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Radiation Laboratory

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SUMMARY OF THE RESEARCH PROGRESS MEETING OF MARCH 15, 1951

Bonnie E. Cushman

June 27, 1951

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Berkeley, California

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I. Application of Scintillation Equipment to In Vivo Iron Studies. R. Huff.

With new equipment developed by Tobias and Anger, radio iron can now be followed throughout the human body without resorting to large tracer doses. The tracer, a mixture of Fe^{59} and globulin combined *in vitro*, is most easily introduced by injecting it into the blood stream. The plasma is thus tagged and the turnover of the iron, its amounts and half-times in various parts of the body are indicated in Fig. 1.

In obtaining the data, tracer in the blood as well as the tissue was counted, but by measuring the concentration in the blood separately corrections may be made. Mixing time of the iron injected into the blood stream is 2-3 minutes and the half-time is about $2\frac{1}{2}$ hours. The sacrum was used for marrow determinations since a greater amount of marrow is there and it lies closer to the surface than in the other regions of the body.

Fig. 2 shows the comparison of counting rates of a normal subject with those of subjects with various disorders. It is seen that polycythemia (enlarged spleen) is characterized by a rapid rise in counting rate and that a lack of production of red cells in the marrow is markedly indicated (c and d). These effects have not been observed in other types of experiments. Further illustrations of the uses of this new method may be found in UCRL-1282.

One difficulty yet to be overcome is that the amount of blood in the marrow, spleen and liver in the body is unknown, thus causing an uncertainty in the evaluation of the counting data, although counts from blood cells and

plasma may be interpreted accurately.

See UCRL-885 and UCRL-886 for a description of the design and operation of the counting equipment.

II. Polarization in n-p Scattering. L. Wouters.

Experiments have been conducted for the study of polarization, the azimuthal dependence of cross section in a beam of particles with spins preferentially aligned. When spins are oriented in one direction an azimuthal asymmetry with respect to the scattering plane should be observed. In a single scattering the effect cannot be seen since the spins of the beam particles are oriented randomly (50 percent up and 50 percent down). However, a second elastic scattering should cause a preferential orientation by analogy with light optics. The effect depends, of course, on the force model considered. The predicted angular dependence of the particle flux intensity for a tensor force model has the general shapes shown in Figs. 3 and 4. The amplitude varies with different particles involved in the scattering process.

Two fundamental experiments (Figs. 5 and 6) are possible, but the mechanical setup of the cyclotron makes p-p-p scattering difficult since a scatterer would have to be placed in the steering magnet. n-n-n scattering is not feasible because of the low cyclotron flux, but by varying it as in Fig. 7 it can be done and the two methods are theoretically equivalent.

The first scattering is done inside the tank of the cyclotron using a LiD target. The second probe is located so that the neutrons leave the tank at 30° and are scattered again by carbon or paraffin. The protons produced are detected by four double coincidence counter telescopes with liquid scintillators and the carbon-paraffin difference taken. Photomultipliers are used at 2 - 2.2 kv with a pulse of 100 μsec. with the result that particles emerging

from any place other than the desired port come out at a different time and are easily discarded when evaluating the data. Absorbers in the telescopes cut out low energy particles.

Three methods of determining whether polarization is present are observing if there is (1) an asymmetry about the counters, (2) a change in count rate as azimuthal angle is varied, and (3) a change in count rate as the scattering angle is varied.

Preliminary results (within $\pm$ 8 percent) indicate that asymmetry does not seem to be present. Further experiments at greater energies and using the LiH-LiD difference will be carried out. If the effect is actually zero, the calculations and theory of n-p scattering of Christian and Hart will be negated.

Information Division
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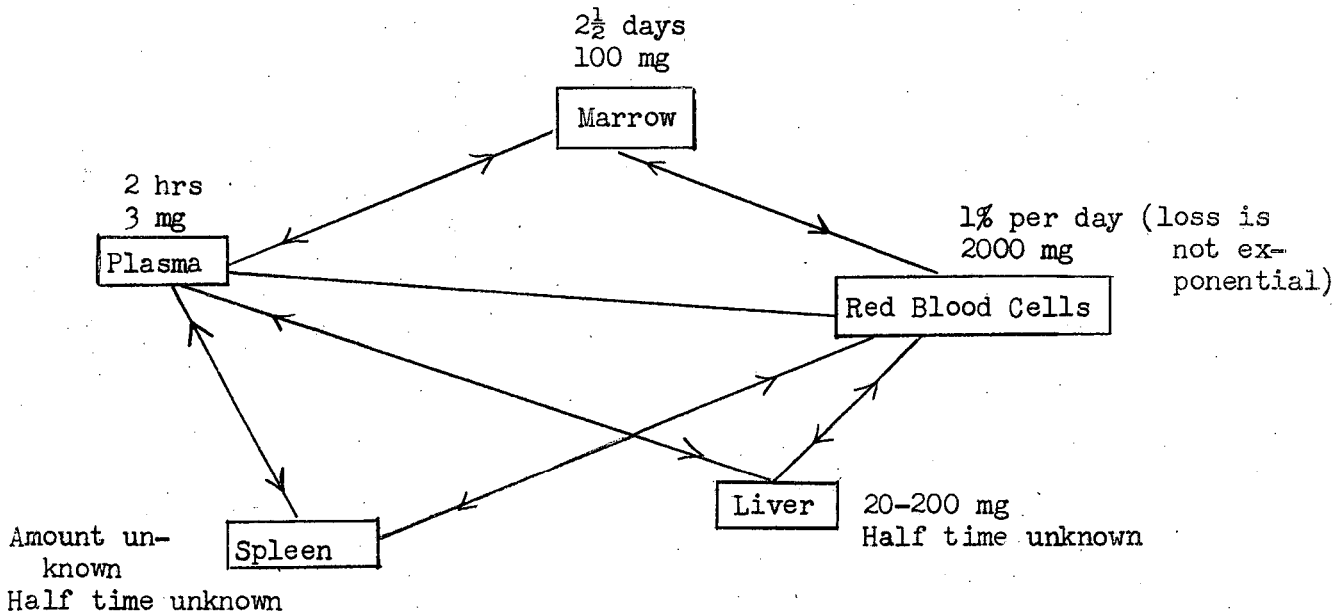
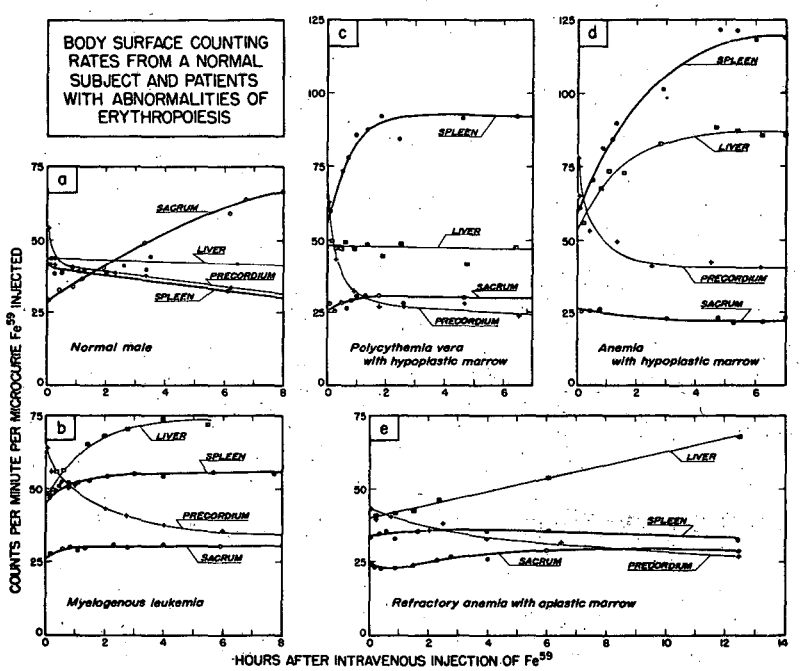
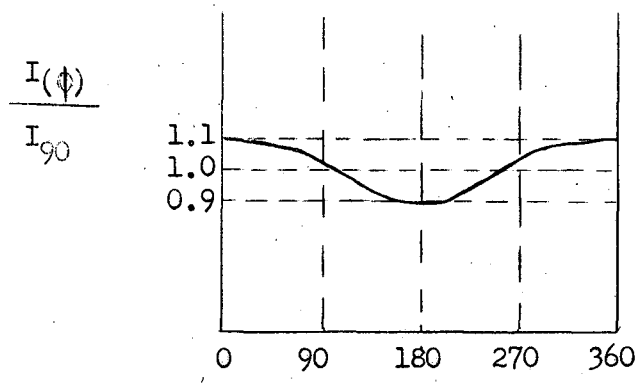

2½ days
100 mg
Marrow
2 hrs
3 mg
Plasma
1% per day (loss is not exponential)
2000 mg
Red Blood Cells
Liver
20-200 mg
Half time unknown
Amount unknown
Spleen
Half time unknown

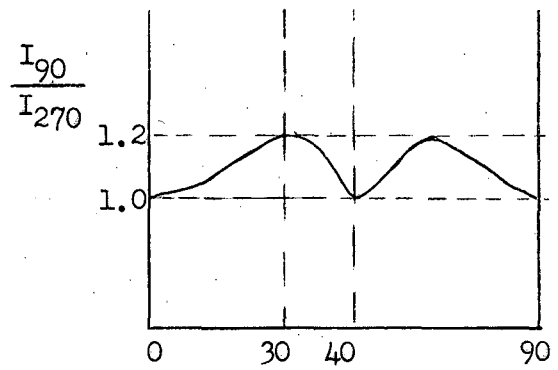
Fig. 1



JHL 2032.

Fig. 2





Laboratory Coordinates

At optimum scattering angle (θ) of 30°

Fig. 3

Right to left ratio

Fig. 4

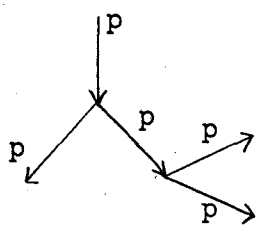


Fig. 5

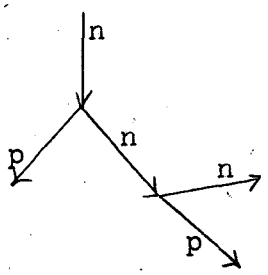


Fig. 6

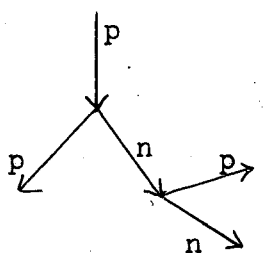


Fig. 7