

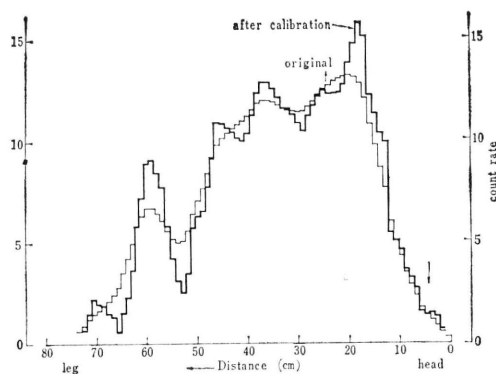
Then, $|Y_0| = |A|^{-1} |Y|$ is obtained.

where, $|A|^{-1}$ is an inverse matrix of $|A|$

However, $|A|^{-1}$ is not easily obtainable and so an iterative method is employed.⁽¹⁾ We have thus obtained ^{132}Cs distribution in two adult males.

Finally, it should be mentioned that these two types of counters have also been successfully applied to health physics problems such as ^{137}Cs monitoring in normal subjects and detection of the accidental contamination etc.

(1) L.D. Skarsgard, H.E. Johns, and L.E.S. Green, *Radiation Research* 14 No. 3 (1961) 261.



The Application of Double Isotopic Method for the Studies in Hematology

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The simultaneous use of two isotopes has many advantages for the studies in hematology. By the simultaneous use of isotopes of two different elements, it is possible to reduce the time required for the investigation and to compare two different functions under the same condition in the same individual. By the simultaneous use of two different isotopes of the same element, it is possible to compare the metabolism of two different compounds under the same condition in the same subject and to devise new analytical methods for the study of the metabolism of various substances. In this paper some of the examples of the application of double isotopic method for the studies in hematology were described.

1) Determination of the red cell life span in various diseases by the simultaneous use of ^{51}Cr and DF^{32}P .

In normal controls, hemolytic anemia and aplastic anemia, the red cell life span as measured by ^{51}Cr technique was parallel to that as measured by DF^{32}P , while in iron deficiency anemia the red cell life span as measured by ^{51}Cr technique was longer than that as measured by DF^{32}P . This discrepancy was found to be due to the reduced elution rate of ^{51}Cr in iron deficiency anemia.

2) Simultaneous determination of the life span of autologous and isologous red cells by ^{51}Cr and DF^{32}P .

By the use of in vivo labelling with DF^{32}P and in vitro labelling with ^{51}Cr , it was possible to determine simultaneously the life span of a patient's own red cells and that of a donor's red cells transfused into the patient. By this method it was demonstrated that in a patient with iron deficiency anemia the shortening of red cell life span was due to a defect of the red cell, while in a patient with aplastic anemia the shortening of red cell life span was due not only to a defect of red cell but also to some factor other than the red cell.

3) Determination of blood loss by ^{51}Cr and ^{59}Fe .

In bleeding subjects, it was possible to correct the apparent shortening of the red cell life span as measured by the ^{51}Cr technique by the simultaneous determination of the blood loss with ^{59}Fe .

4) Determination of the splenic uptake of red cells.

In hemolytic anemia, iron deficiency anemia and Banti's syndrome, it was demonstrated by the simultaneous use of ^{51}Cr labelled red

cells and ^{59}Fe globulinate that the concentration of red cells in the spleen was higher than that in systemic circulation, suggesting a specific uptake of red cells by the spleen. By this method it was also demonstrated that, in iron deficiency anemia, the newly formed red cells were selectively retained by the spleen.

- 5) Studies of iron metabolism in the reticuloendothelial system by the simultaneous use of ^{59}Fe and ^{55}Fe .

A modified method for the simultaneous determination of ^{59}Fe and ^{55}Fe was described. By this technique the functions of the reticuloendothelial system with regard to iron metabolism, namely the uptake of colloidal iron and the processing of colloidal iron, were separately investigated using chondroitin sulfate iron labelled with ^{59}Fe and ^{55}Fe globulinate. In iron deficiency anemia, the release of iron from the reticuloendothelial system following the intravenous administration of colloidal iron was increased as compared with normal controls, while in rheumatoid arthritis and acquired hemolytic anemia, it was decreased as compared with normal controls.

In aplastic anemia it was demonstrated that steroid hormone increased the release of iron from the reticuloendothelial system following the administration of colloidal iron.

- 6) Studies of iron absorption by the simultaneous use of ^{59}Fe and ^{55}Fe .

A new analytical method for the study of iron absorption using ^{59}Fe and ^{55}Fe was described, and the absorption of iron from the intestinal tract was studied under various conditions. By this technique it was demon-

strated that the absorption of iron from the intestine could be divided into two phases, namely the rapid phase and slow phase, and it was confirmed that iron in the form of ferrous iron was more easily absorbed than in the form of ferric iron and the absorption of iron was increased by the simultaneous oral administration of ascorbic acid or reduced glutathione.

- 7) Studies of the metabolism of vitamin B_{12} by the simultaneous use of ^{60}Co and ^{57}Co .

The metabolism of two different derivatives of vitamin B_{12} was studied by using the two derivatives of vitamin B_{12} labelled with ^{60}Co and ^{57}Co , respectively. By this technique it was found that coenzyme B_{12} was taken up by the liver in a greater amount than cyanocobalamin and that the simultaneous intravenous administration of intrinsic factor enhanced the hepatic uptake of both coenzyme B_{12} and cyanocobalamin, especially the former. In rats with liver injury caused by CCl_4 , the hepatic uptake of coenzyme B_{12} and cyanocobalamin was reduced, but even in this case, the hepatic uptake of coenzyme B_{12} was greater than that of cyanocobalamin. It was also confirmed in man by using double isotopic technique that the urinary excretion of hydroxocobalamin labelled with ^{57}Co following intravenous administration was less than that of cyanocobalamin labelled with ^{60}Co , suggesting that hydroxocobalamin was more easily retained in the body than cyanocobalamin.

As shown by these examples, the application of double isotopic technique for the studies in hematology may provide useful tools for the solution of many problems in this field.