

CHEESEMAKING PROJECTS.

(a) *Cheese-starters* (H. R. Whitehead and G. J. E. Hunter).—Failures due to Bacteriophage Action: Last year it was believed that the problem of starter failures had finally been solved. As a result of long experience at the Institute and of many trials in commercial factories it appeared that the adoption of an aseptic technique, together with the use of a large inoculum in the propagation of starter, eliminated the failures which had commonly been experienced. This belief proved to be ill-founded. At the beginning of the present season several failures of single-strain starters occurred in commercial factories under circumstances which made it reasonably certain that faults in the recommended technique were not responsible. Continued success with the same cultures at the Institute led to a revival of the old suggestion that peculiarities in certain milk-supplies were responsible for the starter failures. The difficulty of transporting adequate supplies of milk for experimental purposes rendered it impossible to explore this hypothesis adequately, but the few trials that were made did not give positive results. Colostrum milk, mastitis milk, and milk from different localities all seemed to give equally good results when used as media for the growing of single-strain cultures at the Institute. No failures were experienced.

Finally some light was thrown on the problem during a trial in which a single-strain culture was maintained at the Institute and in two commercial factories on milk reconstituted from skim-milk powder. As usual, no trouble was experienced at the Institute, while in the two factories failures occurred repeatedly at intervals of a few days. It thus became clear that environment must be playing a part, since culture, medium, and technique were identical in the three places. A few further experiments served to show quite clearly that, in the commercial factories, contamination of the cultures with phage occurred through the atmosphere even when a normal bacteriological technique was practised. This explained many of the anomalies in results which had previously been ascribed to differences in procedure.

It is evident now that the technique normally considered adequate to prevent infection of cultures is not efficient under certain circumstances in preventing the access of bacteriophage to cultures. There are still many points about the occurrence in factories of air-borne contamination with phage which cannot be explained—*e.g.*, why does contamination occur more readily at some periods than at others?—but from a practical point of view it is evident that means must be devised, if possible, to prevent the occurrence of the contamination.

With this object in view it is proposed that a special starter-room be built at a certain commercial factory where starter trouble is very prevalent. The room will be quite separate from the factory, and will be designed with the express object of eliminating air-borne phage contamination from the starter. If this can be successfully accomplished, there seems to be no reason why the single-strain starters should not give just as much satisfaction in the commercial factory as they do in the Institute experimental factory.

(b) *Single Strains as Cheese Starters* (H. R. Whitehead, G. J. E. Hunter, W. Riddet, and E. A. Sawyer).—Continued experience with the use of single strains of *Str. cremoris* as cheese starters seem to indicate that each strain has a specific effect which leads to slight but definite differences in the cheeses made with the use of different strains. It is not yet certain whether these differences are due to the specific acid-producing characteristics of each strain or to some other property of the streptococci. From the practical point of view, however, it is evident that satisfactory cheese of true Cheddar type can be made with single-strain starters, and that such starters have very many advantages over mixed cultures if they can be safeguarded from failure.

(c) *Role of Organisms in Cheese-ripening* (I. R. Sherwood).—During the period under review an extensive investigation of the bacterial flora of New Zealand cheese has been completed. The cheeses studied were selected from all the important cheese-producing districts in New Zealand and they covered a wide range of quality. Thirty-six cheeses, representative of the different types examined, were subjected to a detailed bacteriological analysis. The following is a summary of this analysis:—

Aggregate Flora: In agreement with the work of other investigators on the flora of Cheddar cheese made from clean milk, it was found that the bacteria present in New Zealand cheese made from flash-pasteurized milk were almost entirely lactic acid bacteria. Whereas, however, frequency distribution studies on American and English Cheddar cheese by other workers indicated extremely important roles for *Sbm. casei* and for different types of cocci, in the present investigation it was found that the flora of New Zealand cheese was dominated by *Sbm. plantarum*. *Sbm. casei* occurred much less frequently. The Genus *Streptobacterium* (*Sbm. casei* and *Sbm. plantarum*) comprised approximately 90 per cent. of the aggregate flora of the pasteurized-milk cheeses. The remaining 10 per cent. was made up largely of betabacteria, although betacocci occurred occasionally. Other types of lactic acid bacteria were only rarely isolated from the pasteurized-milk cheeses, but occurred frequently in the raw-milk cheeses examined.

The Relation of Different Types of Lactobacilli and Betacocci to Cheese Quality: The fact that different strains of lactobacilli produce widely different effects in cheese has been noted in previous reports. The present studies have greatly clarified the position, in that a relation has been demonstrated between the types of lactobacilli (and betacocci) and the effects which these organisms produce in cheese.

The strains of *Sbm. plantarum* isolated were divided into four varieties on the basis of their biochemical characteristics. The first two varieties produced undesirable effects in cheese—bad flavours and discoloration—while salt-tolerant strains also caused open texture. The third variety, on the other hand, was definitely beneficial to cheese quality. The fourth variety had very little apparent effect.

None of the strains of *Sbm. casei* examined caused the appearance of any serious defects. Most strains improved cheese quality.