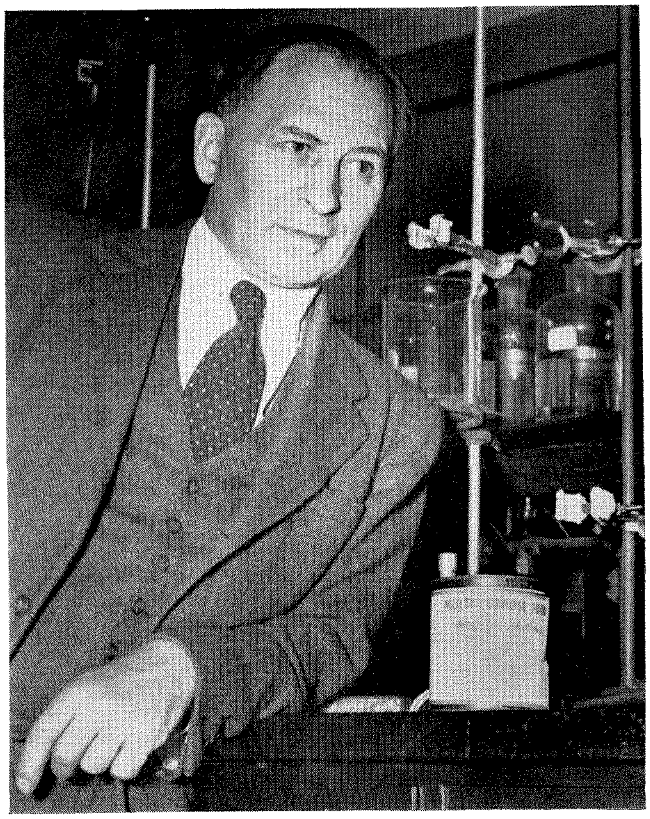


WE COULD FEED THE WORLD

by HENRY BORSOOK

WE HAVE THE TOOLS and the technology to feed everyone in the world with our present resources. And yet it's been estimated that 80 per cent of the world population normally suffers from under-nutrition or malnutrition.

One hears any number of explanations for this ironic situation—but at the bottom of them all is the simple fact that we still think of food in terms of the nineteenth century.

As long as we persist in thinking of food in terms of bushels of wheat, we'll never have enough to go around. As soon as we learn to consider food as a conveyor of essential nutrients—and look for the cheapest and best way to get these nutrients—we'll find we have enough for all.

According to the standard definition, only natural, or unprocessed, food deserves the name. Processed foods, generally considered to be the opposite of unprocessed, are by the same token "unnatural." Processing foods is "tampering with nature"—an odd objection when you consider how willingly we accept such "tampering" in every other branch of science.

There is a general impression, even in nutrition circles, that processed and unprocessed foods are competitors. But I know of no case where this is really true, if the circumstances under which the different foods are intended to be used are taken into account.

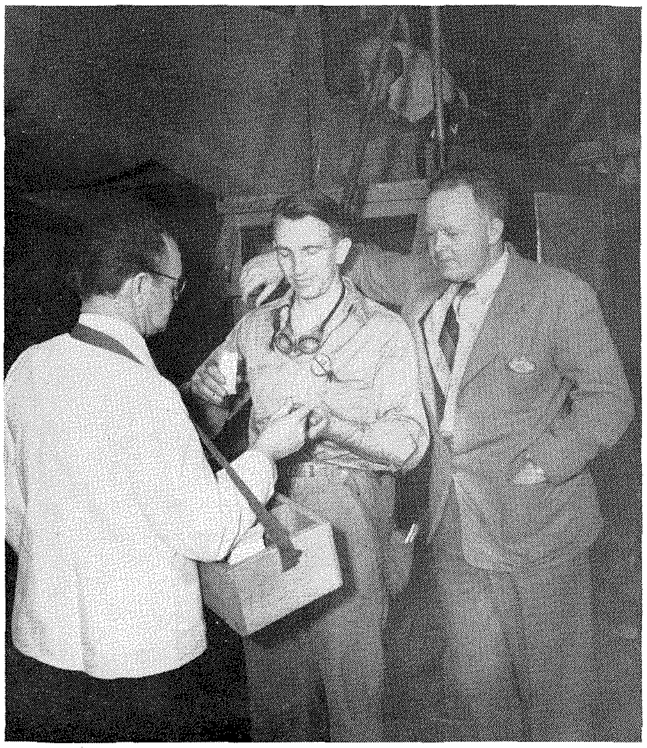
The novelty in the present situation is that, thanks to great advances in nutritional science and food technology, many more foods can now be improved. There is good reason to process a number of foods which we are accustomed (erroneously) to think of as natural foods—that is, unprocessed foods. No one raises an eyebrow any longer at dehydrated vegetables and fruits. Iodized salt and Vitamin D milk are an old story. So is margarine, now that manufacturers and nutritionists have begun to add Vitamin A to it.

During the war, flour in this country was enriched by the use of vitamins, and in some cases iron and calcium. Opponents of the idea of improving natural foods either forget or like to pass over the fact that during the war, in Britain, the dark flour which they had to use was enriched with calcium—to neutralize the deleterious effects of phytic acid in the bran of the high-extraction flour.

During the war, in this country, orange juice concentrated for export was fortified with synthetic Vitamin C, in order to give it a reasonable Vitamin C content. Recently there has been talk of including a certain amount of Vitamin C in canned tomato juice, for the same reason. If any such measure is finally decided upon, it will be necessary to add synthetic Vitamin C to nearly all of the tomato juice canned in the United States—except possibly California and Arizona.

Surely this is evidence enough that the processing of foods is an old story—and that it is a natural and reasonable application of scientific progress to extend this kind of processing to foods wherever they can be improved nutritionally without significantly increasing the price.

My interest is in the nutritional aspect of processing foods. From a *nutritional* point of view, I repeat, a food is only a conveyor of certain essential nutrients. I am aware that there are other important considerations, such as taste and eye-appeal, which are of great practical importance; but they, I think, look after themselves pretty well. The great discoveries in nutrition in this century have enabled us to define the nutritional value of foods in quantitative terms. One important item among these great advances was the discovery and proof that, as far as the physiology of the body is concerned, the source of an essential nutrient is immaterial. It doesn't matter whether it is grown or synthesized in the factory. The economic and social implications of this finding are enormous. In fact, no one can see how the present world shortage of essential nutrients can be solved without taking



Borsook's experiments with defense workers at Lockheed Aircraft showed benefits of scientific consumption of vitamins.

advantage of this great scientific advance, and the great modern technology to which it gave rise.

The essential nutrients are, briefly, **calories,** which may be obtained from proteins, fats and carbohydrates, and from nitrogen in the form of protein (as far as human beings are concerned). Here the content of the ten indispensable **amino acids,** determines whether the protein mixture is adequate or not, for these substances provide all the material from which proteins are built. For nearly all practical purposes, the only **mineral** about which we need to be concerned is calcium. As far as the **vitamin** content of human food is concerned, at least in this country, we need take into account only Vitamins A, B_1, B_2, Niacin, C, and D.

Let me review briefly some of the things we need to take into account in the use of processed and synthetic foods, with regard to the provision of the different essential nutrients.

Where there is a food shortage, we must never forget the need of calories. We learned during the war that a deficiency in calories is what is felt first and most acutely. This, no doubt, applies today in semi-famine areas. A low caloric requirement for sedentary work is 2,000 calories a day. Taking an average value for a mixture of protein, fat, and carbohydrate as five calories per gram, this requirement will call for 400 grams (dry weight) of these food materials; in other words about nine tenths of a pound.

This disposes at once of the notion one meets every once in a while that it may be possible some day to supply all the food requirements in a few pills. It is simply impossible to squeeze nine tenths of a pound into a few pills. The fundamental laws relating matter and energy exclude the possibility of our providing our caloric needs with less than this amount of food.

The minimum protein requirement of an adult is in the neighborhood of 50 grams a day, or shall we say roughly two ounces (dry weight). So little protein, if it is to maintain nitrogen balance, must all be first-class. In other words it must contain adequate amounts of the ten amino acids which the body cannot synthesize from others; hence their designation "indispensable." In most cases, where the protein eaten daily is so low, it is for economic reasons; and hence vegetable proteins are used rather than animal proteins. In general, vegetable proteins tend to be low in two of the indispensable amino acids, lysine and methionine. But by mixing some vegetable proteins, proteins relatively rich in these amino acids would (though they may be low in others) convert the whole mixture into a first class protein. Flour, which is deficient in lysine, is relatively high in methionine. Among the vegetable proteins, those in legumes are on the whole of the best quality. But they are low in methionine. This deficiency could be met easily by the use of bread.

As far as calcium is concerned, the experimental nutritionist Henry Clay Sherman showed many years ago that the calcium in such salts as Calcium Carbonate (chalk) or Calcium Sulfate (plaster of paris) is used as effectively as the calcium in milk. The British, during the war, added Calcium Carbonate to flour.

With regard to the vitamins, I need only say that it doesn't matter whether we use vitamin concentrates from natural sources or synthetic vitamins. They are in every respect identical with those in the foods as they come from the field.

Vitamins have two characteristics which set them apart from the other substances the body uses—the small amount necessary to preserve health, and the complete inability of the human body to make them itself. They are formed for the most part by green plants on land, and by algae and other smaller organisms in the sea. Until recently we had to get the necessary vitamins directly from plants, or indirectly from animals. Now of course the synthesis of vitamins has progressed to the point where 11 of the 13 known vitamins are being produced commercially. The naturally occuring vitamins will for a long time be the main source of vitamins for us human animals. But synthesized ones are invaluable in treating vitamin-deficiency diseases, and in supplementing diets with inadequate supplies of them. And it's cheaper to manufacture many of them than to grow the plants that provide them.

Present technological knowledge and production facilities can, I would guess, supply all the vitamins and minerals needed for optimal nutrition of all the people in the world, including the billon very poor of Asia. But there can be no question that more calories and protein need to be produced.

As for calories, modern technology cannot compete with the sunlight of the tropics and semi-tropics. The photosynthesis of carbohydrates is still the cheapest and best method of obtaining sugar, and thence calories. What the 1,000 million poor people of the world need is money to get it. That takes us out of the field of food and nutrition into economics; and on that subject I have nothing to say.

One thousand million people of the world need more and better proteins. We cannot yet manufacture or synthesize protein. As far as we can see, for a long time to come it will have to be grown, whether as animal or vegetable protein. The production of animal protein is costly and inefficient. Animal protein is a luxury, which is fine if you can afford it. Most of the people of the world cannot afford much of it. Vegetables, with a few exceptions, such as the legumes, are not rich sources of protein. And vegetable protein as a class is not first-class protein.

The prospect is not hopeless. I can see two things which can be done, which would help a great deal. First we should use far more of the protein now grown for human consumption. Today most of it is used as animal feed or is simply thrown away. During the war we threw away large amounts of the soybean protein. We are not doing that now; but too little is going to human consumption. There are large amounts of protein in oil cake and residues in the fermentation industries. We should and could use more of it.

A large fraction of fish protein goes to fertilizer or animal feed. Fish protein is first-class animal protein; it is cheaper than terrestrial animal protein; and I know it can be processed so as to be palatable. One of the necessary measures in the solution of the world protein problem is, then, less waste, and the diversion of more protein to human consumption.

The other necessary step is education. Processors and consumers need to be taught to so blend incomplete proteins that they will cover each other's deficiencies in essential amino acids. This can be supplemented in a few instances by the enrichment with synthetic amino acids.

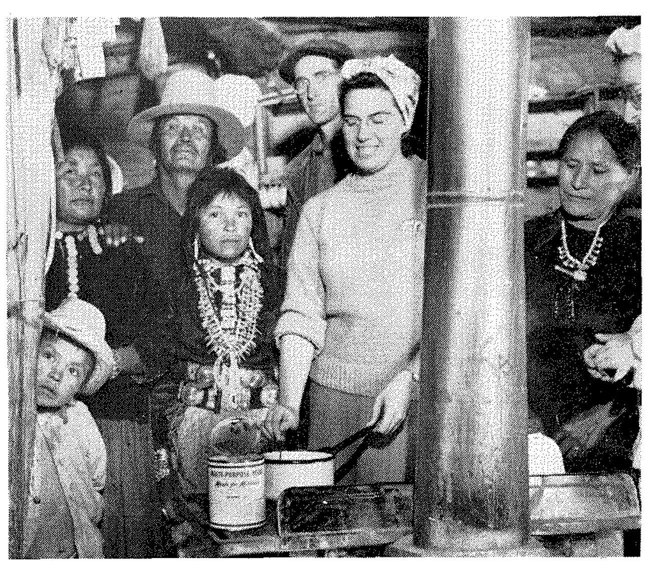
As an example, and only as an example, of the kind of thing I have in mind, I will tell you briefly about a food I had a hand in developing. It has received considerable publicity, and you may know it by the name of Multi-Purpose Food. The specifications which were given me in the devising of this food ran somewhat as follows: Three servings were to supply the Recommended Daily Allowances of protein, minerals, Vitamins A, B_1, B_2, and Niacin. The food was to be palatable, to blend readily with other foods when other foods were available, to be eaten by itself when they were not. The meal had to be quickly cooked, in not more than 10 minutes, and require only the most rudimentary cooking equipment. It had to keep from six months to a year, packaged in a dry state. It was to cost not more than three cents a meal. It could not offend the religious principles of any people. It had to be transported easily. It could not draw on those foods which Americans eat to a large extent.

The major ingredient chosen finally was soy grits, with a low fat content. The soy protein was chosen because it was the best cheap protein from a nutritional point of view. It is cheap because it is a by-product. Soy was grown chiefly for its oil, which has a variety of uses, including the manufacture of paints and lacquers. Why did I choose the soy grits? The mistake that had been made and may still be made with regard to the use of soy protein for human consumption was that it was used as a flour and invited comparison with flour. It is not a good substance for flour. It doesn't cook or bake as flour does. The grits, however, have a good texture, and this quality at once determines their use in a different way than flour. One need add only water to make a good soup. If only a little water is added, it is stew. It can be used as a meat extender. To the grits were added Vitamins A, B_1, B_2, and Niacin, so that one serving of $2\frac{1}{4}$ oz. would supply one-third of the Recommended Daily Allowances of protein and these vitamins. Vitamin C was not added because it is largely destroyed in the cooking. Certain spices were added. These are of such a character that the food blends readily with any other food. For example, if it is used with a little fish, it takes on the character of shall we say fish-balls; with cabbage, of a cabbage dish. As it stands, it is low in methionine and in calories. The deficiency of these two essential nutrients is met by bread. It is cheap compared with any other protein food used for human consumption.

The Multi-Purpose Food is only an example, I reiterate. I refer to it here as a very simple example of what can be done by the application of the science of nutrition and modern food technology. A food such as Multi-Purpose Food, is, of course, not intended to replace the habitual American diet wherever people can afford it. All of us would prefer a steak at any time.

The use of foods of this character should be considered in two extreme situations or conditions. One is semi-starvation, in which even the objection of monotony is removed; the other and more common occurrence is where people have some food, but for budgetary reasons cannot afford enough first-class animal protein. They need vitamins and minerals in an enriched protein food because fruits and vegetables are dear too. The objection that a processed food cannot supply all of the yet unidentified vitamins and the trace elements is again not valid, because these people will be getting them from the rest of their diet. The common objections to food such as the Multi-Purpose Food is that people would not want to eat it alone every day, three times a day. They are not expected to.

It is this example I have in mind when I say that we have in our hands the scientific tools and the technology to prepare foods to meet almost any situation. The use of industrial and agricultural by-products insures their low cost; vitamin concentrates, synthetic vitamins, and commercial minerals will make them as nutritious as an expensive diet scientifically selected from natural fresh foods. In no other way can the needs of such countries as China, India, and even portions of Europe today be met. It isn't necessary to force people to eat brown bread if they prefer white. It isn't necessary for people to get scurvy, if the good food sources of Vitamin C—citrus fruits, tomatoes, cabbage, potatoes, and a few green leafy vegetables—are not available or are too costly. Freedom to eat what we like and still be well-nourished is one of the new freedoms which science and the technology of foods offer to the world if it will only take it. That offer has not yet been accepted.



Multi-Purpose Food has proved a boon to Navajo Indians—though this demonstration isn't stirring up much interest.