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.

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The Role of Amino Acids in Kwashiorkor

Dear Sir:

We have reported elsewhere[1] 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.[1] 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.

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REFERENCE

1. BROCK, J. F., HANSEN, J. D., HOWE, E. E., PRETORIUS, D. J., DAVEL, J. G., and HENDRICKSE, R. G.: Kawashiorkor and protein malnutrition; a dietary therapeutic trial. *Lancet* 2: 355 (20 Aug.), 1955.

took to see not only that the royalties went to support more research in nutrition, but also by his personal efforts to see that neither time nor opportunity was lost in making the benefits of a plentiful supply of this essential nutrient widely available. He became a member of the Food and Nutrition Board of the National Research Council and chairman of its Committee on Cereals, a post he has held since 1940. He played a leading role in furthering the enrichment of bread in the United States. Finally, in 1946, he retired from the Bell Telephone Laboratories in order to give his full time to his nutrition work. Having assisted in and seen the health benefits of the enrichment of bread, flour, and corn meal in the United States, he carried his initiative and support back to the Philippines where he had first tackled the problem so many years before, and we find him supporting the studies which demonstrated the value of adding thiamine to white rice by assisting Dr. Salcedo and his group in showing that beriberi can be eradicated by this procedure. As a result, we can see the Philippines taking the leadership in Asia by enacting a law requiring the enrichment of white rice—a measure which, if enforced and extended to the large rice-eating areas of the world, could become one of the greatest contributions to health that the world has ever seen.

I would like to read you a few sentences from a letter which Dr. Salcedo wrote last month:

> "Please extend my very best wishes for continued good health and more success to Dr. R. R. Williams at the ceremonies on. . .April 23rd. I wish I could be present even only to shake his hand and express to him my personal and lasting gratitude for everything he has done to promote the health through good nutrition to our people. Undernourished millions the world over have benefited by his efforts. Countless co-workers, scientists and friends will always have him nearest to their hearts and uppermost in their minds for generations to come. I shall think of him more fondly. . .during the ensuing years."

Naturally, many honors have come to Dr. Williams. I will not try to enumerate them. Among numerous medals and citations are seven honorary degrees and they honor the donor in the giving. I am sure he will continue to receive others.

He has just passed his seventieth birthday and relinquished the chairmanship of his Williams-Waterman Fund, and, although he will not work regularly at the job, all of us who know him know that he will never cease to be concerned about the malnourished people of the world and that he will be contributing to their betterment as long as he lives.

It has been one of the great inspirations of my life to have had the opportunity to be associated with Dr. Williams in a small way for many years and to have been guided by his wisdom and experience on many occasions. I know that all of his associates will continue to look to him for advice and to call on him for help with the problems of human malnutrition which we know are so close to his heart.

In conclusion, to my mind Dr. Williams represents the best that religious freedom, intellectual freedom, and political freedom can produce. In the troubled times that we see ahead of us in the world, if this country can continue to produce men of Dr. Williams' caliber we have nothing to fear, and the world will be a better place for us all.

—WILLIAM H. SEBRELL, M.D.
Former Director,
National Institute of Health

Erratum

In the Letter to the Editor, "The Role of Amino Acids in Kwashiorkor," AMERICAN JOURNAL OF CLINICAL NUTRITION 4: 286, 1956, the sentence on the fifteenth and sixteenth lines from the bottom, second column, should have read: "There was loss of edema, regeneration of serum protein, and healing of skin lesions. . ."