THE UPTAKE OF $^{[131I]}$TRIIODOTHYRONINE FROM SERUM BY RESIN-IMPREGNATED PAPER IN VITRO

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In 1957 Hamolsky and his colleagues showed that the uptake of $^{131}$I-labelled triiodothyronine ($T_3$) by red cells could be used as an index of thyroid function. Its usefulness as a routine test, however, is limited by several technical disadvantages. Various authors have since reported methods in which resin (Mitchell, Harden & O'Rourke, 1960; Godden & Garnett, 1964) or Sephadex (Cuaron & Fucugauchi, 1964)

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Fig. 1. Relationship between the uptakes of $^{[131I]}$triiodothyronine by red cells and by resin impregnated paper. The resin uptakes are expressed as a percentage of that of the serum control and the uptake by the red cells is corrected for haematocrit values. Subjects with haematocrit values of less than 39% are represented by circles. The equation for the regression line, calculated from values within the normal range, was $y = 3.5x + 42.2$.

Fig. 2. Uptake of $^{[131I]}$triiodothyronine by resin impregnated paper from serum of different groups of subjects. The resin uptakes are expressed as a percentage of the control serum.
are used to replace the red cells. This report describes a simplified method in which filter paper impregnated with resin has been used as the adsorbing medium.

Disks of filter paper, 1 cm. in diameter, incorporating about 5 mg. Amberlite IRA 400 resin were stamped out of large sheets (9 × 12 in.) of Ion Exchange Paper (SB2, British Drug Houses).

Portions of serum (0·5 ml.) were pipetted, in duplicate, into disposable plastic tubes with closely fitting stoppers. $^{131}$I-Labelled $T_3$ was diluted with 0·9 % NaCl solution to an activity of about 0·3 μc/ml. and 1·5 ml. of this solution was added to each serum sample. Radioactivity was counted in a well-type scintillation counter ($S$ counts/sec.) and the tubes replaced in a rack. The rack was tilted so that the tubes were at an angle of about 45° and a single disk of paper was placed carefully, about half way down each tube. The tubes were stoppered and the rack was tipped further so that the paper disks were submerged in the serum solution simultaneously. They were then placed on their sides in a thermostatically controlled water bath in which they were gently agitated for 30 min. at 25°. At the end of the incubation period, the samples were removed quickly and the disks rinsed three times with distilled water and counted ($P$ counts/sec.). A control sample of pooled normal serum obtained from euthyroid patients was run with each batch. The percentage of the activity retained by the paper, $P/S \times 100$, is then calculated for all samples, the mean of the controls is taken as 100 % and the results reported as percentages of this value.

One hundred and ninety-two tests have been carried out on samples from 140 patients. In 52 patients the $T_3$ uptake by red cells was measured on the same blood sample by the technique of Goolden, Gartside, Jackson & Osorio (1962). The results are shown in Fig. 1. Results obtained from patients whose haematocrits were 39 % or less are indicated, and in these patients the results obtained with the paper disk method are probably a better indication of thyroid status. Figure 2 shows the results in 27 thyrotoxic, 82 euthyroid and 20 hypothyroid patients in whom the clinical diagnosis was confirmed by other laboratory tests. Results in eleven women whose $T_3$ uptake was low because they were taking an oral contraceptive are also shown.

The following practical points are worth mentioning: (a) The tubes must be shaken horizontally to ensure uniform mixing. (b) The disks must be placed in the tubes with the same side uppermost. (c) The optimum amount of serum-$T_3$-saline mixture is 2 ml. for tubes of 1·3 cm. diameter. (d) If plasma is used, the values obtained are two-thirds of those obtained with serum.

Preliminary studies with $^{125}$I-labelled $T_3$, kindly provided by the Radiochemical Centre, Amersham, indicate that this compound might provide a more stable solution with a considerably longer expectation of use than $^{131}$I-labelled $T_3$ (Van Zijl, 1962).