

tional equivalents of a secondary phosphoric acid group, as stated by him. The total number of such groups is thus 4.15, the maximum possible being 4 on the basis of any structure for a polynucleotide with the correct theoretical phosphorus analysis. The sample titrated by Zittle would have had to contain about 28 per cent of its weight of water for its phosphorus content to have agreed with the theoretical value; and since this figure is much greater than that normally found, it follows that the phosphorus content was low and that the maximum possible number of secondary phosphoric acid groups must in this case have been less than 4; thus the total of 4.15 equivalents, found experimentally by titration, must have been even more divergent from that theoretically possible in this instance than is at first apparent. We do not consider that the evidence presented by Zittle is at present sufficient to override the considerable weight of experimental fact which is in favour of the formulæ of Fletcher, Gulland and Jordan.

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- ¹ Levene and Simms, *J. Biol. Chem.*, **70**, 327 (1926).
² Allen and Eiler, *J. Biol. Chem.*, **137**, 757 (1941).
³ Fletcher, Gulland and Jordan, *J. Chem. Soc.*, **33** (1944).
⁴ Chantrenne, *Bull. Soc. Chim. Belge*, **55**, 5 (1946).
⁵ Zittle, *J. Biol. Chem.*, **166**, 491 (1946).
⁶ Chantrenne, Linderstrom-Lang and Vandendriessche, *Nature*, **159**, 877 (1947).
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Adsorption of Calcium Ions by an Acid-extracted Brown Alga under Continuous Flow Conditions

THE interaction of simple ions with plant cells has been frequently studied, and it has been found that in some cases cations and anions are both absorbed in the vacuoles¹, while under different conditions the readjustment of the salt content occurs mainly by ion exchange². The experiments now to be described belong to the latter type; but, so far as I am aware, this is the first time that the ionic adsorption by a plant material has been systematically studied under flow conditions comparable to those prevailing in inorganic chromatographic adsorption analysis.

The measurements were done with the brown alga *Ascophyllum nodosum* and with solutions containing calcium ions. The fully swollen well-washed algal material, in which the majority of the cells appeared to be dead, was prepared from particles varying between 5 and 50 mesh/inch, and had been extracted with 1 *N* hydrochloric acid, at 20°, for about half an hour, thereby exchanging the various metals in the cell tissue against hydrogen ions³. The ionic adsorption is characterized by the break-through capacity, α , the number of equivalents of calcium adsorbed until the calcium can just be detected in the effluent; by the half saturation value, β , the equivalents of calcium adsorbed until the calcium concentration in the effluent is one half of that of the original solution; and by the exchange ratio, γ , the equivalents of acid in the effluent per one equivalent adsorbed calcium. The α - and β -values were not detectably influenced by illumination or by the oxygen content of the solution, but they depend on the history, age and particle size of the adsorbent and on the rate of flow,

acidity and concentration of the solution. The exchange ratios, γ , were found to be near unity, which indicates that the uptake of calcium ions depends mainly on a conversion of the water-insoluble acids contained in the cell tissue into the relevant calcium salts, which are also water insoluble. The algal material used for these tests contained 2.8 gm.-equivalents of such acids per kgm. dry weight³. In most runs the α - and β -values were much smaller than 2.8; that is, the calcium ions appear in the effluent before the absorbent is fully neutralized. If, however, the pH value of the solution is relatively high, the break-through capacity approaches the neutralization equivalent, and under such conditions the adsorption capacity of this alga is similar to that of certain recognized cation-exchange materials.

A detailed account of these experiments is to be published elsewhere.

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- ¹ For references see, for example, Steward, *Rev. Biochem.*, **4**, 519 (1935). Hoagland, *Bot. Rev.*, **3**, 307 (1937); or Krogh, *Proc. Roy. Soc., B*, **133**, 140 (1946).
² For example, Genevois, *Protoplasma*, **10**, 478 (1930). Genaud and Genevois, *Bull. Stat. Biolog. d'Arcachon*, **27**, 19 (1930); Lundegårdh, *Biochem. Z.*, **290**, 104 (1937).
³ See Wassermann, *Trans. 17th International Congress of Chemistry*.

Ferromagnetic Structure of Cold-Worked Austenitic Stainless Steels

IN magnetic wire recording, the medium most frequently used for the recording of music is chromium-nickel austenitic stainless steel, which has been rendered ferromagnetic by drawing into fine wire. By suitable heat treatment after drawing, it has been found possible to obtain intrinsic coercivities (JH_c) as high as 500 oersteds, a value so far in excess of the normal range for steels that some explanation seems required.

From the recording characteristics briefly described below, we have been led towards the idea of a dispersion of ferrite particles, probably long in relation to their cross-section, and of individual volumes of the order of a single domain, in a non-magnetic matrix of austenite. Support to this conception is given by the well-known results of the X-ray study of face-centred cubic structures¹ such as austenite, and the probability that the ferrite is produced along the slip planes of cold work; by the evidence both of magnetic testing and of X-ray examination that hard-drawn wires consist of some 50 per cent ferrite and the best heat-treated wires of only about 10 per cent; by the similarity between the variations of remanence with heat treatment for these wires and those for non-magnetic substances containing ferromagnetic impurities²; and by the close resemblance between the recording performance of these wires and that of magnetic tapes in which the medium consists of fine ferromagnetic particles embedded in a non-magnetic adhesive. A series of notes by Néel³ have put forward an explanation of the high coercivities found in powders of cubic ferromagnetics and certain alloys on the assumption of inclusions of magnetic substances of extremely small dimensions in a non-magnetic matrix, and the recent important communication by Prof. E. C. Stoner and E. P. Wohlfarth⁴, on the interpretation of high coercivities in ferromagnetics,