VEGETABLES AS FOOD

BY DR. MAGNUS PYKE

THE low mechanical efficiency with which a steam engine converts heat into energy is perennially shocking to each generation of school-boys, but the wastefulness of the steam engine is nothing compared with the waste of vitamin C which takes place between the time a green vegetable is harvested and its final disappearance from the diner's fork. A cabbage bought at the market may perhaps be expected to contain 60 per cent of its original vitamin C content, the housewife probably throws away no more than 20 per cent of the remainder in preparing the vegetable for the pot, leaving 40 per cent of the original vitamin. During boiling, however, although a negligible proportion is destroyed by the heat, about 65 per cent is extracted by the cooking water and usually thrown away. Thus 17 per cent of the vitamin C with which the cabbage left the field is all that remains when it reaches the table, and if the dish is kept hot before being served even this small residue quickly dwindles to extinction. In 1940, one and a third million tons of green vegetables were produced in Great Britain. From this crop roughly 650,000 kilograms of ascorbic acid, or almost exactly the amount needed to satisfy the physiological requirements of the entire population for a year, was lost.

To the canner it would be thought was presented the opportunity of stopping at least some of these great losses. For him there is the minimum delay between harvesting and processing. The crops are grown to suit him so that loss in preparation for cooking must be small. Cooking, one would think, was inside the tin so that the principal loss by extraction could be avoided. However, the canner, it seems, must do what he should strenuously eschew. He plunges his vegetables for 1½–20 minutes into nearly boiling water before he puts them in their tins and thereby loses the bulk of the vitamin C. Blanching, he calls it, and advances five technological reasons for doing it: but what a pity!

It was at the discussion on April 9 of the nutrition panel of the Society of Chemical Industry on "Vegetables as Food" that these points arose. Miss Mamie Olliver reported one experiment after another of her own unpublished work showing the devastating effect of cooking on the vitamin C in vegetables, and Mr. W. B. Adam concluded that canning affects the nutritive value of vegetables equally as domestic cooking.

Although root vegetables may provide carbohydrate, and green leaves supply protein of useful quality, and although pulses contribute calories, carbohydrate and second-class protein to the diet, vegetables are primarily useful as sources of vitamins A and C and iron and calcium. If the proportions of the day's requirements of each of these four factors in 4 oz. of any vegetable, cooked or raw according to how it is customarily eaten, are plotted one above the other as a column in a graph, a measure of the excellence of the article as a protective food is obtained. A series of vegetables graded in this way and arranged in order of merit is instructive. First come the green vegetables, broccoli tops, watercress,

mustard and cress, Brussels sprouts and spinach, rich in carotene, very rich in vitamin C, and containing useful contributions of iron and calcium, although it is doubtful whether the calcium in spinach is utilisable. Next come cabbage and cauliflower, which still contain substantial amounts of vitamin C but negligible quantities of carotene. In green vegetables carotene is associated with greenness; when the heart of a cabbage is blanched it thereby forfeits its rank in the highest class of 'protective' vegetables. Tomato and lettuce fall in the middle of the list. They contain more carotene but much less vitamin C. The vegetables at the bottom of the list, one-fifth as concentrated as the greens, are turnips, green peas, radish, leeks, parsnips, string beans and onions. Asparagus, cucumber, celery and marrow contain so little of vitamins or minerals that they cannot be graded at all.

How does the carrot stand in such company? Carrots contain carotene, but I have presented figures which showed that although 4 oz. of boiled carrot contains as much carotene as the same amount of boiled Brussels sprouts, this was less than half that in spinach, watercress or broccoli. Carrots besides possess a mere 5 per cent of the vitamin C in the green vegetables and a fraction of their available iron and calcium. Even Dr. Leslie Harris, who asserted that the carotene in carrot can equal or excel that in the best green vegetables, cannot thereby promote it to a rank of equality with them in general excellence as a protective food.

The leading vegetable of all those mentioned at the discussion was 'broccoli tops'. McCance, Widdowson and Shackleton introduced the name to the scientific world when they analysed their samples in 1936, but agriculturists, even guided by a botanical designation, found the term ambiguous. Five London greengrocers approached during an interval in the discussion under review produced three different plants identified respectively as 'purple sprouting broccoli', 'white broccoli' and 'winter cauliflower'. Miss Widdowson expressed the belief that none of these was the 'broccoli tops' reported upon in the literature.

In planning war-time vegetable production there is more to do than identify and grow the crops of highest nutritional value. Yield per acre, hardness and popularity must all be considered. Cabbages which produce heavy crops are tolerated by the public. Brussels sprouts are liked. Although education and shortage can drive people part of the way towards eating what they do not like, palatability is nevertheless important.

Dr. H. V. Taylor showed how war-time vegetable production has been organized to comply with the suggestions of the Scientific Food Policy Committee. A supply of green vegetables has been assured all the year round, the acreage of carrots has been doubled, greenhouses devoted in peace-time to the growing of flowers have been converted to tomatoes and so on. Now, however, the army, the navy, the air force and the general public are insistently crying out for a vegetable product of negligible dietetic

value, namely, pickles. In 1941, therefore, it has been decided to plant several thousand acres of land with onions for pickling, with garlic, cauliflower, gherkins, red cabbage and mustard. Will science say that the decision is wrong?

When the figures are compared side by side, green vegetables are more substantial providers of vitamin C than any fruit except black currant. Thus in war-time they can readily take the place of the oranges and lemons which no longer reach us. According to the analytical figures for carotene, besides supplying the full physiological requirement of vitamin C, green vegetables can also provide all the vitamin A we need. Here is, however, a topic on which further investigation is required. To what extent is the carotene present in each plant physiologically active as vitamin A, and what proportion is absorbed by the body? Even if only 40 per cent of the carotene present in a 4-oz. portion of watercress is physiologically available, it will still provide 50 per cent of the total daily requirement. In spite of the lack of clear-cut evidence on the vitamin A activity of each vegetable, there are, therefore, grounds for asserting that the full vitamin A needs of the body could be supplied by vegetables should circumstances ever require it.

Besides their importance as protective foods, vegetables could play other minor parts in war-time nutrition. A temporary glut of carrots, for example, if dried would provide palatable carbohydrate. Although perhaps more physiological work is needed on the biological value of green leaf protein, Sir John Russell, from the chair, agreed with the weight of

current scientific opinion that its value is high. Preparation of purified vegetable protein might thus provide a valuable addition to the national food supply.

The Society of Chemical Industry's discussion showed that many lacunæ in the knowledge of the nutritive value of vegetables exist. Planning of vegetable production even when guided by scientific advice is a difficult task which may never reach perfection. The crucial rôle of green vegetables is to provide almost alone in war-time the whole dietary requirement of vitamin C. Research on the physiological availability of leaf carotene is not of equal importance. Just as a population is immunized against typhoid for six months or more by a single treatment, so can a country be protected against vitamin A deficiency for a winter by a single dose. The daily requirement of vitamin C, however, must be acquired daily. This is where work, investigation, inspection and analysis at every point must be organized. The Forces equally with the civil authorities must never be satisfied with calculations from a book of tables to insure the nutritional adequacy of food supplies. The men at a mess where the best scientific information had been applied to perfect their diet were found, when submitted to a saturation test, to be grossly deficient in vitamin C. Communal catering tends to increase the times during which dishes are kept hot, a process destructive of vitamin C.

The chemists met the botanists, the dietitians and the administrators to their mutual benefit. The national interest would be served by the further penetration of scientific workers into the market, the communal feeding centre and the canteen.

THE BRITISH PHARMACEUTICAL CONFERENCE

THE seventy-eighth annual meeting of the British Pharmaceutical Conference was held at Conway Hall, Red Lion Square, London, on April 16. With a single day, instead of the best part of a week as in peace-time, the proceedings were severely curtailed, but in addition to the chairman's address, twelve papers were presented at the science session, and although only summaries of them were actually read, the full papers will be available in the official publication of the Conference, in due course. Some of the papers are outlined below.

In his inaugural address as chairman, Mr. A. R. Melhuish dealt with problems affecting pharmacists in their capacity of servants of medicine and servants of the State. He spoke, to use his own phrase, as "a workaday practising pharmacist", and advised his colleagues that they would be doing more for the medical services of the country if they devoted more attention to those fields of activity which do not involve legislation, than if they spent time in striving for such politically unattainable goals as the reservation to them of the sale of all medicines. He impressed on them the importance of 'personality'; the greatest asset for the individual pharmacist in the future, he said, would be his individuality.

Two papers related to ergot. One of them, by C. H. Hampshire and M. W. Partridge, was from the laboratory of the British Pharmacopœia Commission, and the second, by N. L. Allport and N. R. Jones, from the laboratories of the British Drug Houses, Ltd. The first consisted of notes on the extraction and

decomposition of the alkaloids; it showed that neither continuous extraction of ergot with methylene dichloride nor shaking ergot with menstruum of ammoniacal acetone completely extracts the alkaloids, which are completely extracted, however, by continuous extraction with anæsthetic ether. In the second paper, the authors described a rapid method for the determination of ergometrine and ergotoxine.

A paper, by H. Berry, from the College of the Pharmaceutical Society, on the components of acriflavine, was summarized by the author as follows: (1) the bacteriostatic value of the two active components and mixtures of these in varying proportions have been compared against certain organisms; the results show little variation; (2) there is no evidence of a bacteriostatic or physical character of any definite combination between the two components; (3) it is suggested that proflavine or the neutral hydrochloride of 2:8-diaminoacridine should replace acriflavine for surgical use.

A second paper, by F. Wokes, from the College of the Pharmaceutical Society, had as its subject "The Subcutaneous Implantation of Thyroxine Tablets". The author suggested that great caution be employed in the implantation of thyroxine tablets in human subjects, and that preference be given to the oral administration of thyroid, which appears to be much safer and more effective.

A paper, by A. M. Briggs and D. E. Callow, from the Evans Biological Institute, dealt with the