

Much progress toward better diet has been made through food enrichment but there is still much to be done and not all of the problems are technical

FOOD ENRICHMENT

Progress and Controversial Issues

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FROM THE ORGANIZATION of the Food and Nutrition Board in November 1940 its concept has been to sanction and promote enrichment of foods only in the case of staple foods of wide consumption which were so lacking in essential nutrients as to constitute a menace to the health of some substantial segment

Most of the large bakeries in the country are now systematically practicing enrichment of their bread



of the population of the United States. Its policy, first stated in October 1941 has recently been reviewed and reaffirmed without radical change as of April 1953.

The philosophy set forth in the board's statement is in distinct contrast with that of many worthy workers in this and other countries whose theme is often to promote the use of new or less familiar foods chosen to round out the daily complement of nutrients in the usual daily dietary of the population under consideration. Thus B. S. Platt of the British Medical Research Council has often advocated "the biological improvement of foods," such as the conversion of soybeans into curd or sprouts as in China and Japan, or the fermentation of fish as in Indonesia. Another example is the long drawn out efforts to produce Torula yeasts and get them used as human food, both in Jamaica and in Johannesburg. No amount of failure to make these products acceptable to human palates seems to discourage these idealists.

I do not know precisely why we are at odds with our British cousins in this matter. Certainly our consciousness of difference is enhanced by the fact that we both use English and, therefore, know better what thoughts each enter-

tains. In part it is due to the successful British food policy under threat of submarine blockade during the war. They could store wheat as grain longer than flour, they wanted to keep their flour mills busy, and they needed the bran and shorts as stock feeds so they adopted long extraction of flour. One cannot seriously quarrel with the result as they have fed their people adequately under hard conditions even if not always appetizingly.

At all events the use of synthetic vitamins in foods is anathema to most academic students of nutrition in Britain. The view seems to be widely shared among them that, if the pharmaceutical manufacturer makes a profit on his vitamin production, the public is automatically and inevitably compounding a felony by using them. We all recall the Canadian law in effect until early in 1953 which made the addition of any synthetic vitamin to flour an adulteration. It was probably only the insistence of Newfoundland, when the proposal was made to unite Newfoundland with Canada, that Newfoundland's law requiring the enrichment of flour should be retained which brought about a change in Canadian policy as of January 1953. Now, according to the latest information which we have received, the

Canadian bakers and millers have widely seized upon the privilege of enriching their products as permitted under the new law. The Canadian standards are not far from those of the United States but differ in one significant respect in that enriched bread is defined as a product made exclusively from enriched flour.

Enrichment Progress

A summary of the progress of enrichment with respect to each of the food products which are mentioned in the closing paragraph of the Food and Nutrition Board's "Statement of General Policy" will indicate what is being done in the U. S.

The enrichment of white flour remains substantially unchanged and now applies to about 80% of the total production of family flour in the country. All of the large millers continue their policy of not marketing unenriched flour for family use under prevalent brands. Bakery flour is generally not enriched at the mill but all large bakeries and many small ones continue to enrich at the dough stage by the use of wafers.

Continuing efforts have been made over the past 2 or 3 years to secure the general adoption of enriched flour by bakers. A few bakers, including some large ones, have tried it for full-scale production but many have not continued to do so as they report their costs are thereby slightly increased. A basic reason behind this reluctance is that millers must incorporate a slight excess of the vitamins in flour in order to ensure meeting standards in spite of inaccuracies of feeder equipment and in spite of the possible necessity of considerable periods of storage of the flour before it goes into use. The baker on the other hand can add his vitamins at the dough stage which is usually only 24 to 48 hours before the bread actually reaches the consumer.

Another factor is the variable amounts of skim milk solids which are used in bread and the variety of wafers offers at least a partial adjustment of the riboflavin level in the bread to the level of milk preferred by the baker. If enriched bakery flour were used there would often be some excess of riboflavin in the bread over the required minimum for which the baker would get no credit. It still remains true that uniformity of enrichment in bakeries would be greatly promoted if all used enriched bakery flour. No immediate reform in this respect can now be foreseen.

According to our best information the enrichment of white bread continues at about the same level as for the past several years. All large wholesale and chain bakeries systematically practice enrichment faithfully up to standard as far as we can learn.

Statement of General Policy in regard to the addition of specific nutrients to foods

When the Food and Nutrition Board, originally the Committee on Food and Nutrition, was organized over a decade ago, there was an opportunity for applying significant basic developments in the field of nutrition. Certain deficiency diseases were prevalent, and synthetic vitamins were being used in foods with little or no scientific guidance. To deal forthrightly with these problems, a statement of policy was adopted. The board has every reason to believe that this step has proved to be in the public interest. Since that time there have been new developments and valuable experience has been gained. The board has therefore reconsidered its policy and has revised as follows the statement of principles upon which the policy is based.

"(1) The board, within carefully defined limitations, endorses the principle of the addition of specific nutrients to certain staple foods for the purpose of maintaining good nutrition as well as for correcting deficiencies in the diets of the general population or of significant segments of the population. The requirements for endorsement of the addition of a particular nutrient to a particular food include: (a) clear indications of probable advantage from increased intake of the nutrient, (b) assurance that the food item concerned would be an effective vehicle of distribution for the nutrient to be added, and (c) evidence that such addition would not be prejudicial to the achievement of a diet good in other respects. These requirements have been met in the specific cases indicate in paragraph (6) below.

"(2) The board emphasizes the desirability of meeting the nutritional

needs of the people by the use of natural foods as far as practicable, and to that end encourages education in the proper choice and preparation of foods and the betterment of food production, processing, storage, and distribution so as to provide more fully the essential nutrients native thereto.

"(3) In order to avoid undue artificiality of food supply the board favors, whenever practicable, the choice, as vehicles for the distribution of additional nutrients, of those foods which have suffered loss in refining or other processing, and recommends that the nutrients added to such foods should preferably be the kinds and quantities native to the class of foods involved.

"(4) The addition of other than natural levels of nutrients to foods which are suitable vehicles of distribution may be favored when in the judgment of the board the addition will be advantageous to the public health and when other methods for effecting the desired purpose appear to be less feasible.

"(5) Whenever technological and economic developments lead to extensive reduction in the consumption of a staple food, with a consequent nutritionally significant reduction in the intake of an essential nutrient or nutrients, the board believes that consideration should be given to the desirability of restoring such nutrient or nutrients to the dietary.

"(6) The board reaffirms its endorsement of the enrichment of flour, bread, degerminated corn meal, and corn grits, the nutritive improvement of whole grain corn meal and of white rice, and the addition of vitamin D to milk, of vitamin A to table fats, and of iodine to table salt."

Obligatory Legislation

There has been little progress during the past three or four years in the enactment of obligatory bread and flour enrichment in additional states. Twenty-six states, as well as Puerto Rico and Hawaii, had enacted such legislation by 1950 but no new states have been added to the list since that time. Legislative efforts to secure such legislation have been made in Michigan and Minnesota during these latter years but without success. The principal obstacle has been the residual effects of earlier opposition by some elements of the dairy industry. The basis of this opposition

was the belief that synthetic vitamins were being substituted for the addition of milk in bread. This has been controverted, rather than supported, by a survey by Hugh L. Cook at the University of Wisconsin in 1948. Nevertheless the past propaganda effects persist in many legislative halls.

Increasingly it appears that the principal virtue of obligatory legislation with regard to enrichment lies in the increased prospect of maintenance of enrichment practices through a future possible period of business recession when cutting of every possible cost will inevitably become popular. However, a canvass of the

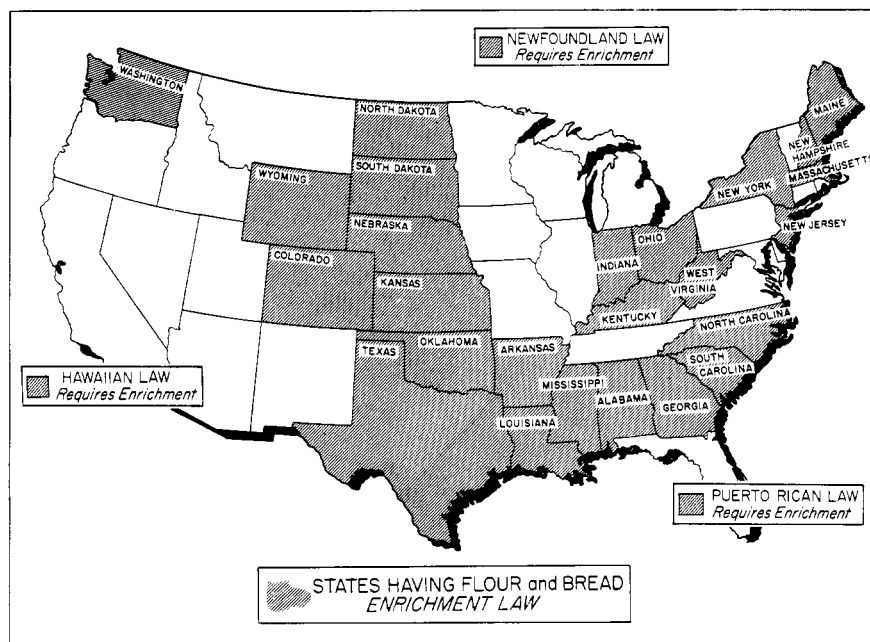
states which have enacted such legislation is not highly reassuring with regard to the effectiveness of enforcement. Many states which enacted the legislation have neglected to provide appropriations to cover the expense of regular inspections and several others fail to report a diligent and continuous inspection procedure. Actually all of our data with regard to the present extent of the effective enrichment of white bread lack the degree of precision which one would wish. There are in the country some 25,000 or 30,000 bakeries and the systematic inspection of these constitutes a large and continuing task. Fortunately the chain and wholesale bakeries supply a high proportion of all of the bread produced in the country and thus constitute a saving factor in the situation.

Considerable interest is arising in flour enrichment in other countries apart from Canada, already mentioned. Denmark and Norway have adopted the practice. Chile is inaugurating a program of enrichment of a large part of its domestic supply of flour. Guatemala, Costa Rica, Panama, and San Salvador are reported to have enacted, or being about to enact, laws requiring the enrichment of imported white flour. Similar legislation is under consideration in Cuba, both as to imports and as to domestic production.

As to degerminated corn meal and grits, we have every reason to believe that almost the entire supply of our southern states is being systematically enriched with vitamins, whether in states which have enacted legislation requiring it or in others contiguous thereto. Similar enrichment of whole grain corn meal is steadily progressing through the southern states. South Carolina and Alabama have modified their laws to apply to the locally produced whole grain corn meal, as well as to the degerminated products mostly brought in from the Midwest corn belt area. Some 3000 of the supposed 8000 corn millers in the South are now regularly enriching their product. A considerable proportion of those not doing so are very small millers who, for economic reasons, are gradually passing out of existence. Corn enrichment is now being practiced experimentally by a score of millers in Yugoslavia with evidence of very beneficial results on the extent of incidence of pellagra in that country.

Rice Enrichment

As to white rice, progress has been rather slow except in Puerto Rico. There a law requiring the fortification of all white rice has been in effect for the past 2 years with full compliance, as far as we know, upon the part of American millers and Puerto Rican importers and merchants. Puerto Rico's rice is largely of the short grain variety grown in California and the California rice millers



have readily adopted the enrichment practice.

The same type of rice is also favored in Hawaii, especially by the large component of the population that is of Japanese ancestry and whose members are the largest consumers of rice. Legislation there has so far failed of enactment, but some 10% of the total importation of rice is reported to be of the enriched variety. A good deal of the opposition to legislation has been on the part of people of Japanese ancestry and affiliations. The argument has been made that to prohibit the importation of nonenriched rice would exclude imports from Japan. This has always been a rather academic point because Japan has no rice to spare for export and, indeed, imports a large share of its own supply. Any vestige of force in this argument has recently been vitiated by the embarkation of four leading Japanese pharmaceutical companies in the manufacture and sale of rice premix produced primarily, if not wholly, with vitamins of Japanese manufacture.

There has been a strong resistance to rice enrichment among rice millers of our southern states and efforts to secure legislation in Cuba requiring the enrichment of rice has been long delayed primarily on this account. Cubans, unlike Puerto Ricans, prefer the long grain rices grown in the southern Mississippi Valley. Legislation requiring the enrichment of imported rice, as well as rice of domestic production in Cuba is now on the books and may well be enacted within a matter of weeks.

In the United States there are only two general areas where the consumption of rice is large enough to justify consideration of compulsory legislation with respect to rice. These are the Gulf Coast

in the vicinity of New Orleans, and the southern Atlantic Coast in the vicinity of Charleston, S. C. Such legislation in these states has been discussed but has made no great progress because in each case rice consumption is high only in a portion of each state. However, the recent success of sales campaigns by Converted Rice which shares the merit of nutritional improvement over white rice, is reported to have made quite an impression on the white rice millers. They now seem somewhat more ready to consider rice enrichment as a measure to hold their markets.

In Asia, and particularly in the Philippines, the battle to secure general enrichment of rice still goes on. There is very little industry support among the rice growers or rice millers for such a reform because the slightly higher cost of enriched rice, not to exceed 2% of its value, is a handicap in its sale. In the Philippines legislation has been inactive prohibiting the sale of unenriched white rice but, for reasons which are partly commercial and partly political, effective enforcement has not yet been secured. It is hoped that the new administration in the Philippines will give it a very vigorous endorsement.

Dairy Products

Addition of vitamin D to milk is practiced to a variable extent in different parts of the country, ranging from 40% in some areas to about 70% in others. To a large extent the price differential which formerly applied to large amounts of vitamin D milk, which was also homogenized, is being abandoned. No data are available as to the percentage of all of our infants and small children who receive vitamin D milk predominantly or

exclusively. We must suppose that it is a very considerable proportion.

Substantially all of the oleomargarine marketed in the United States is fortified with vitamin A to the extent of 15,000 units per pound. This has been accomplished with only minor effort on the part of public welfare groups and the wide adoption of the practice must largely be ascribed to the fact that this addition helped materially to put oleomargarine in a favorable position to compete with butter.

Unfortunately only about half of the table salt produced in the United States is reported as iodized. It seems that a further campaign to secure more general adoption of this practice would be in order.

The enrichment of macaroni, spaghetti, and noodles has made little progress though the practice is permitted by official food standards. Only about half of these paste products are now enriched. They are used in large volume only by people of Italian origin who in many areas are not numerous; their use by other elements of population is widespread but occasional.

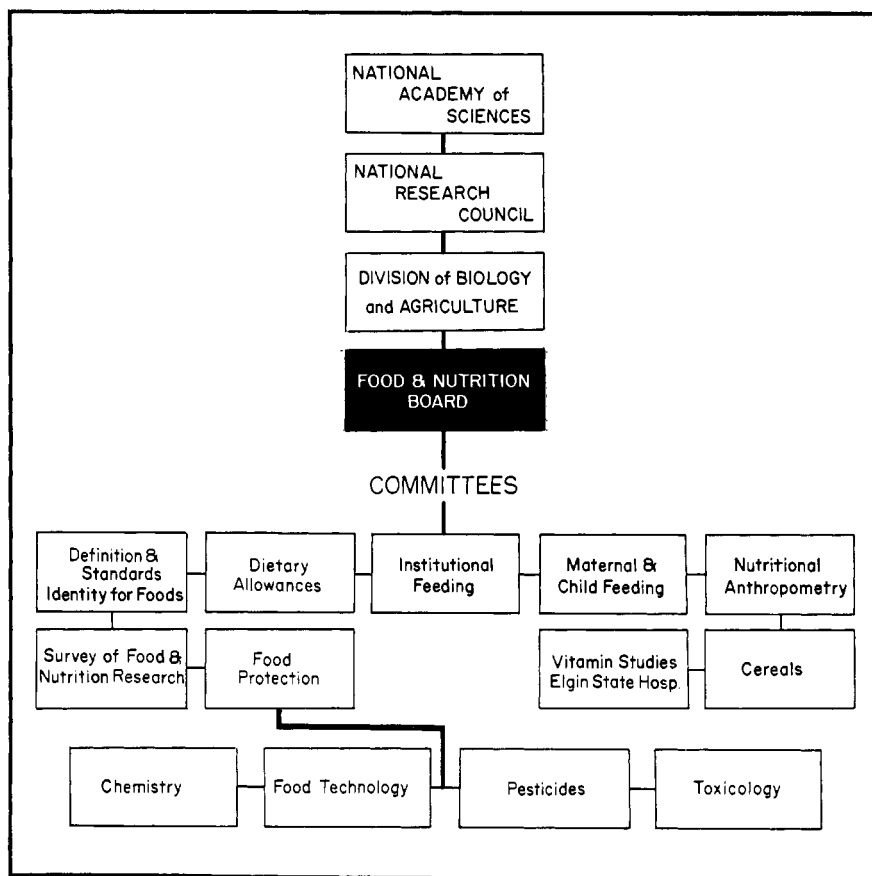
Current Further Possibilities

We shall now approach the several questions of how enrichment practices may be modified in the future. However, before going off the deep end into waters which the writer has explored only privately so far, let us first look at some modifications or extensions which have been before the Food and Nutrition Board for discussion.

The addition of calcium as an enrich-

Robert R. Williams, chairman of the Williams-Waterman Fund for the Combat of Dietary Diseases, is a well-known biological chemist who played a leading part in the synthesis of vitamin B₁. Dr. Williams, whose parents were missionaries, was born in Nellore, India, in 1886. He came to this country for schooling and later to take a B.S. and M.S. in chemistry at the University of Chicago. He

then went to the Philippines, where one of his tasks was research on the beriberi vitamin. During World War I he was in Chemical Warfare and the Air Service of the U.S. Army. He joined the Bell System in 1919 and became chemical director of the Bell Telephone Laboratories in 1925, a position he held for 20 years. Research on vitamin B₁ continued as an avocation and culminated in the synthesis in 1936. The resulting patents, assigned to the Research Corp., provided the Williams-Waterman Fund for the Combat of Dietary Diseases. Under its auspices, Dr. Williams went to the Philippines and China in 1946 to introduce a nutritionally improved form of rice for the correction of beriberi. He is chairman of the committee on cereals of the Food and Nutrition Board of the NRC and the recipient of many honorary degrees and awards.



The Food and Nutrition Board and its committees are under the administration of the National Research Council

ing ingredient for cereals has often been favorably discussed by nutritionists who are aware of the low calcium intakes which prevail among peoples throughout the world who consume little milk. More calcium is one of the most prevalent needs of Asia. Pure grades of limestone are widespread and very cheap. Their addition to flour and corn meal is cheap and easy. Such addition of limestone has consistently been included in the enrichment formula for most whole corn meal in our South. Further a large share of the white flour used in that area is self-rising flour which automatically carries with it ample amounts of calcium in the form of calcium acid phosphate as a leavening agent.

Furthermore the general practice of using considerable amounts of milk in loaf breads extends to all regions of this country. Use of calcium salts as yeast foods and as anti-mold agents for bread further enhances the calcium intake. Low calcium intake may be a problem in some areas of low calcium ground waters as in the Northwest but if so it seems strictly for regional consideration. Calcium (as well as vitamin D) has been an optional ingredient for enriched flour and bread from the beginning of the program and so remains.

Addition of calcium to rice presents special technical problems because the required amount of any calcium salt would build up the premix grains of

rice to unwieldy size. Perhaps this can be overcome in future by compacted grains of ground limestone imitative in size and shape to grains of rice.

Optional Enrichment

The use of the optional ingredients in flour and bread has been very limited except as noted above. Millers generally feel that addition of lime salts to flour would be an unpleasant reminder of the adulteration of flour with calcium sulfate decades ago. Calcium and vitamin D have rarely been claimed in label statements on bread or flour (except self-rising). Within the past year, however, a number of bakeries have adopted at least experimentally the inclusion of vitamin D in bread and claims therefor. Partly this has been done as a new angle for use in advertising, partly in genuine belief that it would add another needed betterment of the general dietary. The evidence pro and con has been recently reweighed by the board. No statement has yet been issued by the board but the general tenor of discussion was in favor of the view that it is unnecessary to resort to bread as a vehicle for vitamin D in spite of the fact that the board has recognized it as an optional ingredient for enriched flour and bread. Milk has always been regarded by the board as the most desirable vehicle for vitamin D.

Milk has been proposed as a vehicle for distribution of other vitamins but the board has not favored it, feeling that additional supplements are not in general needed by milk consumers. Special attention was paid to vitamin A addition to milk but it appeared that fortification of oleomargarine was already achieving an adequate distribution of vitamin A. This conclusion also applied to the proposal of vitamin A and D skim milk and a similar disposition also applied to a proposed fortification of cheese.

Several proposed uses for vitamin C in foods pertain to factors other than nutritional ones. One of these is to use vitamin C to prevent the development of an oxidized flavor in milk. Exposure of milk to copper and the character of the winter rations of the dairy cow are believed to predispose milk to this flavor development. These factors appear to be in process of being brought under continuously better control and the board felt that more evidence should be secured of the merits of and need for ascorbic acid as an antioxidant in this case. Evidence as to increased marketability of milk so treated was particularly desired. If oxidized flavor can be shown to be a substantial deterrent to milk consumption the board might favor the use of ascorbic acid to prevent it.

Somewhat similar uses of vitamin C have been proposed to preserve the color and flavor of heat processed foods, for example, to prevent oxidative browning, enzymatic discoloration, and loss of flavor in fruit and vegetables. Such measures have received the commendation of numerous reputable scientific workers. In general, additions of vitamin C are sanctioned by federal authorities in the case of foods which have a substantial natural content of vitamin C. The upper limit of ultimate vitamin C content approximates that of the natural product in fresh form. It does not appear that such restoration of vitamin C lost in processing is widely practiced.

A somewhat more novel use of vitamin C to preserve color and flavor in cooked, cured or comminuted meat products is sanctioned by the U. S. Department of Agriculture and well may come into extensive use. In the case of cured meats, vitamin C appears to act in conjunction with nitrate and nitrite which are permitted as curing agents.

A forecast of what may come in the future is the recent agitation for the inclusion of added pyridoxine in infant foods. Consideration of this matter has been greatly advanced by the discovery of 10 cases of convulsive seizures in infants fed on a liquid milk preparation specially designed for pediatric use. All cases responded favorably and ultimately completely to therapeutic use of pyridoxine. Thus we learn by our mistakes.

Enrichment in Other Countries

Obviously the enrichment programs in the United States has been designed to fit such characteristics as nutritional status, food habits, and economic conditions of the people of this country. They may or may not fit the needs of other lands as well. It is fortunate that to a considerable extent our formulas do fit, at least in part, the needs of some other populations. For the Indian populations of Mexico, Guatemala, Colombia, and Peru they are almost useless because corn, their principal cereal, is raised on the farm and processed by the housewife to its final destination. There is scarcely any industrialization of the food supply. In the cities of Latin America, however, the consumption of white rice and flour are high and our enrichment processes are capable of doing much good. The principal obstacles to their use are lack of initiative and even more often lack of dollar exchange with which to buy the vitamins.

If one turns to Asia the predominance of cereals in the diets of the masses is still more conspicuous. With some exceptions our form of cereal enrichment would greatly invigorate the people, for example, in the Philippines where beriberi is rife. Here we encounter the same form of handicaps in their introduction as we have mentioned in Latin America.

There are considerable parts of the world where our enrichment formulas would not be applicable. Russia's black bread and Northwest India's whole wheat chapatis would leave little room for our formulas. Other parts of rice-eating India have met the cereal-vitamin problem reasonably adequately by the use of parboiling. There are parts of Latin America and Europe where the extensive use of potatoes and other roots and tubers may make our form of enrichment unnecessary.

Widespread Needs

Yet for most of the world, apart from Anglo-North America and Western Europe, there is an outstanding and conspicuous need which is not met by our present enrichment formulas and which will be difficult, if not impossible, to meet by improved agriculture. This need is for more high quality protein of the animal protein type. In those countries where the productive capacity of the land is already strained to meet the caloric demands of present populations, it is useless to talk of raising more beef, pork or poultry to meet the need. That would take 5 or 10 times more land than is available. Something can be done by expansion of fishing and especially by fish culture but I doubt that these can become sufficient. We may well be compelled to resort to chemical synthesis to defeat Malthus' predictions for another century.

The prevalence of anemias in various

tropical countries suggests the possible future usefulness of food enrichment with folic acid in those areas. For this purpose its present price must be very greatly reduced. Perhaps in addition it may have to be produced in the countries where it is needed to avoid dollar exchange problems. This consideration may well apply to most of the other synthetics which will be mentioned.

Vitamin B₁₂ is not yet synthetic but its production requires a very high grade of chemical skill. Production by biological processes which also produce useful antibiotics seems more eligible for consideration in countries of less industrial development. A broadly diversified chemical industry nearby may be unnecessary for the successful conduct of such processes. Scrimshaw's studies of the utility of vitamin B₁₂ (or aureomycin) for growth of children on diets low in animal protein should provoke careful thought on the part of business managements of firms which could consider setting up branches in South Asia. I shall not attempt to discuss the economics of chemical manufacture in relatively backward countries remote from the great chemical factories and laboratories of the Western world. Those more competent than I should think about them. Present restrictions of world trade are disastrous in many ways and proper remedies should be eagerly sought.

What has been said concerning vitamin B₁₂ applies with comparable force to processes for the synthesis of lysine and methionine. Equally economical processes may be required for threonine and tryptophane. The less abundant essential amino acids, if their synthesis and distribution for use throughout the tropics can be accomplished, may well provide the sole possible solution for the semistarvation of the world at large.

Their use is being advocated as supplements to our present cereal enrichment formulas in the United States. Such action will surely be bitterly opposed by all producers of animal food products and represents a virtual impossibility politically. I shall not feel warranted in defending measures which would decrease our use of animal foods under present circumstances. If that Utopian day should come which was envisioned by Lord Boyd-Orr at the founding of the Food and Agriculture Organization, we shall have to take another look at the matter. Boyd-Orr's proposal was a vast international fund which would buy up all surpluses of food wherever they developed and transport them to areas of need. We are still far from being "One World" in an economic sense though I hope we are haltingly progressing toward that goal.

(Based on a discussion before the Food Industries Advisory Committee of the Nutrition Foundation, White Sulphur Springs, W. Va., May 10, 1954.)