SOCIETY OF AGRICULTURAL BACTERIOLOGISTS

THE Annual Conference of the Society of Agricultural Bacteriologists, held at the Midland Agricultural College during September 12–13, covered a wide range of subjects. The papers may be classified, somewhat arbitrarily, into those concerned with dairying and those with other fields.

Instances of the economic importance of the sulphate-reducing bacteria included the formation of the black colour in the mud of certain districts, the evolution of hydrogen sulphide in sewage, and the discoloration of paper pulp. The role of these bacteria in the underground microbiological corrosion of metals was considered in some detail. Another paper described how the principle of the activated sludge process may be applied to an aerated culture of nitrogen-fixing bacteria so as to build up continuously a stock of bacterial protein from carbohydrate and atmospheric nitrogen.

Media containing thallium salts have been found to yield excellent results in the diagnosis of streptococcal mastitis and in the isolation of lactic streptococci from milk and fæcal streptococci from water samples.

Papers of considerable interest to water bacteriologists dealt with investigations on the bacterial flora of lakes and streams. In lakes during the winter months, when the waters are in circulation, the counts of bacteria tend to be much the same at different depths, while during the summer, when the waters are stratified in two layers, counts in the upper layer are of a higher order than those in the lower layer. where they tend towards a low constant value. Coliform bacteria in relatively pure lakes and streams, though smaller in numbers than those in waters subject to pollution, show unexpectedly a higher proportion of the fæcal type.

Items of general interest included recommendations for economy in the war-time use of peptone for bacteriological media, and the role of statistics in the planning of experiments and in computing the error of the plate count.

In the field of dairy bacteriology, there were several papers on the methylene blue and the resazurin tests for bacterial quality of milk. A high correlation has been observed between the plate count and the methylene blue test and between the reduction of methylene blue and the reduction of resazurin to the vivid pink stage. Two causes of anomalous results in these tests are: (*a*) the growth of cryophilic bacteria during storage of milk samples in the refrigerator; and (*b*) the decrease, during storage, in the reducing power of milk containing large numbers of leucocytes. For pasteurized milk a reduction time of six hours or less in the test at 15·5° C. has been found to indicate either contamination by coliform bacteria or poor keeping quality.

The phosphatase test, applied to milk pasteurized in bottles, has revealed the fact that in one of three commercial plants examined a high proportion of samples had probably been underheated. The acid-producing bacteria which predominated in the freshly pasteurized milk were rapidly supplanted by alkali-forming types and played little or no part in spoilage during storage. Heat-resistant cocci which survived pasteurization appeared to consist largely of *Micrococcus luteus* and were not derived from the cow's udder.

Several papers were concerned with the bacteriology of starters and cheese. Infection of starters with bacteriophage is found to be an important cause of general slowness in cheese-making in Great Britain, even though mixed starter cultures are customary, but the incidence of the trouble may be reduced by observing certain precautions and by adopting a 'vitality' test as a measure of control.

Studies in cheese ripening have disclosed the fact that lacto bacilli may assist flavour through the liberation of an intracellular lipase on autolysis of the cells, while some light has been thrown on the sources of the carbon dioxide evolved from cheese during storage in cargo. In Cheddar cheese the gas results from bacterial action, but in Stilton it is mainly correlated with the growth of the mould.

Problems in disinfection received attention from several workers. For hypochlorites to be effective in the treatment of dairy utensils, the latter must be scrupulously clean, free from corrosion and open seams, and must be agitated or scrubbed during treatment. A technique was outlined for routine disinfection in the cowshed to combat, *inter alia*, the spread of mastitis streptococci.

An item of interest to the dairy industry was the demonstration of a portable apparatus, depending in principle on measurement of *p*H value, for rapidly testing the quality of the incoming milk at a creamery.

THE FORTIFICATION OF FOODS

THE diet of man now contains a variety of foods very different from those consumed by his prehistoric ancestors. Cooking, which may wash out or destroy mineral constituents and vitamins, has long been practised, while more modern processes such as the decortication of cereals, and the extraction and refining of oils and fats, may lead, according to the results of animal experiments and clinical evidence of human disease, to dietary deficiencies. Recent advances in methods of analysis of foods and in our knowledge of man's need for some of the vitamins and essential minerals have enabled us to estimate the dietary significance of these more modern methods of preparing foods. Now that a number of synthetic vitamins or vitamin concentrates are available it is possible in some cases to fortify foodstuffs so as to increase man's intake of these essential dietary factors to the level which modern investigations have shown to be desirable.

The great interest attached to this problem of fortification was reflected by the very large attendance at a joint meeting of the Society of Public Analysts

and Other Analytical Chemists, and the Food Group of the Society of Chemical Industry held at Burlington House on December 3 to discuss "The Fortification of Human Foods by the Addition of Specific Nutrients".

The first paper on "The Principles of Food Fortification" was read by A. L. Bacharach, who defined fortification, which he held to be synonymous with enrichment, as the addition of specific nutrients. He laid down a number of principles which should govern the whole policy of fortification. The amount of enrichment should be adjusted to the need of the consumer for the specific nutrient; this might have to be altered at different times or in different areas according to the amount already available in the diet. The nutrient should be added to some widely consumed foodstuff, such as bread or margarine, in order to ensure even distribution to the whole community, and, as the need must be greatest for those of limited means, fortification should not result in an increase in the cost of the foodstuff, which might defeat the principle of general distribution. Precautions should be taken to ensure that the consumer actually received the added nutrient, which should be stable and not be physiologically incompatible with any other component of the fortified food. Due allowance should be made for any loss likely to occur during the normal preparation of the foodstuff for the table. Fortification should not impair taste or flavour and so should not be detectable by the consumer, though the analyst should be able to determine the amount of the nutrient present. Mr. Bacharach's last principle, that of disclosure, is one which has not yet received official recognition in Great Britain, though it was endorsed by all subsequent speakers. When a food is fortified with a particular nutrient the amount of this nutrient present should be stated in simple and concise chemical or biological units and not, for example, in terms of 'summer butter'.

Illustrating his principles by references to examples of fortification already in operation in Great Britain or in the United States, Mr. Bacharach pointed out that the addition of iodine to table salt was probably the first fortification which was carried out not simply to replace something lost during purification but to overcome what is, in some areas, a known dietary deficiency in iodine by distributing this element in a simple and economical manner. Thus the aim of fortification should be to remedy some known dietary deficiency, not merely to imitate some allied foodstuff; white bread fortified with calcium is a better source of available calcium than wholemeal, though it may be inferior to wholemeal in other respects; vitaminized margarine should, if the need arises, contain more of the vitamins A and D than summer butter.

Mr. Bacharach vigorously attacked the naturalist school which professes an almost mystical belief in the superiority of dietary factors present in, or isolated from, natural sources. Members of this school would, apparently, condemn the fortification of flour with synthetic aneurin, but would applaud the same fortification if made with vitamin B_1 laboriously isolated from yeast. Ascorbic acid cannot wholly replace orange juice, but it can prevent scurvy if administered in the proper amounts.

Mr. Bacharach concluded by referring to the need for extending fortification to cover other nutrients and mentioned the advances which have been made in the United States. Iron should be added to white bread, and attempts should be made to lower the cost of production of riboflavin.

The second paper, on "The Technological Aspects of Fortification" by Drs. D. W. Kent-Jones and A. J. Amos, was read by Dr. Amos, who distinguished between fortification and enrichment, preferring to reserve the former term for cases in which losses of nutrient due to purification are made good, as, for example, when B_1 is added to white flour, or when a food is strengthened with some particular nutrient to make it equivalent to some allied food, as when vitamins A and D are added to margarine. Enrichment, on the other hand, should be reserved for additions of a nutrient to a food which is not normally a good source of the nutrient.

The methods adopted to carry out fortification must ensure uniform distribution without loss of the added nutrient, which should have no effect on the palatability or keeping quality of the final product. The fortification of margarine with vitamins A and D was carried out by some manufacturers long before compulsory fortification was introduced in Great Britain. In the early days concentrates were used which sometimes imparted flavour, but with the introduction of calciferol and whale oil concentrates this difficulty was overcome.

The fortification of white bread with B_1 has been achieved in three different ways, all of which are now being used in Great Britain and in the United States. In the method adopted by the Ministry of Food, aneurin is added to the flour during the milling process. The physical properties of aneurin render impossible the direct addition of the small amount required (0·2 gm. aneurin to 280 lb. flour), so a concentrate similar to flour is prepared by spray drying a suspension of flour in water containing the requisite amount of aneurin. The addition of 1 oz. of this concentrate to each 280 lb. flour is then performed without difficulty by a special mixer. In the second method of enrichment the B_1 is introduced into bread via the yeast used to ferment the dough. This yeast, obtained by cultivation in a special medium, contains about sixty times as much B_1 as ordinary yeast. The third method is based on the addition of 20–25 per cent wheat germ to flour.

The proposed enrichment of flour with calcium is not yet in operation, partly because opinion is divided as to the merits of the scheme, but also because of technical difficulties. Creta Prepærata has been chosen as the most suitable form of calcium carbonate, since it has the least effect on the hydrogen ion concentration of the dough.

The lack of stability of ascorbic acid in aqueous solution causes practical difficulties in fortification. The addition of this vitamin should be made as late as possible during the process, aeration should be avoided and care taken to exclude traces of copper and iron. If vitamin C is added to a fatty food, a water in oil suspension should be used. The difficulties encountered with vitamin C serve to emphasize the need for careful control at all stages of the fortification process. As an example of what can be done even with an unstable substance, Dr. Amos mentioned that jam for dispatch to British prisoners of war is fortified with vitamin C. The loss during manufacture is not greater than 15 per cent, while the loss on storage for twelve months in sealed containers does not exceed 20 per cent.

H. E. Cox later gave a paper on "The Machinery for the Enforcement of Standards for Fortified

Foods". Dr. Cox assumed that, in normal times, fortification will be optional and not compulsory. If optional fortification becomes general, the law will need fortification to deal with the chaotic conditions which would probably result from wild claims made for various fortified foods. At present the Ministry of Food has control of fortification, but, in times of peace this control should pass to the Ministry of Health, when fresh legislation will be necessary to empower the Minister to issue regulations covering fortification. Indeed, Dr. Cox argued that the present activities of the Ministry of Food are directly contrary to the will of Parliament as expressed in the Foods and Drugs Act 1938.

According to this Act the Ministry of Health may restrict or prohibit additions to food, but has no power to order that additions be made. When the emergency control of the Ministry of Food is ended, the new regulations should prescribe maximum and minimum limits for fortification as is now being done in the United States. These limits must be capable of detection by analysis, hence the urgent need for the standardization of methods of analysis. Eventually this analytical control should be done by the public analyst and not by nominees of the Ministry of Food. If the public analyst is to guard the public against fraudulent claims, all fortified foods must be clearly marked with the actual amount of added nutrient present in the food, and no vague claims that vitamins have been added should be allowed.

The final paper, on "Analysis of Fortified Foods", was given by H. E. Monk. As methods of analysis for minerals are well known, Mr. Monk confined his remarks to a well-balanced summary of the methods of analysis for vitamins and of the difficulties likely to be encountered by the public analyst employing these methods. Since fortification with vitamins is to be carried out for nutritional purposes, it might appear at first sight that biological assay should be used when possible. Chemical and physical methods have the advantages of speed, accuracy and cheapness and, except possibly for vitamin D, are likely to replace the lengthy biological assays. Microbiological assay such as is used for riboflavin should not, however, be excluded.

To carry out a physical or chemical estimation it is first necessary to extract the vitamin from the foodstuff, and great care is needed to ensure that this extraction is complete. Having obtained the vitamin extract, precautions must be taken against loss during the estimation. Finally, the method used should be specific for the vitamin, and in cases of doubt, alternative methods should be used wherever possible in order to guard against erroneous results due to the presence of interfering substances.

In the spirited discussion which followed, repeated reference was made to the necessity for disclosing the vitamin content of fortified foods. Thus it was stated that the vitamin D content of margarine has recently been doubled in order to make up for the lack of eggs. Only three members present admitted that they were aware of this change.

It was generally agreed that the meeting had been one of the most successful of its kind and that the knowledge of the tasks which lay ahead should inspire the chemist to investigate the accuracy of present methods and devise new methods for the rapid estimation of vitamins.

E. R. D.

FORTHCOMING EVENTS

SATURDAY, DECEMBER 20

BRITISH PSYCHOLOGICAL SOCIETY (at Tavistock House, Tavistock Square, London, W.C.1), at 11 a.m.—Discussion on "Problems Affecting the Under-Fives in Total War"

APPOINTMENTS VACANT

APPLICATIONS are invited for the following appointments on or before the dates mentioned:

LECTURER IN THE DEPARTMENT OF CIVIL AND MECHANICAL ENGINEERING—The Registrar, The University, Leeds 2 (December 29).

EDUCATIONAL PSYCHOLOGIST and a PSYCHIATRIST—The Secretary for Education, Education Offices, York (December 30).

TEACHER OF ENGINEERING DRAWING in the Department of Mathematics and Physics of the Polytechnic, Regent Street, London, W.1, now at Lancaster—Dr. J. Topping, Storey Institute Technical College, Lancaster.

REPORTS AND OTHER PUBLICATIONS

(not included in the monthly Books Supplement)

Great Britain and Ireland

Proceedings of the Royal Irish Academy. Vol. 47, Section A, No. 1: On the Solutions of Wave Equations for Non-Vanishing Rest-Mass including a Source-Function. By Erwin Schrödinger. Pp. 24. 1*s*. Vol. 47, Section A, No. 2: Experiments on Condensation Nuclei. By P. J. Nolan. Pp. 25–38. 1*s*. Vol. 47, Section B, No. 1: Descriptions of Five New Species of Alyshdae (Hymenoptera) and Notes on some Others. By A. W. Stelfox. Pp. 16. 1*s*. Vol. 47, Section B, No. 2: The Cytoplasmic Bodies of Drosera. By J. Brontë Gatenby and J. D. Smyth. Pp. 17–20. Vol. 47, Section B, No. 3: The Nuclear Apparatus as shown by Feulgen's "Nuclealfärbung" Reaction. By Mildred M. Moore. Pp. 21–52. 2*s*. Vol. 47, Section B, No. 4: A List of the Microlepidoptera of Ireland. By Bryan P. Beirne. Pp. 53–148. 4*s*. Vol. 47, Section B, No. 5: The Neck Body in Normal and X-radiated Insect Spermatogenesis. By J. Brontë Gatenby. Pp. 149–160. 1*s*. (Dublin: Hodges, Figgis and Co., Ltd.; London: Williams and Norgate, Ltd.) [2411

Other Countries

U.S. Office of Education: Federal Security Agency. Bulletin 1940, No. 6 (Monograph No. 14): Supervision of Health and Physical Education as a Function of State Departments of Education. By Dr. James Frederick Rogers. (Studies of State Departments of Education.) Pp. vi+106. (Washington, D.C.: Government Printing Office.) 15 cents. [1311

Cornell University Agricultural Experiment Station. Bulletin 748: Fertilizers and Field Crops. 1: Results of Sixteen Years of Experiments on Volusia Silt Loam in Allegany County, New York. By E. L. Worthen. Pp. 28. Bulletin 749: Fertilizers and Field Crops. 2: Results of Sixteen Years of Experiments on Honeoye Silty Clay Loam in Monroe County, New York. By E. L. Worthen. Pp. 26. Bulletin 750: Fertilizers and Field Crops. 3: Results of Twenty Years of Experiments on Volusia Silt Loam in Cortland County, New York. By E. L. Worthen. Pp. 16. Bulletin 751: Costs of Farm Power and Equipment. By J. P. Hertel and Paul Williamson. Pp. 38. Bulletin 752: Studies on the Control of Internal Breakdown of Table Beets by the use of Boron. By G. J. Raleigh, O. A. Lorenz and C. B. Sayre. Pp. 16. Bulletin 754: A Comparative Study of High-Temperature, Short-Time, and Holder Pasteurization. By A. Millenky and H. J. Brueckner. Pp. 26. Bulletin 756: Costs and Returns from Farm Enterprises. By Paul S. Williamson. Pp. 41. Bulletin 762: Controlled-Atmosphere Storage of Apples. By R. M. Smock and A. Van Doren. Pp. 45. Bulletin 766: Controlling the Pre-Harvest Drop of Apples. By M. B. Hoffman. Pp. 18. Memoir 234: Studies on Bitter Pit of Apple. By R. M. Smock. Pp. 45. Memoir 235: A Study of Dormancy in Seeds of Polygonum. By Oren L. Justice. Pp. 43. Memoir 237: Reproduction of the Field Mouse *Microtus pennsylvanicus* (Ord). By W. J. Hamilton, Jr. Pp. 23. (Ithaca, N.Y.: Cornell University.) [1311

Proceedings of the California Academy of Sciences, Fourth Series. Vol. 22, No. 11: The Templeton Crocker Expedition of the California Academy of Sciences, 1932. No. 40: The Genus Scalesia. By John Thomas Howell. Pp. 221–272. Vol. 23, No. 30: Notes on a California Earthworm, *Plutellus papillifer* (Eisen, 1893). By Gordon E. Gates. Pp. 443–452. (San Francisco: California Academy of Sciences.) [1311

U.S. Department of Agriculture. Circular No. 610: Adsorption of Mercuric Chloride from Solution by Gladiolus Corms. By R. H. Nelson and C. C. Cassil. Pp. 12. (Washington, D.C.: Government Printing Office.) 5 cents. [1311

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