

anemia of protein-calorie malnutrition in children is often a multiple etiology and may reflect simultaneously occurring deficiencies in hemopoietic substances in addition to deficiencies in protein and calories. Thus, hematologic recovery is complete only if the supply of folic acid, iron, vitamin B₁₂, riboflavin, and pyridoxine is adequate. In the type of protein-calorie malnutrition seen in Central America, it appears that the complicating concurrent multiple deficiency diseases are not as prominent as in other parts of the world. In Guatemalan children, the red cell mass is reduced in proportion to lean body mass and was repaired during therapy in proportion to lean body tissue. Interaction between protein anabolism and stores of other required nutrients such as iron and folic acid was emphasized; there generally is a decrease in the plasma concentrations of these substances during the brisk anabolism of hemoglobin.

Erythropoietin, an endocrine-like substance that is capable of stimulating red cell production in mammals, has not been fully characterized but it appears to be a glycoprotein of relatively low molecular weight (70,000) synthe-

sized by the kidney in response to hypoxia or anemia (C. Gurney, Rutgers). It is believed that erythropoietin stimulates the synthesis of DNA, RNA, and δ -aminolevulinic acid, a precursor of heme in hemopoietic tissues.

E. V. Cox (Royal Berkshire Hospital) reported that normocytic or macrocytic anemia occurs in patients with scurvy. The bone marrow in these patients appeared to be macronormoblastic and hypercellular but not megaloblastic. The controversial question of whether vitamin C is a primary agent in hemopoiesis was discussed. There is conflicting evidence that other vitamin deficiencies may coexist in scurvy and complicate the interpretation of the response of the anemia of scurvy to vitamin C. Nonetheless, there are uncomplicated cases of anemia in scurvy that do respond to vitamin C. The data suggest that anemia of scurvy has more than one cause and that ascorbic acid may potentiate the use of other nutrients required in hemopoiesis.

W. J. Darby (Vanderbilt University) reviewed the tocopherol-responsive anemias in man which have been observed in infants with protein-calorie malnutrition in Jordan, Nigeria, and

Thailand. The amount of tocopherol in serums of children with this anemia range from 0.2 to 0.6 mg/100 ml percent, a value considered low but not deficient when compared with animal studies. In some investigations, a full reticulocyte response accompanied by hemoglobin synthesis was observed. In others studies, particularly those in South India, where megaloblastic anemia is common, vitamin E causes a reticulocyte response without net hemoglobin synthesis. In contrast to kwashiorkor, L. Barnes (University of Pennsylvania) has observed that vitamin E arrests the hemolytic anemia observed in premature infants, reduces reticulocyte counts, and extends the life of the red cell.

All of the papers presented in this symposium will be edited by R. S. Harris and published in volume 26 (1968) of *Vitamins and Hormones*.

F. WEBER
Department of Vitamin and Nutritional Research, F. Hoffman-La Roche & Co., Ltd., Basel, Switzerland

ROBERT E. OLSON
Department of Biochemistry, St. Louis University School of Medicine, St. Louis, Missouri

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DR. J. ROSE
Hon. Secretary, I.C.C.C.
COLLEGE OF TECHNOLOGY
BLACKBURN, LANCS. BB2 1LH
GREAT BRITAIN