measurements (Gryzbowski, Tate & Datta, 1970) suggest that even univalent anions such as Cl^- will complex with Mg^{2+} , and this reaches significant proportions when $[\text{Cl}^-]$ approaches 100mm. The extent to which $[\text{Mg}^{2+}]$ is less than the total $[\text{Mg}]$ in the types of cell-free systems widely employed and the amount of complexes formed by the various ions will be presented. Novelli (1967) has emphasized the variability of optimum ionic requirements for the charging of tRNA, and analysis of such values offers an interesting contrast with likely conditions *in vivo*.

Both Mg^{2+} and Mn^{2+} can activate RNA polymerase, but the precise role they play is not known. The situation in the presence of high concentrations of ammonium sulphate is particularly interesting. Not only does the high concentration of sulphate complex a large proportion of the bivalent metal ion (e.g. the free ion is a few per cent of the total present), but the amount of nucleotide triphosphates as their bivalent cation chelates also decreases, the ammonium complexes rising. Kinetic studies must clearly take these factors into account.

Gryzbowski, A. K., Tate, S. S. & Datta, S. P. (1970). *J. chem. Soc.* (in the Press).

Novelli, G. D. (1967). *A. Rev. Biochem.* **36**, 449.

Staehelin, M. (1969). *Biochim. biophys. Acta*, **174**, 713.

Quantitative Analysis of Proteins by Displacement Electrophoresis

By D. PEEL*, J. O. N. HINCKLEY and A. J. P. MARTIN. (Abbotsbury Laboratories, Barnet Lane, Elstree, Herts., U.K.)

The method of electrophoresis in which a simple mixture is placed in a tube between a fast-moving ion and a slow ion was first described by Kendall & Crittenden (1923). It has been applied by various workers for the separation of isotopes, inorganic and small organic ions, in a variety of apparatus forms: see Kendall (1942), Longworth (1953), Konstantinov & Oshurkova (1967), Preetz (1967), Behne, Bilal, Freyer & Thiemann (1968) and Everaerts (1968).

The ions separate with the most mobile ion leading until each occupies a section of tube, with a more or less sharp boundary between neighbours. The concentration within each section is constant and all move at the same speed, the concentration automatically falling until the potential gradient is inversely proportional to the mobility (Kohlrausch, 1897), irrespective of the original concentration in the sample. With strong ions any counter-ion can be used, but weak ions require a buffering counter-

ion to avoid disturbance due to pH changes (Everaerts, 1968).

Because of the analogy with displacement chromatography, Martin & Everaerts (1967) named it 'displacement electrophoresis'. In their method a capillary tube is used that permits the use of high potential gradients, since cooling is efficient and radial temperature gradients are small. The sharpness of the boundaries is proportional to the potential gradient and inversely to the mobility difference. Flow of liquid, whether due to electroendosmosis or density difference, or deliberately introduced to keep the fronts stationary, makes the boundaries less sharp.

If the current is held constant, the heat output of each zone is proportional to the potential gradient. In thin-walled tubes the temperature is proportional to the heat output, so it is possible with a fixed thermocouple to record the passage of each front and the mobility of each ion. The recorder chart shows a curve of staircase form, the height of each step showing the mobility, and the length the length of tube occupied by each ion.

In this instance we have built an apparatus and found suitable conditions for the separation of proteins. Quantitative and qualitative analyses of mixtures of crystalline proteins will be shown.

Our thanks are due to N. V. Philips, Gloeilampenfabrieken, Eindhoven, The Netherlands, for supporting this work.

Behne, D., Bilal, B. A., Freyer, H. D. & Thiemann, W. (1968). *Talanta*, **15**, 153.

Everaerts, F. M. (1968). Ph.D. Thesis: Technische Hogeschool, Eindhoven.

Kendall, J. (1942). *Nature, Lond.*, **150**, 136.

Kendall, J. & Crittenden, E. D. (1923). *Proc. natn. Acad. Sci. U.S.A.* **9**, 75.

Kohlrausch, F. (1897). *Annln Phys.* **62**, 209.

Konstantinov, B. P. & Oshurkova, O. V. (1967). *Russ. J. phys. Chem.* **12**, 1280.

Longworth, L. G. (1953). *Circ. U.S. natn. Mus.* **524**, 59.

Martin, A. J. P. & Everaerts, F. M. (1967). *Analytica chim. Acta*, **38**, 233.

Preetz, W. (1967). *Talanta*, **14**, 143.

The Effect of Mechanical Stress on the Properties of Reconstituted Collagen

By D. A. HALL. (University of Leeds Department of Medicine, The General Infirmary, Leeds LS1 3EX, U.K.)

Collagen reconstituted by alterations of temperature or pH will redissolve to an extent that depends on the period during which the precipitating conditions are maintained (Gross, 1958). In the present study macromolecular ox achilles-tendon collagen

* Present address: Pye Unicam Ltd., York Street, Cambridge CBI 2PX, U.K.