A more detailed description of the experience gained will be published elsewhere. This work was supported financially by the Swedish State Council of Technical Research.

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A Test of the Interpretation of X-Ray Patterns of Micelles

CLEAR transparent solutions of soaps and detergents give characteristic X-ray patterns, due to the colloidal micelles formed by association of ions or molecules or both. There is still, however, no agreement about the number and kinds of micelles which can be present[1]. Hess and Gunderman[2] were the first to explain the X-ray patterns upon the basis of lamellar micelles consisting of double layers of molecules separated by equally spaced layers of water. Harkins[3] recently directed attention to a so-called '*M*-band' in the pattern and attributed it to diffraction from the double-leaflet alone.

The following experiments with a double-leaflet of lead stearate show that it is indeed possible for a double-leaflet to give an *M*-band.

The film of lead stearate was deposited on a thickly chromium-plated, slightly curved brass slide from monolayers of 'stearic acid' spread on a saturated solution of lead chloride at *p*H 5·5, following the procedure of Clark and Leppla[4]. Either 'oleic acid' or castor oil was used as piston oil. The multilayers were placed at an angle of grazing incidence in a slit camera as used in the X-ray investigation of solutions of detergents, with a distance of 200 mm. between specimens and film. Thus a single double-leaflet or any multiple thereof could be examined and the patterns compared with those from solutions.

A single double-leaflet gave, after 17 hr. exposure, a faint but distinct diffraction pattern in three orders, definitely *less* intense than micelle patterns, in spite of the presence here of lead atoms, but comparable with the rather indistinct *M*-band.

As the double layers were multiplied, the multilayers gave much more intense patterns, quite comparable with those of micelles. Comparison with a multilayer consisting of twenty-five double layers showed that the positions of all the *lines* of the diffraction pattern are *independent* of the number of layers and are identical with the powder pattern of solid lead stearate, the long spacing of which is 49·5 A. This enables us to decide another disputed question. It has sometimes been proposed to apply a correction factor of 1·23 to Bragg spacings in solutions of detergents, as in those of fluids[5]; but it is evident from the present results that 1·23 should *not* be applied.

The occurrence of higher orders in patterns from multilayers of *solid* lead stearate, and their absence in micelles, can be readily explained by taking into account the thermal motion of the micelles and the high electron density of the lead atoms[6].

A detailed report of this investigation will appear elsewhere. We are grateful to Prof. J. W. McBain for advice and the facilities of his laboratory. One of us (J. T. D.) is indebted to the Bristol Myers Co., the other (W. P.) to Lever Brothers Co., for the award of the fellowships.

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Variable Colour-Amplitude Phase-Contrast Microscopy

SEVERAL variable phase-contrast systems have been described. Most of these make use of polarized light in order to obtain variation of phase or amplitude, or both[1]. An experimental microscope has been constructed by Messrs. Cooke, Troughton and Simms, Ltd., which allows the operator to obtain positive or negative phase-contrast at will, and to control the intensity of either the direct or diffracted light. A 'Soleil' compensator enables retardations ranging from $+\lambda/4$ to $-\lambda/4$ to be introduced. A full description of this instrument[2], together with an account of the work carried out with it in this laboratory, will appear shortly[3].

A system of this type affords the possibility of introducing a difference of colour between the direct and diffracted light. This can be done by using a dichroic filter in place of either the polarizer or the analyser. Recent work, carried out in collaboration with Mr. D. Anderson, of the British Scientific Instrument Research Association Laboratories, has resulted in the production of a very large number of strongly dichroic filters. These were made by staining stretched cellulosic films with various dyes. With suitable combinations of such filters it is possible to have the light passing through the phase annulus, say, green, whereas that passing through the rest of the objective (the diffracted light) is, for example, red. As the polarizer or filter is rotated these colours reverse. Were these colours 'pure', no phase-contrast effects would be obtained, as the conditions necessary for interference could not exist. However, in actual fact, the transmission spectra of the filters usually overlap considerably, so that phase-contrast is possible over the common spectral range. Superimposed on this phase-contrast effect, we have what is essentially 'differential colour illumination' described by Rheinberg[4]. This results in the background and broad detail (carried mainly by the light which has passed through the annulus) appearing in one colour, while fine detail and regions of discontinuity of phase-change appear in another.

A full evaluation of the method must await the construction of a special objective with polarizing elements incorporated in the phase plate. Most of the systems hitherto described make use of quartz or other birefringent materials which may introduce complications such as rotary dispersion and dispersion of birefringence. Nevertheless the results so far