

flour by the addition of some B vitamins and other nutrients does not make sense. To remove by an elaborate process some of the most important nutrients of wheat and then to manufacture, with still greater trouble, a few of these nutrients and add them to white flour, from which they and several others have been extracted, is as near to being crazy as anything could well be. Anyhow, it is not possible at present to add more than three out of the 11 known factors of the vitamin B complex, the unknown factors being altogether ignored. This is not enriching, it is tinkering.

Dr. S..K. Kon (National Institute for Research in Dairying, University of Reading): With Professor Kay's permission I should like to answer the question which Dr. Bergel addressed to him. The cow can grow, reproduce, and secrete milk on diets sufficiently deficient in the vitamin B complex to kill rats in a comparatively short time. The presence of assimilable carbohydrate in the rumen is more important for the synthesis of vitamins than that of vitamin B₁. In refectation, when undigested starch is present in the caecum, rats can grow and thrive on a diet devoid of most members of the vitamin B complex.

Dr. P. Ellinger (Lister Institute, Chelsea Bridge Road, London, S.W.1): There is, apart from beriberi, no vitamin B deficiency disease of human beings which can directly be connected with a diet poor in the respective vitamin. On the other hand evidence is increasing that at least a large proportion of the requirements for members of the vitamin B complex is covered by the release of these vitamins from the intestinal flora. Man seems, therefore, less interested in their consumption than pigs and hens, and it may prove economical to leave the wheat offals to these latter.

Dr. E. Work (I.C.I., Welwyn Garden City, Herts.): In countries such as Denmark where wholemeal bread is eaten, what are the cattle fed on?

Professor J. A. Scott Watson (Ministry of Agriculture and Fisheries, Whitehall, London, S.W.1): They import quantities of milling offals, or did so before the war, from this country; our own stockbreeders had plenty.

Chairman's Summing Up

Professor R. A. Peters (Department of Biochemistry, University Museum, Oxford): I am afraid I find summarizing difficult. I think that the first thing we ought to do is to congratulate the officers and committee for the programme that they have organized and put before us today, and the various speakers for presenting to us so admirably the different aspects of the questions under consideration.

I have of course been a good deal impressed by what Dr. McCance told us about the work at the Cereals Research Station under Dr. Moran, a most interesting piece of research. It is extremely important that it should go on so that we can learn more and more about it.

It would seem that there is every cause for letting the cows have the bran, I have been convinced of that. That brings us down to the 85 per cent. extraction as recommended some years ago. With regard to the question of offals, it would seem again from what we have heard about

poultry that they at least need some of these offals. I feel rather strongly that more research should be done and that Dr. Kodicek, who said that we ought to aim at an enrichment policy for poultry food, was on the right lines. It would be perfectly easy at the same time to learn how to enrich the wheat grain; it seems to me that this is a point again where research is badly needed.

We have just heard very powerful medical opinion against the argument that people cannot eat the 85 per cent. bread; of course there may be some cases of allergy, but there are few foodstuffs to which a very few are not allergic. We have had powerful arguments also from Professor Fridericia of Denmark, where we are told that a nation lives happily on high extraction flour; possibly it might require more research into the best methods of baking this.

In regard to the question of "enrichment", it is quite clear, as Mr. Bacharach said, that the supposition of white flour being adequate has been completely dropped; that constitutes a big nutritional advance. Of course enrichment is an enormously interesting experiment and achievement of modern chemistry. Chemistry is now powerful enough to put into foodstuffs substances in which we may not consider them to be adequate. All this is well worth doing, even if only as an experimental run. I think Mr. Bacharach gave us some very good points in regard to that discussion. You have to bear in mind that if you once start on a very thorough programme of enrichment it must be thorough and it is impossible to stop. We have three or four vitamins, minerals and so forth, now recognized as necessary but we already know of many more, at least three, which also will have to be considered soon. It is indeed a slippery slope upon which to step. I was particularly interested that Professor Watson mentioned Dr. McCollum's opinion, because it is important to know that he is in favour of higher extraction. I think it would be a very bold man who would say that putting in one mineral and perhaps three vitamins was adequate.

There are certain research points also which need clearing up. It is complete nonsense of course to say that synthetic and natural vitamins are different. At the same time we should try to find out whether the methods of presentation in the natural and enriched flour are the same. In illustration, I could mention some experiments which Mr. Croft and I have been doing upon rats with amino-acids (Croft and Peters, 1945). We have found that extra methionine and casein decrease loss of nitrogen in burns; yet methionine given in an amino-acid mixture in the same amount as in the casein was not effective. In trying to explain this, we thought that a more rapid absorption of amino-acids might flood the liver and thus prevent some action of the methionine. There are evidently points about absorption, and digestion also, still to be understood. In conclusion, I suppose that a conservative view would be that we have to go rather slowly before we can be satisfied that the enrichment has produced a flour which is really going to be satisfactory to those folk who depend mainly on bread.

REFERENCE

Croft, P. B. and Peters, R. A. (1945). *Lancet*, **248**, 266.