References

Ariëns, E. J. (1954). *Archs int. Pharmacodyn. Thér.*, **99**, 32–49.
Barrett, A. M. (1965). *Br. J. Pharmac. Chemother.*, **25**, 545–556.
Engelhardt, A. (1965). *Arch. exp. Path. Pharmak.*, **250**, 245–246.
Fain, J. N. (1967). *Ann. N.Y. Acad. Sci.*, **139**, 879–890.
Koefoed-Johnsen, V., Levi, H. & Ussing, H. H. (1952). *Acta physiol. scand.*, **25**, 150–163.
Rudman, D., Garcia, L. A., Brown, S. J., Malkin, M. F. & Perl, W. (1964). *J. Lipid Res.*, **5**, 28–37.
Santi, R., Ferrari, M., Tóth, C. E., Contessa, A. R., Fassina, G., Bruni, A. & Luciani, S. (1967). *J. Pharm. Pharmac.*, **19**, 45–51.
Somani, P. & Lum, B. K. B. (1965). *J. Pharmac. exp. Ther.*, **147**, 194–204.
Ussing, H. H. & Zerahn, K. (1951). *Acta physiol. scand.*, **23**, 110–127.
Wenke, M., Mühlbachová, E., Elisová, K., Schusterová, D. & Hynie, S. (1964). *Int. J. Neuropharmac.*, **3**, 283–292.

The penetration temperature of aqueous sodium dodecyl sulphate solutions into solid long-chain alcohols

SIR,—When a surfactant, amphiphile and water are mixed, a spontaneous formation of ternary liquid crystalline phase occurs in one of two ways depending on how the components are mixed (Lawrence, 1959, 1961a, b). If a piece of surfactant-amphiphile mixture is flooded with water, myelinic tubular forms appear. These are strongly birefringent close to the original mixture but the birefringence decreases as the myelins become more elongated and finally the outer part dissolves to form an isotropic solution.

If, however, the solid amphiphile is immersed in surfactant solution, spontaneous formation of ternary mesophase again occurs, but with two differences. Firstly, true myelins are not formed but only tubular myelin-like protuberances. These are deformed spherulites which, unlike true myelins, do not possess a central core of isotropic solution (Lawrence, 1958). Secondly, there is a sharply defined temperature, T_{pen}, below which an isotropic solution occurs very slowly, while at and above T_{pen} penetration of surfactant solution into the amphiphile occurs by formation of ternary liquid crystal phase. The first step is the formation of a film of mesophase around the amphiphile, followed by myelinic-like protuberances, formed as the surfactant solution penetrates into the amphiphile. These extrude into the aqueous solution and then break up into liquid crystal spherulites as they become fluid enough for surface tension to act.

T_{pen} varies with the nature of the hydrophobic and hydrophilic groups of the surfactant and amphiphile. It has been stated that T_{pen} does not vary with concentration of surfactant over wide limits (Lawrence, 1958; Lawrence, Bingham & others, 1964) or that it varies only slightly with concentration (Lawrence, 1961a, b). We have investigated this for aqueous sodium dodecyl sulphate solutions in the range 0·5% to 20·0% w/w using the normal C_{14}, C_{16} and C_{18} alcohols. The purity of the alkyl sulphate and 1-hexadecanol was as given by Barry & Shotton (1967), 1-octadecanol was Fluka purrissimum grade, and the 1-tetradecanol was Fluka purum grade which was purified by preparative gas chromatography. Dry and wet melting points were respectively: for 1-tetradecanol 39·5, 40·0; 1-hexadecanol 49·5, 52·0; 1-octadecanol 58·5, 61·5.

A few mg of an alcohol were melted on a cavity slide and agitated with a needle whilst cooling so as to yield a thin solid layer when cold. The cavity was filled with one of the sodium dodecyl sulphate solutions, a cover slip added and the slide was placed on a Kofler micro hot stage fitted to a polarizing

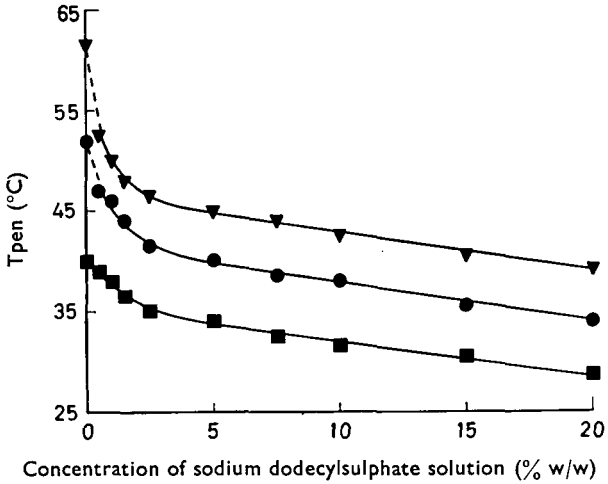

FIG. 1. Variation of the penetration temperature (T_{pen}) of aqueous solutions of sodium dodecyl sulphate into n-alkanols. ▼ 1-Octadecanol. ● 1-Hexadecanol. ■ 1-Tetradecanol.

microscope (Barry, 1967). The microscope was focussed on the edge of a crystal and the temperature at which liquid crystals first appeared was noted. The procedure was repeated at least three times for each alcohol and each solution and the average temperature found. The results shown in Fig. 1 indicate a pronounced dependence of T_{pen} on the surfactant concentration, the penetration temperature falling sharply as the concentration rises. This variation is most marked at low surfactant concentrations. The melting points in distilled water are all somewhat higher than the melting points of the dry compounds. Lawrence (1960) suggested that this is because alkanols form solid solutions with water.

Department of Pharmaceutics,
The School of Pharmacy,
29–39 Brunswick Square,
London, W.C.1, England.

B. W. BARRY*
E. SHOTTON

December 12, 1967

* Present address: School of Pharmacy, Portsmouth College of Technology Portsmouth.

References

Barry, B. W. (1967). Ph.D. thesis. University of London.
Barry, B. W. & Shotton, E. (1967). *J. Pharm. Pharmac.*, **19**, *Suppl.*, pp. 110S–120S.
Lawrence, A. S. C. (1958). *Discuss. Faraday Soc.*, **25**, 51–58, 58–80.
Lawrence, A. S. C. (1959). *Nature, Lond.*, **183**, 1491–1494.
Lawrence, A. S. C. (1960). *Membrane Transport Metab. Proc. Symp.*, Prague, Published 1961, 35–44.
Lawrence, A. S. C. (1961a). *Chemy Ind.*, 1764–1771.
Lawrence, A. S. C. (1961b). *Surface Activity and Detergency*, editor Durham, K., London: Macmillan, pp. 158–192.
Lawrence, A. S. C., Bingham, A., Capper, C. B. & Hume, K. (1964). *J. phys. Chem., Ithaca*, **68**, 3470–3476.