The liver from an animal killed at the sixty-seventh hour after nephrectomy is shown in Fig. 1a; only one hepatocyte and one fibroblast were labelled. In the liver from a sham nephrectomized mouse (Fig. 1b) many labelled nuclei were visible. Indexes of hepatocyte nuclei labelled with tritiated thymidine are given in Table 1. In all cases the indexes of labelled hepatocytes were significantly lower after nephrectomy than after sham nephrectomy. The repression of DNA synthesis in the liver cells after unilateral nephrectomy suggests a regulatory influence of renal tissue on proliferation in other tissues.

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Strontium-Calcium Selectivity of Alginates

THERE has been considerable medical interest in the ion exchange properties of alginates. Inhibition of the uptake of strontium by rats given doses of sodium alginate has been reported¹⁻³ and there was a similar experiment with a human adult⁴. The absorption of calcium was not significantly affected. The results were considered to have potential value in connexion with therapy of overdoses of strontium-90 (ref. 5). The effect of two commercial alginates with different chemical compositions, that is, different ratios of mannuronic and guluronic acid residues in the alginate, on strontium uptake in rats was compared⁶. The alginate with the greater content of guluronic acid residues reduced the uptake of strontium from the diet more effectively.

Alginates rich in guluronic acid are known to have more affinity for divalent metals in the ion exchange reactions calcium-sodium, copper-sodium and barium-sodium than more mannuronic acid-rich alginates^{7,8}. In the ion exchange reaction between calcium and magnesium, alginates rich in guluronic acid also have been shown to have more affinity for calcium than have alginates rich in mannuronic acid⁹.

The potential therapeutic applications of alginates make their calcium-strontium ion exchange reaction particularly interesting. The ion exchange properties were determined by dialysing 2 ml. of 1 per cent sodium alginate against 50 ml. of a solution containing a mixture of calcium chloride and strontium nitrate. The ionic strengths of the solutions were 0.66, and the equivalent ratio of the two salts in the solution was chosen to give approximately equal amounts of the two cations bound to the alginate. The salt solution was changed three times, and the alginate gels were dialysed thoroughly against distilled water, and finally against 0.1 normal hydrochloric acid (three samples of 20 ml.). The amount of the two cations in the combined acid dialysates were determined by atomic absorption. The results were calculated as the selectivity coefficient

$$k_{\text{Sr}}^{\text{Ca}} = \frac{[\text{Sr}_g][\text{Ca}_i]}{[\text{Ca}_g][\text{Sr}_i]}$$

where $[\text{Ca}_i]$ and $[\text{Sr}_i]$ refer to concentrations in the original salt solution and $[\text{Ca}_g]$ and $[\text{Sr}_g]$ to the concentrations in the acid dialysates. Two alginate samples prepared from *Laminaria digitata* (Huds.) Lamour. (61.5 per cent and 68 per cent mannuronic acid) and two samples prepared from the stipes of *L. hyperborea* (Gunn.) Fosl. (30.5 per cent and 27.5 per cent mannuronic acid)

Fig. 1. Strontium-calcium selectivity coefficients for alginates and alginate fragments of varying uronic acid compositions.

were used. In addition, two oligouronides with more extreme uronic acid compositions (91 per cent and 8 per cent mannuronic acid, respectively) were investigated. The oligouronides were prepared by partial acid hydrolysis¹⁰, and their average degree of polymerization was twenty. The results are given in Fig. 1. By extrapolation of the curve the selectivity coefficients of the two homopolymers can be estimated.

The correlation between the selectivity coefficients and the composition of the uronic acid of the alginates is very clear and indicates that the strontium selectivity of the alginates is caused by their content of L-guluronic acid residues. A polyguluronic acid would seem to be the alginate preparation with the most selectivity for strontium compared with calcium. So far, however, no polyguluronic acid has been isolated from brown algae or from other sources. Among the larger brown algae, the stipes of *L. hyperborea* give the alginate with the greatest content of guluronic acid¹¹. This was the source of the commercial alginate with a high guluronic acid content used by Harrison *et al.*⁶. Alginates can be separated into fractions with different uronic acid compositions by precipitation^{9,11}, but in no case have fractions with more than 75 per cent guluronic acid residues been obtained. Oligouronides with a very high content of guluronic acid residues (85-93 per cent), however, can be prepared by partial acid hydrolysis of alginates and fractionation of the hydrolytic products¹⁰. When an alginate rich in guluronic acid is used for the preparation, a high yield may be obtained without fractional precipitation of the hydrolytic products¹².

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