Weather records at Slough, by Mr. R. Bentley. Instrumental observations were begun there by Sir William Herschel in the latter part of the eighteenth century. Mr. Bentley communicates classified rainfall values for 1874-1899, and has collected non-instrumental records of interesting phenomena in South Buckinghamshire from a very remote period.

American Journal of Science, February.—Apparent hysteresis in torsional magnetostriction and its relation to viscosity, by C. Barus. A differential method is employed, in which the two identical wires of iron or nickel to be compared are fastened coaxially one above the other, a mirror being attached between them. Accidental temperature effects are avoided by keeping the lower wire submerged in a tube of flowing water. A current can be sent either round or through the wire, so as to place the wire in either a longitudinal or circular field, the effect to be observed showing itself in a shifting of the fiducial zero. The phenomena are independent of the direction of the current and a larger angle of twist does not appear to magnify them. The results, which are somewhat complex, can be understood if magnetisation be regarded as a means of shaking up the molecular mechanism, and thus to produce temporary molecular instability or momentarily very low viscosity.—The dinosaurian genus Creosaurus, Marsh, by S. W. Williston. A description of a shoulder girdle and arm of a carnivorous dinosaur obtained from a deposit in the Freeze Out Mountains, Wyoming. The fossil is well differentiated from Allosaurus, although occurring with remains which may possibly belong to that genus.—The stereographic projection and its possibilities from a graphical standpoint, by S. L. Penfold. A continuation of a previous paper. The graphical methods are applied to some solutions of spherical triangles, in determining geographical distances, and to map projection.—On the melting point of gold, by L. Holborn and A. L. Day. These results have been already noted in the January number of *Wiedemann's Annalen*.—On some new mineral occurrences in Canada, by G. Chr. Hoffmann. The minerals described are lepidolite, newburyite, struvite, schorlomite, danalite, spodumene and uranophane.

Bulletin of the American Mathematical Society, February.—The seventh annual meeting of the Society was held in New York City, on December 28, 1900. Several important changes in the organisation of the Society were made, the membership of which has now reached the fine total of 357 names. Prof. F. N. Cole gives a brief recapitulation of advance since the foundation of the Society, and fully records the proceedings at the Christmas gathering. The titles of seventeen papers are given and abstracts of many of them are here printed. On some birational transformations of the Kummer surface into itself, by Dr. J. I. Hutchinson, is a paper read at the meeting. Another paper that was read is entitled "Theorems concerning positive definitions of finite assemblage and infinite assemblage," by C. J. Keyser. A third paper, by W. B. Ford, is entitled "Dini's method of showing the convergence of Fourier's series and of other allied developments." Short notice follows of Fehr's Application de la méthode vectorielle de Grassmann à la géométrie infinitésimale, by E. B. Wilson, and of the Annuaire pour l'An 1901, publié par le Bureau des Longitudes, by Prof. E. W. Brown. Notes and new publications as usual.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, February 21.—"An Investigation of the Spectra of Flames resulting from Operations in the Open-hearth and 'Basic' Bessemer Processes." By W. N. Hartley, F.R.S., Royal College of Science, Dublin, and Hugh Ramage, A.R.C.Sc.I., St. John's College, Cambridge.

Three papers on "Flame Spectra," by one of the authors, were published in the *Philosophical Transactions* for 1894. Parts I. and II., "Flame Spectra at High Temperatures," and Part III., "The Spectroscopic Phenomena and Thermochemistry of the Bessemer Process."

The spectroscopic results were quite different from those previously obtained by observing the "acid" process, as the continuous spectrum was much stronger. Many lines and bands new to the Bessemer flame spectra were observed.

Twenty-six plates of spectra were photographed. The spectra increase in intensity as the blow proceeds in the first stage, and this can only result from a corresponding increase in the temperature of the bath of metal and of the flame.

Considerable difficulty was experienced in the identification of some of the lines and bands; some were due to uncommon elements, and others were relatively much stronger than a study of the oxyhydrogen flame and other spectra of the same metals had hitherto shown.

Conclusions.

(1) Line spectra are not observed in the open-hearth furnace. This is attributed mainly to the fact that the atmosphere of the furnace is oxidising, and under these conditions, as Gouy has shown (*Phil. Mag.*, vol. ii., 1877, p. 156), only sodium gives a spectrum approaching in intensity that which it gives in a reducing flame.

(2) The phenomena of the "basic" Bessemer blow differ considerably from those of the "acid" process.

First, a flame is visible from the commencement of blowing. The immediate production of this flame is caused by carbonaceous matter in the lining of the vessel, its luminosity is due partly to the volatilisation of the alkalies, and to the incandescence of lime dust carried out by the blast.

Secondly, volatilisation of metal occurs largely at an early period in the blow, and is due chiefly to the smaller quantity of silicon present.

Thirdly, a very large amount of fume is formed towards the close of the second period. The flame is comparatively short, and the metallic vapours carried up are burnt by the blast.

Fourthly, the "over blow" is characterised by a very powerful illumination from what appears to be a brilliant yellow flame: a dense fume is produced at this time composed of oxidised metallic vapours, chiefly iron. The spectrum is continuous, but does not extend beyond wave-length 4000. The light emanates from a torrent of very small particles, liquid or solid, at a yellowish-white heat.

Fifthly, the spectra of flames from the first stage of the "basic" process differ from those of the "acid" process in several particulars. The manganese bands are relatively feeble, and lines of elements, not usually associated with Bessemer metal, are present. Lithium, sodium, potassium, rubidium and cæsium have been traced mainly to the lime used; manganese, copper, silver and gallium to the metal.

(3) Differences in the intensity of metallic lines. The intensity of the lines of any metal varies with the amount of the metal in the charge, but they are also to be traced to changes in temperature; as the temperature of the flame rises, some lines