necessary information for the performance of a visual discrimination. Lesions to the visual pathway must limit the number of ways in which a stimulus can be represented, but unless they are very extensive they need not effectively limit the rate of information transmission.

Problems in Associating Systems

from a Correspondent in Molecular Biology

THE study of protein systems in which sub-units exist in association–dissociation equilibrium has come to have a fundamental interest in protein chemistry and enzymology. Many examples have recently come to light of situations in which the state of aggregation of the protein controls its function, and increasing attention has therefore been focused on the theoretical problems of analysing such systems by transport and equilibrium methods, notably sedimentation velocity and equilibrium, free boundary electrophoresis and partition chromatography. In all these processes the act of fractionation leads to the displacement of the equilibrium in a manner which is determined by the properties of the aggregated and disaggregated forms, the total concentration and the equilibrium constant(s) for the association. In principle it is possible to derive information about the stoichiometry, the equilibrium and the value of the equilibrium constant; the theory for such systems has been developed in general terms by Gilbert and others.

An article by Kegeles, Rhodes and Bethune (*Proc. US Nat. Acad. Sci.*, **58**, 45; 1967) now draws attention to a serious experimental source of error, hitherto completely overlooked, which may invalidate many of the results obtained on associating systems studied in the ultracentrifuge by sedimentation velocity. In high-speed sedimentation experiments a substantial hydrostatic pressure is generated, which can amount to hundreds of atmospheres towards the bottom of the cell. In aqueous systems, at least, this is insufficient to have more than a trivial effect on sedimentation velocities, but it can have a drastic influence on an equilibrium process. There is ample evidence that association processes are commonly accompanied by an increase in molar volume, which can be observed by dilatometry. The application of pressure consequently leads to a displacement of the equilibrium towards the dissociated form. For realistic values of the molar volume of association, it turns out that the pressures generated in the ultracentrifuge at high speeds are sufficient to produce a substantial change in the equilibrium constant, which would therefore vary through the liquid column, and make analysis intractable. Kegeles *et al.* show that concentration distributions of quite misleading and unexpected shapes could be obtained, and evaluate some of the consequences of this situation.

In any event it appears clear at this stage that low-speed sedimentation equilibrium and partition chromatography ('Sephadex' gel filtration, for example) offer safer methods of studying such equilibria. The applicability of gel filtration has been discussed by Gilbert, Ackers and others, and a new analysis by Ackers (*J. Biol. Chem.*, **242**, 3026; 1967) has now appeared. Gel filtration involves a simple partition process of the molecules between the insides of the gel globules and the free solvent outside. The method has several experimental advantages, and Ackers has shown that dissociation constants may be determined even when the partition coefficients of the molecules are concentration-dependent. Although gel filtration provides probably the most advantageous approach to these equilibria, it cannot give molecular weights, except of an approximate nature, and sedimentation equilibrium is probably best used for this purpose. It is probable, however, that the increasingly firm theoretical foundation of the gel filtration technique, allied with its experimental precision and simplicity, will encourage widespread application.

An interesting example of the application of sedimentation equilibrium is the work of van Holde and Rossetti (*Biochemistry*, **6**, 2189; 1967) on the association of purine in aqueous solution (which presumably involves the stacking mechanism operative in polynucleotides). The results compare well with earlier studies by other methods, and support the conclusion that the aggregation process can be described by a single association constant. Thermodynamic parameters are derived.

Steady State Crustal Spreading

by

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Evidence which bears on the processes of continental drift, ocean floor spreading and the appearance of mid-oceanic rises is rapidly accumulating. The assumption that the mid-oceanic rises represent a steady state[1,2] leads to estimates of the rate of ocean floor spreading and of subsidence which in turn suggest geophysical tests of the theory.

Crust

RECENT identification of the relationship between the observed symmetric magnetic anomaly patterns across mid-ocean ridges[4] and magnetic field reversals during the past $3{\cdot}4 \times 10^6$ yr B.P.[5] has provided a unique method of determining ocean floor spreading rates. Vine[6] determined rates of 0·95 cm/yr for the Mid-Atlantic Ridge south of Iceland, 1·9 cm/yr at 38° S., 4·4 cm/yr for the East