pilchards. The kinds of organisms eaten depend on the phase of the fish—they are larval gastropods, diatoms and flagellates, larval molluscs and crustacea in the case of the herring; green (chlorophyllian) organisms, copepod eggs and larvæ, and copepods (sprat); copepod eggs, larvæ and adults, then mud-containing unicellular organisms, and finally molluscan larvæ in the case of the pilchard. A remarkable result is the great proportion of larval fishes which contain no apparent food, and this observation may lead to most valuable results if it can be shown that there is a correlation between the number of empty stomachs and the poverty of the sea in the necessary food-organisms. In that case we should have an easily observed measure of the coincidence between the period of abundance of larval fishes with that of sufficient food, or *vice versa,* and this is obviously the kind of datum required in order that we may be able to forecast good or bad fishery years. Obviously, the work noticed is of much importance. J. J.

The Need for Research in Colloid Chemistry.[1]

By WILLIAM CLAYTON.

COLLOID chemistry has never been discussed so frequently as it is to-day. Its comparatively recent growth and development, and the fact that its ramifications extend into every field of chemical research and industry, seem to be leading chemists to turn to colloid chemistry as a possible panacea for their numerous and varied difficulties. Certain it is that no branch of applied chemistry to-day can be declared free from colloid problems, and that the chemistry of to-morrow will be colloid chemistry, pure and applied.

Prof. Bancroft's compilation of two hundred research problems adequately serves, not only to demonstrate the wide industrial applications of colloid theory, but also to show the present position of the theoretical science itself with its too frequently purely empirical generalisations. He devotes seventy-one of his problems to a consideration of adsorption phenomena—a correct proportion, no doubt, since adsorption data can be obtained in a very definite *quantitative* way, and the results admit of immediate and varied application.

Adsorption is now recognised as playing a determining influence in heterogeneous catalysis, emulsions, fogs and smokes, surface tension, stability of solutions, coagulation and precipitation, etc. Prof. Bancroft pays particular attention to adsorbed gas films and their influence in contact catalysis. Notable progress in this field has been made by Langmuir in America, who has adduced good evidence that such adsorbed films are of monomolecular thickness. That stable films can exist at atmospheric pressure can be argued from several effects, *e.g.* catalytic poisons, passivity, over-voltage, and lubrication.

Under adsorption Prof. Bancroft details problems in flotation and wetting power, pointing out that no systematic study of the selective adsorption of liquids by solids has yet been published. Quantitative work is urgently needed in this connection, especially as the literature on the flotation of ores contains many papers lacking in sound colloid chemistry.

The caking of powders, setting of cements, behaviour of coarse and fine powders in liquids, and the reversibility of the calomel electrode are a few of the many problems involving adsorption phenomena.

One problem (No. 56) is of outstanding importance, viz. "the quantitative adsorption of dyes by alumina, stannic acid, etc., with special reference to hydrogen-ion concentration." The work of Jacques Loeb on the effect of various electrolytes on gelatin in solutions, with definite hydrion concentrations, has placed the chemistry of gelatin, casein, and other amphoteric proteins on an entirely new footing. Such proteins possess a certain pH value indicating neutrality (gelatin, $p\text{H}=4{\cdot}7$). When the pH value exceeds the neutrality figure the protein behaves as an acid, combining with cations; when the pH value is less, the basic tendencies are pronounced and combination with anions occurs. In the light of this work such familiar generalisations as the Hofmeister series of ions or the Pauli series of acids present no real existence, since the pH values were not measured. Membrane permeability, dye-staining, and certain physiological phenomena must all be referred to measured hydrion concentrations.

On the subject of emulsions Prof. Bancroft rightly points out that, whilst the problem of making emulsions has been well investigated, the converse, breaking of emulsions, has not been so thoroughly studied. Stable emulsions are only too frequently a source of great trouble in industrial operations, and work on the theoretical principles involved in devising means for their coagulation or separation is very desirable. In this connection, too, it is pointed out that, in the centrifuging of colloidal systems, no systematic study has been made connecting the quantitative relations between density, size of particles, and number of revolutions per minute necessary to cause precipitation.

Mention is made of the recent work of Holmes and Child, who failed to find evidence for the adsorption of gelatin at the oil-water interface in kerosene/water emulsions. This result contradicts the observation of Winkelblech, who proved that gelatin concentrates at the dineric interface when organic liquids are shaken with water. In any case, the effect of adsorbed films or protective layers of the emulsifying agent in emulsions still leaves much room for inquiry. The old problem of effect of oil concentration on the type of emulsion is brought up once more, Prof. Bancroft doubting the accuracy of Bhatnagar's recent work on the reversal of phases in oil and water emulsions.

A problem of direct industrial importance is referred to in connection with the saponification of fats with lime. It is tentatively put forward that water is the real hydrolysing agent, and that the lime is important because the calcium soap which is formed causes the water to emulsify in the fat, instead of the fat in the water. In this connection it is of interest to refer to Weston's recent work on the use of colloidal clay as an emulsifier-catalyst in the saponification of oils and fats.

Finally, we can only briefly mention one other important field discussed by Prof. Bancroft, viz. the formation and stability of colloids in non-aqueous liquids. The nature of the stabiliser present in such solutions, the peculiar behaviour of the alcohols with silver alcosol, the formation of jellies in organic liquids, the chemistry of the cellulose esters, the behaviour of mixed colloids in non-aqueous solvents—these are but a few of the problems requiring inves-

[1] "Research Problems in Colloid Chemistry." By Wilder D. Bancroft, Member of the Committee on the Chemistry of Colloids: National Research Council. Reprint and Circular Series of the National Research Council (U.S.A.). No. 13 (1921). 50 cents.

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