THE NATION'S LARDER IN WARTIME

*This is an abridged version of one of a series of lectures recently delivered before the Royal Institution**

THE FUNCTION OF THE FOOD INDUSTRY

BY

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In every part of the world the food factory is replacing the domestic kitchen. It is not for me to discuss those changes in the economies of the urban dweller, those influences on the women of to-day, which are responsible. The replacement is deplored by some and stimulated by others, but it is an incontrovertible fact. Another incontrovertible fact is that communal feeding is the most economic method of feeding. To cater for a dozen costs less for each person than to cater for each one of a dozen individuals; to cater for a million is to save the nation's wealth.

The food industry occupies an intermediate position between ordinary household catering as known generally a hundred years ago and mass catering of the canteen type. My task is to try to indicate the function of the food industry in times of stress, and therefore to get a clear idea of the industry as a whole.

First let me mention that I have found evidence of muddled thinking in respect of "prices." Thus land is tilled and fertilized, a crop sown and tended, energy absorbed by the growing plant from the sun, something taken from the soil, and the crop garnered. All these factors could be similarly expressed in units of energy together with certain units of vitamins and other important nutritional elements. Our problem to-day is to see that the maximum use is made of this total energy. We are not concerned here with the difference between the prime cost of producing the crop and the price at which it is sold to the customer; we are not concerned with the purely artificial proportion of this price difference between the producer, the intermediate dealer, and the retailer. To indicate the most equitable division, in wartime at any rate, is a function of government—a function which, in fixing prices of raw materials and of certain finished goods, the Government has partly assumed.

The functions of the food industry fall into three groups: the preparation for distribution of primary articles such as milk and milk products, butcher's meat, flour and bread, and vegetables; the preparation of what may be called "grocery lines" such as tinned and cooked goods, confectionery, and ready-to-serve meals; and, finally, the preparation and serving of meals themselves.

Sir John Orr, in his lecture a fortnight ago,¹ put before us the necessity for considering the nutritional value of the foods we eat and the importance of giving due consideration to the vitamin and salt contents of diets. Hitherto the direct interpretation into diet sheets of such lists as he showed us would have remained solely the duty of the housewife. She would have taken the raw materials and would have cooked and baked, stewed and roasted, and would have thereby interpreted and satisfied to the best of her ability the demands of the dietitian.

To-day the situation is entirely different. Certainly the final choice is left to the household caterer, but between the land and the kitchen there has developed this food industry which, in part or whole, prepares much of the food provided by the land. For better or for worse this tendency grows, for town dwellers have little or no connexion with raw material, and those who live in the country rely almost equally for their supplies on intermediate distributors.

Mass Production of Food

One of the outstanding features of the age is the variety of goods always available. To give full rein to our whims and fancies is not in the national interest in times of war, and our Government has taken great care to see that we are not in a position to please ourselves. As the Minister of Food has said, the question of the ration of sugar depends not only on the availability of shipping space but also on the availability of American dollars. Economic conditions thus limit the range of raw materials available. The food industry can in such times make the best use of the goods that are obtained, whether from our own land or from over-seas. This mass production of food has made possible a more intensive study of food problems from the scientific point of view than could have been carried out had the industry continued to be in the hands of a large number of small concerns. The tinning of fruit is an example. Studies conducted by or on behalf of large firms have resulted in a definition of those conditions of the tinning process which ensure the retention of the maximum amount of vitamin potency. A far greater destruction of the vitamins occurs when fruit is prepared and cooked in the home.

The first function of the food industry concerns the group of primary products. The story of the loaf is not so simple as some assume. The whiteness of the flour depends on the amount of the outer layers of the grain included; the whiter the flour the greater the proportion of the centre of the kernel. There is, however, always a proportion normally discarded as flour and sold as fodder for livestock generally. In times of war it is usual for governments to insist that more of the whole grain be included in the flour for baking. In the amount of vitamin B₁ in the part of the grain normally discarded lies possibly the most important reason why brown or whole-meal bread should be eaten during times of nerve tension. But there is one aspect of the "whole bread" problem which is not often considered by those who advocate the use of brown bread. It is not easy for the modern bakery to change over from the production of white bread to that of brown. The doughs made from brown flour have characteristics and physical properties which make it impossible for the machinery to deal with them without modification, and such modifications cannot be brought about, even in peacetime, by a wave of the hand.

Although the miller has prepared a product as standard as possible of its type, the baker has to apply the knowledge gained by rule-of-thumb methods, now interpreted by the chemist, in order to produce a loaf of standard appearance. Every step has to be controlled: the making of the dough, the fermentation, and all the other pro-

* The lectures will be published *in extenso* by Messrs. G. Bell and Sons, Ltd., of York House, Portugal Street, W.C.2.

¹ *British Medical Journal*, June 22, p. 1027.

cesses, even down to the wrapping of the loaf. It is only by this close control that a particular bread can be produced as unvarying and as cheaply as it is to-day.

Economy in the Factory

The proper utilization of milk is interesting and complex. A moment's consideration will show that an intermediary between producer and consumer is absolutely necessary. The large dairy factories must be prepared to transform the surplus milk of the "flush" season into other edible goods. Besides the main function of taking milk from the farms and cleaning it and pasteurizing it, butter, cream, and cheese, and condensed and dried milks have to be made; and by-products—lactose, dried whey, and casein—have to be worked up. Another aspect of the milk problem is the manufacture of ice cream, made in millions of gallons annually, standardized in composition, of a bacteriological purity far exceeding that of the ordinary milk supply, and one of the safest and most nutritious foods available.

The preparation of potatoes in the ordinary way for boiling—a method of cooking typically English—consists in peeling and eyeing. Factory procedure is different from that of the home. At the factory the potatoes are introduced into a bowl having a corrugated or roughened inner surface and a spinning bottom plate which is flooded with water. The friction between the potatoes and the bowl causes the removal of the skin. By another method the potatoes are introduced into a travelling oven, where the temperature is about 1,200° C., for eight seconds. This results in the shrivelling of the skin, and then the potatoes are run down an inclined plane with a stream of water and the shrivelled skins are rubbed off. With hand peeling there is a loss of 22 per cent., with machine peeling a loss of 7.8 per cent., and with furnace peeling a loss of 3.5 per cent. In each of these cases there is careful eyeing, for which there is no mechanical method available.

An example or two from the "grocery line" will also show that the national economy is favourably affected by full utilization of factory-produced goods. The loss by home cooking of an average ham is 15 to 20 per cent., made up of fat and other important constituents. The cooking of hams under standard controlled conditions has been intensively studied, and the loss of total ingredients has been found to be from 6 to 10 per cent. There is a further economy in the latter procedure. Any fat which rises to the surface of the cooking vat is skimmed off under controlled conditions and subsequently purified to yield an edible fat. The fat which rises to the surface when boiled puddings or Christmas puddings are cooked might equally be instanced.

Another example of economy which might be mentioned is in the squeezing of an orange to make an orange drink. The housewife normally discards not only the peel but the pith. The food factory utilizes the peel to make glacé or candied peel, and the pith to produce pectin, an important constituent of jams.

Preparation of Cooked Food

An aspect of the food industry which is assuming greater proportions every year is the preparation and distribution of cooked foods: meat pies and fruit pies, cakes and confectionery of all kinds, table jellies and sauces, and that further group which is a distinct aid to the housewife—namely, the ready-mixed cake and pudding powders and prepared short and flaky paste. Certainly the housewife in making a cake from flour and eggs and

fat and fruit can do so as cheaply, in reference to her own household budget, as by buying a cake mixture, perhaps even more cheaply. But the making of one cake or even of several results in far greater wastage of raw materials than if the mixed ingredients are used. Certainly the most economic method from the national viewpoint is the purchase of ready-baked cakes, for the amount of fuel consumed, either directly or indirectly, in the preparation and baking is less with the mass manufacture than with the home-produced goods.

In a controlled test, using an ordinary gas cooker, a housewife baked a cake and twenty-four small rock cakes. The final weight was 4½ lb. The gas consumption showed that to bake a pound of cake had required 10 cu. ft. The gas consumption of a travelling oven—that is, a factory oven of the modern type through which the cakes pass on a travelling band or on trays, producing hundreds of pounds of finished goods an hour—was 1½ cu. ft. of gas for every pound of cakes produced. Domestic cooking was therefore eight times more costly in gas usage than factory cooking.

To-day the food industry is faced with a shortening of supplies. Anyone with a discerning palate will have noted the gradual reduction of the sweetness of most tarts and cakes to be bought in shops. Other sugars, more expensive than cane sugar, have been used to replace the sugar ordinarily used. The Minister of Food has asked the food manufacturers to improvise—which means, as I understand it, to find substitutes or alternatives.

There are two distinct types of improvisation—namely, the adaptation to some new use of food products already known, and the development of some new process by which from inedible substances a food may be produced. Neither of the two is easy, and because in the past generation food has been so plentiful there has been little stimulus to proceed with the necessary fundamental work of a scientific character on which to base the investigations required. Another deterring factor has been the very efficient Food and Drugs Act, for it has been impossible to improvise and yet satisfy that all-embracing requirement that food should be of the substance demanded by the purchaser. The restriction of shipping space or of foreign credits, affecting the import of raw materials, has made it difficult to find alternatives. For example, since the restriction of cane sugar was instituted some months ago the amount of another sugar—glucose—used in the baking trade has increased enormously. Glucose is not so sweet as sucrose (the sugar of the sugar cane and of the beetroot), but by introducing various modifications in the method of manufacture of bakery goods it can be used to replace a certain proportion of sucrose. The raw materials, however, from which glucose has been made—that is to say, various starches—are all-important. The only home product from which it could be made is the potato, and with this the process necessitates the primary manufacture of potato starch, quite uneconomical in this country in peacetime. From the beginning of June the supply and therefore the use of glucose are restricted, and an alternative sugar is thus made unobtainable.

Food from Inedible Material

In a somewhat similar category is fat. Apart from butter, and leaving aside suet and mutton fat, which have very definite characteristics, no fats are produced in this country which can be used as cooking fats. Baking compounds and margarines are made from oils expressed from various oil seeds and from whale oil, properly refined and treated by a process which raises the melting point so

that they become solid or semi-solid at ordinary temperatures and can be blended to suit particular purposes. Much has been done since the outbreak of war to "make do" with available fats in the baking trade, but here again the supply is being restricted and the difficulty of the baker becomes more and more apparent. Cakes and pastries are not essential to keep body and soul together, but personally I am a great believer in the psychological value of variety in food materials or variety in presentation.

The "Ersatz" coffee and tea of Germany are examples of alternatives. The coffee is essentially roasted malt and the tea a mixture of various leaves of shrubs. Both are palatable but with no resemblance to the substances which they are to replace, lacking the stimulating action given to the normal infusion by the caffeine present in the coffee bean and in the tea leaf.

The production of food from inedible substances is quite possible in respect of certain goods. An interesting example of the transformation of an inedible into an edible product is to be found in fats. Such bodies as liquid paraffin are not absorbed by the human system. Taken by the mouth they pass away absolutely untouched. But by a series of chemical changes they can be transformed into long-chain fatty acids and then into chlorides which have a constitution similar to that of the chlorides of edible fats. They can then be chemically combined with other groupings and in this form are digested by the human stomach.

Synthesized Protein

The shortage of meat means lack of protein, and as long ago as the last war there were great factories in Germany for the production of protein by a biological method. Yeast used in the fermentation industries and in bread-making is a small micro-organism and contains a proportion of protein matter. By appropriate treatment this protein can be made available, as in the type of product known as marmite. Certain yeasts have the power of synthesizing much larger quantities of protein, and the protein industry of Germany depends on their activity. Germany by her planned policy has developed these industries, although I have no doubt that she prefers the temporarily available beef of Denmark and Holland to the protein provided by yeast under the guidance of her chemists.

I will say almost nothing about the last of the three indicated functions of the food industry, which is the preparation and serving of meals. The large middle-class restaurant and the "chain" tearooms are all run on the same principle as the food industry itself—the avoidance of waste and the economical preparation of food. Each large restaurant is a small factory in itself, and the tearooms, which are fed by a centralized kitchen, are really the retail distributors of that kitchen. Mechanically controlled ovens, mechanical egg poachers, mechanically washed china, thermostatically controlled frying baths, all tend to that economical use of the raw materials and labour which is so essential in these days of stress. There are other aspects of quality and purity and of scientific control concerned with the safety of the factory-produced food which I might have stressed. The best chef in the world or the most careful housewife cannot guarantee the bacteriological purity of the product as can the large food firms.

The one conclusion to be drawn is that mass production, mechanization, and scientific control all combine to reduce waste, whether of materials, of fuel, or of man power. In the words of the Postmaster-General in a recent speech, they help "to do more, making use of less."

THE INTERNATIONAL STANDARDS FOR ANTI-TOXINS, ANTISERA, AND TUBERCULIN

The international standards for sera and bacteriological products are held, on behalf of the Health Organization of the League of Nations, by the State Serum Institute, Copenhagen, which has hitherto furnished samples to the laboratories, institutions, and research workers requiring them in different countries. That supply being now interrupted, the Health Organization of the League has requested the Medical Research Council to allow samples of the British standards for these products held at the National Institute for Medical Research, Hampstead, to be furnished to those who have hitherto received the international standards from Copenhagen. The Medical Research Council has agreed to make this arrangement to meet the emergency and to prevent the complete interruption of this international service. The British standards in question are either part of the same materials as those kept as international standards in Copenhagen or have been repeatedly verified by the British and Danish Institutes to ensure that the units determined in terms of the British standards are exactly equivalent to the international units.

The following are the standards available:

1. *Identical in Material with the International Standards.*—Staphylococcus antitoxin; gas-gangrene antitoxins (*perfringens*, *Vibrio septique*, *oedematiens*, *histolyticus*); anti-dysentery serum (Shiga); anti-pneumococcus sera (Type I and Type II); old tuberculin.

2. *Different in Material, but with Identity of the Unit Indication Confirmed Twice a Year at Copenhagen and Hampstead.*—Diphtheria antitoxin; tetanus antitoxin. The National Institute at Hampstead can also supply on request a standard solution of diphtheria antitoxin for use in the flocculation test.

The stocks of these standards held at Hampstead are adequate to meet all demands, with the exception of the standards for anti-pneumococcus serum, Type I and Type II. The remaining stocks of these two standards are low, both at Copenhagen and at Hampstead, and it is requested, therefore, that demands for them be restricted to essential needs. It is further requested that, in order to conserve the stocks of these standards so far as possible, laboratories will co-operate with the Hampstead Institute by establishing local laboratory standards for these two anti-pneumococcus sera by adopting for routine testing samples of the anti-pneumococcus sera Type I and Type II, the potency of which has been determined by comparative tests made with the relevant international standard preparation.

Former recipients of the international standards who wish to be supplied during the interruption of the issues from the Copenhagen Institute should make immediate application, stating which of the standards they require and how many bottles in each case, to the Department of Biological Standards, National Institute for Medical Research, Hampstead, N.W.3, England. On receipt of this information the required supplies will be dispatched at once.

The council of the Ophthalmological Society of the United Kingdom has instituted a Treacher Collins Prize of £100, awarded triennially, for the best essay submitted upon a subject selected by the council. The prize is open to qualified medical practitioners of any nationality. The essay must be written in the English language. The subject for the second award of the prize is "Allergic Affections of the Eye and its Adnexa." The closing date for sending in essays is December 31, 1941. They should be submitted to the honorary secretary, Ophthalmological Society of the United Kingdom, 5, Racquet Court, Fleet Street, E.C.4, from whom, also, any further particulars can be obtained. No name should be on any essay, but a distinguishing pseudonym or quotation, which should also be upon a sealed envelope containing the candidate's name and address. This envelope should accompany the essay.