tigation and interpretation by modern colloid chemistry. Non-aqueous colloid systems present as yet an almost entirely new field.

Prof. Bancroft has presented in very readable form stimulating problems which should serve to emphasise the growing necessity for the research worker in all branches of chemistry to keep in close touch with the future developments of a branch of his science underlying all industrial chemistry, but which, unfortunately, is not yet sufficiently recognised in the curricula of universities and other institutions possessing honours schools of chemistry.

Orientation in Egypt.[1]

By COL. H. G. LYONS, F.R.S.

MR. RICHARDS'S short note of eleven pages, which has been published by the Survey of Egypt, deals with observations which were made in 1913 and 1914 to determine the azimuth of the axis of Karnak temple. In 1890 Sir Norman Lockyer took some preliminary observations, which suggested to him that the temple at the time of its foundation had been definitely oriented to the sun at sunset at the summer solstice, a conclusion which others made by Mr. Wakefield in 1891, and later by Mr. Howard Payn (NATURE, October 19, 1911) appeared to confirm.

On all these occasions, however, the line of the temple axis was much obstructed by fallen blocks of masonry, and not until 1913 was the clearing so far advanced that satisfactory observations could be made. The results then obtained differed considerably from the earlier ones. As a control the temple axis was carefully surveyed in 1914, and a new determination of the azimuth was then carried out, which fully confirmed that of the year before, namely, 26° 54′ 0″ north of west. The declination of the sun for it to shine down the temple axis must, consequently, be 25° 9′ 55″, instead of 24° 18′ 0″, which the earlier observations had indicated, and the date of foundation deduced therefrom, instead of being 3700 B.C., would be carried back to a time far anterior to the earliest estimate of any Egyptian civilisation. Karnak temple cannot, therefore, be a solar temple having its axis directed to sunset at the summer solstice.

[1] "Note on the Age of the Great Temple o Ammon at Karnak as determined by the Orientation of its Axis." By F. S. Richards. (Cairo Government Press, 1921.)

It had seemed that much support was given to the hypothesis of orientation by inscriptions which definitely describe the foundation ceremony as including the stretching of the measuring cord and the alignment of a peg on a celestial body. But our knowledge of the foundation ceremonial is still incomplete, and it is doubtful if it described a practice which was carefully and accurately carried out at the founding of each new temple; more probably it was a very early rite, which had become purely ceremonial by the time when masonry temples were erected, and when other considerations often influenced the laying out of a site.

At Karnak the axis of the sanctuary, of which the azimuth was determined, was 35·5 metres long, but on account of weathering the centres of various doorways cannot be determined within a centimetre, and an error of 1′ in the azimuth, which may be introduced by this, would alter the date by some 190 years.

Luxor temple has been quoted as a case of a temple in which successive additions were laid out with slightly different azimuths of their axes to compensate for the changing amplitude of the star, which could no longer be seen along the axis of the earlier portion. But Borchardt (*Zeitschrift für aegyptische Sprache*, vol. 34, 1896) has indicated conditions on the site which may equally have necessitated the slight displacements of the later additions, apart from any astronomical considerations. It seems, therefore, unlikely that the foundation dates of Egyptian temples can be determined more accurately from astronomical data than by archæological methods.

Experiments on Plague Eradication in India.

IN "An Experiment in the Eradication of Plague Infection carried out in the Poona and Adjacent Districts: First Report (for the period 1914–16)," and "Further Experiments in Plague Prevention carried out at Poona: Second Report (for the period 1916–18)" (*Indian Journal of Medical Research*, vol. 8, No. 3, January, 1921), Major J. C. G. Kunhardt, I.M.S., and Assistant-Surgeon G. D. Chitre give their experiences as to the possibilities of eradicating plague by rat reduction during the non-epidemic season, and suggest improvements in the methods of rat-destruction.

The basis of the work is the finding of the Plague Research Commission that epidemics of bubonic plague in India may be regarded as entirely dependent on, and perpetuated by, epizootic plague in rats. Hence measures for increasing the immunity of man by inoculation, or for protecting him from infected fleas by evacuation, flea-destruction, etc., could, by themselves, in no way bring about the eradication of the disease from any area; and measures for the eradication of plague infection must depend entirely on the reduction of the rat population. This reduction can be effected indirectly, either by limiting the shelter and food-supply of rats, or by fostering their natural enemies; or directly, by their destruction with traps, poison baits, etc. Practical considerations of several kinds, however, convinced the authors that active rat-destruction was the only available measure.

The method adopted depended on the fact that there is normally, in every year, a season when plague dies down. The new epidemic may be started either through the importation of infection from outside, or through the recrudescence of the disease harboured, though not manifest, in the area itself. In the area selected for experiment—the districts of Poona, Ahmednagar, Satara, and Sholapur—the "off-season" includes April, May and June.

It has been shown that in the great majority of places infection dies out completely before or during the off-season. It may not do so, however, in a large town or village, or one into which infection was first introduced comparatively late in the plague season, since here a number of rats would still be present at the beginning of the off-season, sufficient, sometimes, to enable a rat-epizootic to smoulder on during the unfavourable period. Under the opposite conditions—small town or village, and early introduction—the rat population becomes so reduced by the

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 50*l.* a year for two years, W. W. Hewett and K. P. Rush. Sir Ernest Cassel scholarships of the value of not less than 200*l.* for the study of commerce in foreign countries, C. E. Benzecry, W. F. Crick, T. A. Hooker, and F. W Taylor.