terol represent a major part of the fatty acid transport system between liver, depots, and periphery. An adequate amount of essential acids is necessary to make this system function at maximal efficiency, with consequent reduction in unit concentration of circulating lipids. This hypothesis is currently being subjected to experimental evaluation.

—Laurence W. Kinsell, M.D.,
Roger W. Friskey, M.D.,
George D. Michaels, Ph.D.,
Frederick R. Brown, Jr., M.D.
Institute for Metabolic Research of the Highland Alameda County Hospital, Oakland, Calif.

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The Role of Amino Acids in Kwashiorkor

Dear Sir:

We have reported elsewhere the results of some dietary therapeutic trials on kwashiorkor (a syndrome of protein malnutrition in recently weaned infants). We had hoped that a clinical test could be evolved which might be analogous to the reticulocyte response in pernicious anemia used for the fractionation of liver extracts. Our trials have indeed shown that the infant with kwashiorkor can be used in an analogous way for testing the curative capacity of synthetic milk substitutes. The rate of rise of serum albumin and, in some recent cases (at the suggestion of R. F. A. Dean) of serum amylase, can be used as objective measures of the curative efficiency of the formula, although they have less mathematical accuracy than has the reticulocyte curve in pernicious anemia.

It is hoped that other laboratory criteria can be evolved for making the test more sensitive and accurate. The test has been called a test for "initiation of cure." It represents the change from a downward course in the illness into the beginning of recovery. Conclusions drawn from this test would not apply to what we have called "consolidation of cure," which presumably requires a prolonged use of all known essential nutrients in suitable combination and quality.

The existing test for "initiation of cure" has, however, already established certain conclusions about the nature of the curative nutrients or fractions contained in skimmed milk.

We have reported "initiation of cure" with (a) Labco "vitamin free" casein as 38 per cent of the diet with and without the addition of known vitamins, (b) a mixture of eighteen crystalline amino acids as 59.5 per cent of the diet with added vitamins including all those known to be necessary for healthy development. The "initiation of cure" thus represents an extension of the depletion method for the study of amino acids.

Since our publication further tests have shown "initiation of cure" with a diet containing 16 per cent of a mixture of eleven amino acids (Rose's eight essential amino acids plus arginine, histidine, and tyrosine) and the same vitamin mixture. In four cases out of eight we obtained satisfactory "initiation of cure," without any adjunctive treatment other than the basic sulfonamide and penicillin cover which is used in all trials.

In four more cases treated with the same amino acid mixture without the vitamins, improvement was very much slower and less complete than we are accustomed to observe. There was less of edema, regeneration of serum protein, and slower healing of skin lesions, but the children after a week on this diet again became apathetic and anorexic. We do not regard this as satisfactory "initiation of cure."

Either these latter four cases were unusually severe or complicated or, as seems more likely, we are reaching the lower limit of amino acid formulation at which cure can be initiated by vitamin-free protein or amino acids.

We feel that the cases previously published suggest with a fair degree of certainty that the limiting nutrients in the diets which cause kwashiorkor are amino acids and that provision of these amino acids is capable of initiat-
ing cure; further, that no unknown factors are necessary for "initiation of cure" if the requisite amino acids are provided. We also feel that the additional eight cases here reported demonstrate that the limiting amino acids are among the eleven listed.

It is of considerable interest that "initiation of cure" with the casein formulations was independent of the presence of vitamins, whereas eleven amino acids alone were distinctly inferior to these same amino acids plus vitamins. It is within the realm of possibility that vitamins may in some manner permit more efficient use of the amino acids provided at marginal levels in these children. We plan to test this hypothesis experimentally.

-- J. F. BROCK, D.M., F.R.C.P.
J. D. L. HANSEN, M.B., M.R.C.P.,
D.C.H.
Departments of Medicine and Paediatrics, University of Cape Town
and Groote Schuur Hospital,
Cape Town, South Africa
E. E. HOWE, PH.D.
Research Laboratories, Chemical Division, Merck and Co., Inc.,
Rahway, New Jersey

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REFERENCE