

time the off-season arrives that infection dies out completely, presumably because the few susceptible rats then surviving are so scattered as to render it difficult or impossible for infected fleas to perpetuate the epizootic by passing from one rat to another.

Now the few towns or villages in which plague infection is likely to persist through the off-season can be detected with a little practice and with the aid of certain "charts"; and the authors' scheme was to reinforce the natural tendency of plague infection to die out by further reducing the rat population in these centres by poisoning or some other means of destruction. Any future epidemics which might occur within the experimental area would then be entirely dependent on re-importation from without.

The experiment was carried out in those places, fifty in number, which were considered likely to carry over the infection from one season to the next (of the 407 places excluded as not likely to carry over, only three, in fact, continued to harbour plague throughout the off-season). The agent of destruction was the "Punjab Rat-exterminator."

Briefly, the experiment was not a success; and since there was practically no failure in "spotting" the places likely to carry over, since, too, the authors are able to conclude that an epidemic of plague in this area is far more dependent on off-season centres of plague infection within the area than on importation of infection from without, it follows that failure was attributable largely to the inadequacy of the methods of rat-destruction.

The authors, therefore, determined to concentrate on the improvement of methods of rat-destruction. Traps were found to vary considerably in efficiency, and can be much improved by attention to certain apparently trivial details of construction. Hydrocyanic acid gas, in general a useful method of destroying rats and their fleas, would be of little practical value for the present purpose unless some method could be devised of rendering Indian houses more airtight while they are being fumigated.

The most efficient and suitable rat poison, of all those experimented with, was barium carbonate. Three grains is a suitable dose; this quantity mixed with four times its weight of food material does not diminish the amount of the latter consumed by the rat; the Punjab rat-exterminator—a phosphorous compound—was, however, found to be actively repulsive to the rat. Barium carbonate, again, was found to be twice as poisonous as the Punjab compound, and a lethal dose costs only one-sixtieth as much as one of the latter substance. Arsenious acid would be the most suitable substitute for the barium carbonate if this were not available. *Bajri* flour is the best vehicle.

The authors' experiments are as yet incomplete, and have, so far, been carried out only in the laboratory; they hope, however, to amplify them and confirm them under more natural conditions. When, armed with their new knowledge, they return to the practical work of rat destruction, we hope that the problem of plague extermination will be advanced one stage nearer a solution.

### The Carbonisation of Peat in Vertical Gas Retorts.

THE programme of work undertaken by the Fuel Research Board includes research into the utilisation of machine-won peat, and a report has been issued giving the results of the first series of experiments on the carbonisation of peat in vertical gas

retorts with steaming. This material was macerated in 1920, spread on the bog at Turraun, air dried and harvested there, and early in 1921 a hundred tons were sent to the Fuel Research Station, primarily for experiments upon its use in carbonisation and boiler firing.

The peat as received at East Greenwich consisted of hard blocks with a density rather under 1, or about twice that of the ordinary hand-cut sods made on the same bog. The water content, about 25 per cent., was reduced on storage under cover to 17 per cent. These peat blocks are reported to have lent themselves admirably, after suitable treatment, to carbonisation in vertical retorts at temperatures between 750° and 850° C., and also in steel retorts at 550° and 600° C., the resultant charcoal being ideal fuel for suction gas producers. The vertical retort setting for carbonisation was of the Glover-West design, somewhat modified, as used in the tests already reported on the steaming process for gas-making from coal. Some difficulties were encountered, mainly of a mechanical order. The peat was not suitable for feeding with the ordinary arrangement, and the high percentage of dust which it contained on crushing gave trouble from its being carried forward into the gas main and forming a thick mass with the tar. A through-put of three tons of peat per retort was maintained.

After supplying sufficient heat for carbonisation of the peat there were for disposal from each ton of peat 7940 cubic feet of gas of 325 B.Th.U., 12.6 gallons of tar, 95½ gallons of liquor of 3.6 oz. strength per ton, and 5.4 cwt. of charcoal. The liquor was weak, and its quantity corresponded with some 27 lb. of ammonium sulphate per ton. The peat gas, which was very dense, contained 15 to 17 per cent. carbon dioxide, but it burned with a satisfactory flame though with only slight luminosity. A feature of the gas was the heavy sickly odour which it gave out on combustion. The light spirit amounted to nearly two gallons per ton of peat.

The report is supplemented by eight tables in which various thermal and chemical data are collected, including analyses of the peat and its products, and an examination of the tar oils.

J. W. C.

### University and Educational Intelligence.

ABERDEEN.—A special examination for ex-Service students has resulted in the capping of twenty-eight graduates in medicine—M.B. and Ch.B. degrees—of whom four are with distinction. The informal graduation ceremony was conducted on December 24 by the Vice-Chancellor, Principal the Rev. Sir George Adam Smith.

LEEDS.—The Council of the University has conferred upon Mr. W. E. H. Berwick the appointment of reader in mathematical analysis. Mr. Berwick has been lecturer in the department of mathematics of the University since October, 1920.

THE following elections to the scholarships in commerce have been made by the University of London:—Sir Edward Stern scholarships of 50l. a year for two years, W. W. Hewett and K. P. Rush. Sir Ernest Cassel scholarships of the value of not less than 200l. for the study of commerce in foreign countries, C. E. Benzecry, W. F. Crick, T. A. Hooker, and F. W. Taylor.

THE *Chemical Age* announces that the trustees of the Ferguson Bequest Fund have unanimously approved the appointment of Mr. Henry Hyman to be the first Ferguson fellow for research in applied chemistry. The fellowship is of the annual value of 200*l.* for two years, and the research may be carried out at Glasgow University, the Royal Technical College, or elsewhere, as the fellowship committee may direct.

THE proprietors of the *Practical Engineer*, by arrangement with the International Correspondence Schools, are offering a scholarship in mechanical engineering of the value of 30*l.* The scholarship, which is open to subscribers to that periodical of all ages and both sexes, will be awarded to the candidate submitting the best essay on "Why I would Choose an Engineering Career To-day." Full particulars may be obtained from the *Practical Engineer* offices, 8 Breems Buildings, Chancery Lane, E.C.4.

THE British Federation of University Women is giving practical expression to its belief in international ideals by the offer of a travelling fellowship, value 300*l.*, which is open to members of all national federations of university women forming branches of the International Federation. The fellowship will be tenable for the academic year 1922-23, the main condition being that research or post-graduate study shall be undertaken in some country other than that in which the fellow has received her previous education or habitually resides. Full particulars can be obtained from the Secretary, British Federation of University Women, 73 Avenue Chambers, Vernon Place, W.C.1.

### Calendar of Scientific Pioneers.

**December 29, 1731. Brook Taylor died.**—Educated at Cambridge and a man of means, Taylor was devoted to the arts and sciences, served as secretary to the Royal Society, and in 1715 published his "Methodus Incrementorum Directa et Inversa," a treatise dealing with the calculus of finite differences and containing the important theorem which bears his name.

**December 30, 1644. Johann Baptista van Helmont died.**—A student of medicine at Louvain, van Helmont settled on his estate near Brussels. Though imbued with the superstitions of his day, he was a careful experimenter, and is remembered for his early researches on various gaseous substances.

**December 30, 1691. Robert Boyle died.**—The son of an Irish earl, Boyle devoted his life to the advancement of science and the spread of religion. He made numerous additions to physics and chemistry, and his name is perpetuated by the well-known Boyle's law, discovered by him in 1662 and independently by Mariotte about 1676.

**December 31, 1719. John Flamsteed died.**—The first of a long line of distinguished Astronomers-Royal, Flamsteed began his observations at Greenwich on October 29, 1676, the erection of the observatory being directly due to the need for improving the means of finding the longitude at sea. Flamsteed investigated the fundamental points of astronomy and formed a catalogue of 2935 stars, but his "Historia Cœlestis" was not published in its complete form until 1725.

**December 31, 1868. James David Forbes died.**—For twenty-seven years professor of natural philosophy at Edinburgh, Forbes was best known for his researches on heat and on glaciers. Like Brewster, he was one of the founders of the British Association.

E. C. S.

### Societies and Academies.

LONDON.

**Geological Society**, December 7.—Mr. R. D. Oldham, president, in the chair.—S. S. Buckman: Jurassic chronology: II., Preliminary studies. Certain Jurassic strata near Eype's Mouth (Dorset): the junction-bed of Watton Cliff and associated rocks. A detailed section is recorded of a white lithographic bed in Watton Cliff which shows faunal inversion. The dating of this bed is discussed, and a theory of stratal repetition and coalescence is discussed. Its main date is taken to be Yeovilian, *Hammatoceras hemera*. The white lithographic bed of Burton Bradstock is cited as evidence of stratal repetition, and a theory as to its deposition and partial destruction is put forward. Both beds are cited as evidence of Alpenkalk conditions prevailing in western Europe at two well-separated Jurassic dates, both of them earlier than the times of Alpenkalk deposits in central and eastern Europe. A new species of rhychnonellid from a deposit at Thorncombe Beacon is described.—J. Stansfield: Banded precipitates of vivianite in a Saskatchewan fireclay. The pale grey Tertiary fireclay worked for firebricks contains bluish-black patches, the central portions of which are deeply coloured and usually surrounded by a uniformly stained area or by several concentric stained layers of varying tint. The colour is due to an amorphous variety of vivianite, formed presumably by precipitation brought about by iron-solutions reacting on solutions of phosphates of organic origin, such solutions being brought together by diffusion through the colloidal clay. The spacing of the vivianite-bands is irregular, and appears to follow no known law.

**Optical Society**, December 8.—Mr. R. S. Whipple, president, in the chair.—L. C. Martin: The physical meaning of spherical aberration. Experimental determination of the intensity of light near the focus of a lens system shows that the "spurious disc" appearance persisted at the best visual focus, even with large amounts of aberration. Increasing the aberrations draws light from the central concentration and scatters it in the surrounding field; from measurements of the loss the necessity of restricting the phase residuals to within  $\lambda/6$  is inferred. Spherical aberration produces marked asymmetry on each side of the focus.—F. L. Hopwood: An auto-stroboscope and an incandescent colour top. The production of a variety of stationary dark images, due to the eclipse of an incandescent wire by an adjacent cold wire or opaque object when both are revolving about a common axis, was described. The phenomena might be practically applied to the study of the behaviour of a rotating body by converting it into an auto-stroboscope.—J. W. Gifford: Achromatic one-radius doublet eyepieces. Eyepieces both of the Huygenian and the Ramsden types have been constructed from pairs of one-radius achromatic doublets with external plane surfaces to the flint lenses. They compare well with the German orthoscopes in definition, while the cost of production, since the same radius serves for each doublet, or in the case of the Ramsden throughout, is sensibly less. Such eyepieces are adapted either for the telescope or the microscope. By their use a more perfect achromatism is obtained, and also in both of them a flat field, very extensive in one case, likely to be useful in such operations as counting blood corpuscles, etc.

**Association of Economic Biologists**, December 9.—Sir David Prain, president, in the chair.—J. H. Priestley: The resistance of the normal and injured plant-surface to the entry of pathogenic organisms. When the protective surface of the flowering plant is injured the