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To study erythropoiesis and anemia, one must have a firm foundation of indices that accurately measure red blood cell production and destruction. This paper, authored by hematology legends Arno G. Motulsky and Clement A. Finch, provides that foundation. Using methods that would not be approved in today's environment, the authors studied a cohort of normal healthy patients and an equal number of patients with different forms of anemia. The results confirm a reciprocal model of red cell production and destruction, show that anemia can be the result of either underproduction (aregenerative anemia or ineffective erythropoiesis) or increased destruction, and define parameters for distinguishing these 2 possibilities that are still widely used today.

Giblett ER, Coleman DH, Pirzio-Biroli G, Donohue DM, Motulsky AG, Finch CA. Erythrokinetics: quantitative measurements of red cell production and destruction in normal subjects and patients with anemia. *Blood*. 1956;11(4):291-309.

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Erythrokinetics: Quantitative Measurements of Red Cell Production and Destruction in Normal Subjects and Patients with Anemia

By Eloise R. Giblett, Daniel H. Coleman, Giacomo Pirzio-Biroli, Dennis M. Donohue, Arno G. Motulsky and Clement A. Finch

THE TERM ERYTHROKINETICS is selected to indicate the over-all activity of cell production and destruction within the erythron. The studies described in this paper were undertaken in an attempt to quantitatively define erythrokinetics in normal man and in patients with anemia.

While the determination of red cell life span gives an indication of red cell destruction, it does not measure production or detect impaired delivery of red cells to the circulating blood. Furthermore, although the Ashby technic of differential agglutination has established the normal erythrocyte life span as 100 to 120 days[1], the method has serious limitations in patients with anemia. It is impossible to utilize this technic to study the survival of the patient's cells in his own circulation. Moreover, isoantibodies may occasionally develop altering cell survival which cannot be demonstrated by present serologic methods. When isotope tags are employed, these objections are overcome, but problems of elution and toxicity (using Cr^{51}) or reutilization (using Fe^{59}) are encountered.

It was therefore considered important in our studies to employ a battery of tests in each subject in order to characterize erythroid marrow activity and red cell turnover in the circulating blood. Those methods specifically concerned with red cell production included marrow erythroid-myeloid ratio, the reticulocyte count, and the incorporation of radioiron into circulating hemoglobin. Destruction was measured by the amount of urobilinogen pigment excreted. The reliability and usefulness of these procedures for quantitation of red cell production and destruction was determined.

The measurements made have been expressed in a manner which allows comparison between individuals of different size, with different blood volumes and with different hematocrit concentrations. To accomplish this, red cell production has been referred to the *normal* circulating red cell mass of the individual. Red cell destruction, on the other hand, has been related to the amount of cells destroyed per unit of *existing* red cell mass. The reason for using these different reference standards of cell volume is illustrated in table 1. Normal persons of

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