cases a regular supply of fresh cultures solves the difficulty in a practical way. A scheme for testing the activity of a bulk starter before it is used in the vat has in some instances proved useful in giving warning to a factory-manager of the imminence of starter trouble. The use of two or three strains of streptococci of an active type in mixed cultures has given less trouble than the use of a single strain in other instances. But all these schemes have failed at one time or another, and it is clear that a complete solution has still to be found.

(*b*) *Cheese-ripening.*—(i) *Effect of Pasteurization of the Milk:* It has been known for several years that the protein in cheese manufactured from pasteurized milk breaks down somewhat more slowly and less completely during the ripening process than does the protein in raw-milk cheese. Previous workers attributed these effects to destruction of bacteria by the heat treatment of the milk. It was assumed that the organisms present in raw-milk cheese were more proteolytic than those in pasteurized-milk cheese, and, consequently, more rapid and complete degradation arose from bacterial action in the former type of cheese. The experiments at this Institute have indicated, however, that this view is probably incorrect. The pasteurization of milk at temperatures above approximately 150° F. has been found to alter its composition in such a way that trypsin and rennet do not decompose the protein in the same manner as they do the protein of raw milk. Application of these results to cheese-ripening has shown that the differences in protein decomposition which occur between cheeses made from raw milk and pasteurized milk can also be accounted for, largely, on the basis of chemical alteration produced in the milk constituents by heat treatment. This alteration affects the proteolytic action of rennet and bacteria upon the cheese-curd.

These findings are of some practical importance in connection with the subject of cheese flavour. During cheese-manufacture care must be exercised to keep the temperature of pasteurization of the milk low, since cheese made from milk pasteurized at a high temperature does not possess a normal cheese flavour. The failure of desirable cheese flavours to develop in such cheese has, in the past, usually been attributed to destruction of the natural milk flora by the heat treatment. The results of the experiments mentioned above raised the question as to whether the change in composition of the milk brought about by pasteurization might not be the most important factor. If the absence of typical Cheddar flavour were due to destruction of the natural flavour-forming organisms in the milk, it should be possible to manufacture good cheese from milk pasteurized at a high temperature simply by inoculating desirable flavour-forming strains of lactobacilli. This has been attempted in practice, and it has been found that, while the flavour of the cheese is improved to an appreciable extent, yet it is still not a good normal Cheddar flavour. Evidently the main factor involved is the alteration in composition of the milk by pasteurization at high temperatures.

(ii) *Cheese Flavour:* From inoculation experiments referred to below further confirmatory evidence has been derived in support of the views advanced in the last report. A large number of additional strains of lactobacilli and cocci have been found to impart characteristic flavours to cheese. A large amount of work remains to be done upon the most suitable amount of inoculum and the method of addition, on the symbiotic relations of the organisms and on the optimum acidity and moisture conditions in the cheese-curd.

(iii) *Openness:* Gas-forming lactobacilli have been shown to be a major factor in the production of slit openness in cheese. It has been found that open cheeses evolve larger amounts of carbon dioxide than do close cheeses. The inoculation into the cheese-vat of mixed cultures from open cheeses invariably reproduces the defect in the "daughter" cheeses. From around the slits in open cheeses organisms capable of forming unusually large proportions of carbon dioxide have been isolated. The inoculation of these bacteria into cheese has consistently produced openness. One of the most striking aspects of the later experiments in this connection is the small amount of inoculum that is effective in producing openness and in modifying flavour: with some strains of lactobacilli the smallest proportion yet employed (one part of clotted culture to 10,000,000 parts of milk) has been found to be ample. These observations explain why so many difficulties have been encountered in keeping control vats free from contamination.

(iv) *Discoloration:* Pure strains of lactobacilli capable of producing typical bleached discoloration in cheeses have been isolated from around the slits in cheeses which were either discoloured or which subsequently developed this defect. Inoculation of these organisms into cheese milk caused discoloration in the resultant cheeses. Except for their power to produce discoloration, the organisms in many cases were indistinguishable in other respects from lactobacilli which do not produce the defect.

(*c*) *Payment for Cheese Milk.*—The previous report recorded the conclusions formed from the investigations, extending over several years, on the relationship of fat and casein in milk to yield of cheese—viz., that the Walker-casein value for a supplier's composite milk sample, used along with the fat test, provided a satisfactory basis for estimation of the cheese yielding capacity of milk. It was recommended that payment should be made according to the cheese test of the milk, with a reduction for a portion of the cost of manufacture, according to the volume of milk delivered. The data on which these conclusions have been based have now been assembled for publication. A study has been presented of the various systems of payment that have been proposed previously. The experimental results are applied to a study of payment on a cheese test as determined from the average relationship between—(1) Casein/fat ratio in the milk and yield of cheese per pound of fat; (2) "casein + fat" in milk and yield of cheese per 100 lb. milk; and (3) fat in the milk and yield of cheese per 100 lb. milk. It is considered that the deduction of cheese test from the average relationship between casein/fat ratio in the milk and yield of cheese per pound of fat is fundamentally the most sound method. Results are given for the application of the casein/fat ratio cheese-test table to the estimation of yields of cheese in commercial factories for some fifty-nine composite sample testing periods. The agreement between the estimated and the actual yields of cheese was satisfactory.