

study of streptococci and lactobacilli and their classification is also being undertaken.

There are a number of researches on the chemical composition and physical properties of dairy products; but space forbids the mention of but one or two interesting things about the variation in the composition of milk among the different breeds. When the breed data are set out with increasing non-fatty solids, it is found that in addition to the known increase in protein there is also an increase in lactose. It seems, incidentally, that some of our lack of knowledge about carbohydrate quantities arises from the determination of them by difference instead of by a direct method as was adopted here. Another point is that variations in percentages of protein in the milk of different breeds falls almost entirely on the casein.

Sows' milk is the subject of a good deal of work in this report, particularly in connexion with vitamins.

There is a list of fifty-eight papers published by members of the Institute staff during the year ended September 1949.

COPPER METABOLISM SYMPOSIUM AT THE McCOLLUM-PRATT INSTITUTE

IN 1947 Mr. John Lee Pratt, of Fredericksburg, Virginia, provided a generous gift to the Johns Hopkins University with the request that it be used to further the study of trace elements in nutrition. Personal experience of farming North Virginian terrain, depleted by centuries of heavy cropping, had thoroughly convinced him of the important part played by trace elements in the nutrition of plants and animals, and prompted him to seek a way of extending knowledge of the functions which micro-nutrients assume in living organisms.

Thus the McCollum-Pratt Institute came into being, its title appropriately combining the name of the donor with that of Prof. E. V. McCollum, doyen of American nutritional scientists, whose wise counsel in the beginning of this venture ensured that those charged with the quest should enjoy a wide freedom of approach to the many problems which await solution. Splendid opportunities for advanced study of the nutritional physiology and biochemistry of micro-nutrients are offered there under the direction of Prof. W. D. McElroy and his colleagues, Drs. R. Ballentine, S. P. Colowick, A. Dawson, H. Little and N. Kaplan.

An important term of reference of the Institute is "to serve as a centre at which world authorities on the subject of micro-nutrients would convene from time to time to discuss problems in the field", and to this end a symposium on copper metabolism was arranged in mid-June when more than fifty chemists and physiologists from the United States, Australia and New Zealand assembled at the Johns Hopkins's Homewood Campus, Baltimore, to discuss various aspects of copper metabolism; many of those who participated were guests of the Institute.

The broad field covered by the seventeen papers formally presented during the six sessions of the symposium provided a framework of existing knowledge that clearly expressed the extent and importance of the subject around which the discussions were centred; and, perhaps what is more important, the contributions rendered even more manifest the gaps

in our knowledge. Stimulating discussion helped further to clarify the main problems.

The proceedings opened with a review of the physical chemistry of the copper atom, of its size, its affinities, the radius and disposition of its outer electron orbits, and other properties which determine its valency and ability to form covalent complexes. The copper-protein complexes were then considered and what is known of the copper-containing enzymes reviewed. The sessions on the second day were devoted to various aspects of copper metabolism in animals, and those of the third day to copper metabolism in plants and to those relationships between soils and plant growth which determine the assimilation and utilization of copper.

The breadth of the subject precludes the provision here of a satisfactory review either of the formal papers or of the discussions. A summary of them has been published*, and the full proceedings, published by the Johns Hopkins Press, are soon to appear.

The scope of the symposium may be gathered from the following list of the formal papers presented: copper complexing reactions, by A. H. Corwin (Johns Hopkins University); ascorbic acid oxidase, by C. R. Dawson (Columbia University); copper proteins involved in tyrosine oxidation, by Frank Mallette (Johns Hopkins University); phenol oxidases and plant respiration, by John M. Nelson (Columbia University); browning reactions involving copper proteins, by John B. Thompson (Trace Metal Research Laboratory, Chicago); the occurrence, evolution and properties of haemocyanin, by Alfred C. Redfield (Woods Hole Oceanographic Institute); the use of radioactive copper in nutritional studies, by C. L. Comar (University of Tennessee); problems associated with copper deficiency in ruminants, by H. R. Marston (Commonwealth Scientific and Industrial Research Organization, University of Adelaide); influence of copper on the metabolism of phosphorus and molybdenum, by George K. Davis (University of Florida); copper and molybdenum in relation to diseases of cattle and sheep in New Zealand, by I. J. Cunningham (Wallaceville Animal Research Station, New Zealand); copper metabolism in human subjects, by G. E. Cartwright (University of Utah); metabolism of copper in the invertebrates, by Vincent Dethier (Johns Hopkins University); chemical nature of the copper complexes in peat soils and plants, by Jeffrey E. Dawson (Cornell University); trace elements and phosphate in herbage plant nutrition, by H. C. Trumble (United Nations Food and Agriculture Organization); mineral nutrients in native forages in relation to land forms and soil conditions of eastern North Carolina, by Kenneth C. Beeson and G. Matrone (United States Department of Agriculture, Ithaca, N.Y.); the copper nutrition of green plants and fungi, by Robert A. Steinberg (United States Department of Agriculture, Beltsville, Md.); functional aspects of copper nutrition in plants, by D. I. Arnon (University of California, Berkeley).

The symposium was a good one, and served well to fulfil the hopes of the founder of McCollum-Pratt Institute and of those who were responsible for translating his wishes into practical effect. The publication of the full proceedings will provide a valuable reference for those interested in the subject of copper metabolism.

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* A Symposium on Copper Metabolism. Animal, Plant and Soil Relationships. By Dr. Bently Glass. Contribution No. 5 of the McCollum-Pratt Institute. (Baltimore: Johns Hopkins University, 1950.)