

The following is a more detailed account of the projects which have been referred to above :—

CHEESEMAKING PROJECTS.

(a) *Cheese-starters* (Dr. H. R. Whitehead and G. J. Hunter).—A large proportion of the time available during the period under review has had to be devoted to attempts to put into commercial practice the particular technique for the maintenance of starters which had been found at the Institute to eliminate failures. The system of “heavy inoculation” combined with a true aseptic technique has been entirely successful in the field, where it is applied by workers from the Institute. Active single-strain starters prepared at the Institute can therefore be used successfully in factories with a resultant steadiness in manufacture from day to day. The failures which still occur in practice are in the great majority of cases avoidable; they are due to faulty technique which permits cultures to become contaminated with bacteriophage from the surroundings. *Experience has shown that it is very difficult to instruct any one in the correct technique by correspondence; personal instruction seems to be essential.*

Demonstrations of the recommended methods for starter propagation culminated in a prolonged trial in three factories in Taranaki during February. Members of the Institute staff maintained a single-strain culture (HP) in these factories for a month without the occurrence of any difficulty. The starter behaved in the same manner as it has done in the Institute over the past two years. During the trial tuition in the methods employed was given, and as a result no further difficulty with the culture was experienced in the three factories for the rest of the season. *Failures in neighbouring factories indicated the importance of personal tuition.*

As a result of experience during the past year we believe that the “heavy inoculation” system of starter maintenance entirely eliminates the spontaneous development of bacteriophage within a starter culture. The failures which occur owing to faulty technique are the result of contamination with bacteriophage from the surroundings. During last season the most probable source of this contamination was found. It appears that bacteriophage may be present in the whey in a cheese-vat even when the curd in the vat is developing acid quite normally. Thus a technique which allows the slightest trace of whey to gain access to a starter culture will lead sooner or later to starter failure. The occurrence of bacteriophage in whey is being investigated more fully, since it has obvious importance from both the fundamental and the practical points of view.

The question of whether single-strain cultures used alone are suitable for the manufacture of the most desirable cheese is still unsettled. They undoubtedly lead to the production of cheese of closer texture, and, given the appropriate making procedure, can yield a cheese which develops an excellent flavour as ripening proceeds. The culture (HP) which has been most generally used up to the present necessitates the adoption of a manufacturing procedure different from that which is usually employed with mixed starters. Unless care is taken with a starter like HP an excessive amount of acid is developed at one stage or another, and this leads to defects in the ripened cheese. The solution of the main starter problem (the maintenance indefinitely of starter activity) has enabled us to proceed in a logical manner with this matter of investigating the most effective cheesemaking procedure, and it should prove ultimately possible to specify with milk of a given composition the best manufacturing details to adopt with given starter cultures. It may prove necessary to use mixed starter cultures of known composition or to select more precisely the single strains to be used, but the underlying principles have at any rate been worked out, and it is possible to make much more rapid progress towards the goal, the consistent production from day to day of the finest quality cheese.

(b) *Role of Organisms in Cheese-ripening* (I. R. Sherwood).—As mentioned in previous reports, lactobacilli have been shown to be of considerable importance in cheese-ripening. The development of flavour, for instance, appears to be mainly due to their activity. Certain types of these organisms, however, possess objectionable qualities not only in so far as flavour is concerned, but also in connection with cheese texture and colour. The presence in cheese of gas-producing strains frequently leads to the development of slit openness, while many strains produce discoloration.

The immediate practical problem under investigation, therefore, is the control of the types of lactobacilli which grow in cheese, so as to ensure the dominance of desirable strains. There seem to be three possible ways in which this may be done :—

(1) *By attempting to prevent undesirable types of lactobacilli from gaining access to the milk.* Comparatively little is known concerning the distribution of the various strains of lactobacilli in nature. It is conceivable that objectionable types may find their way into milk from a few specific sources, in which case the infection could possibly be prevented. To decide whether this can be done a detailed study of the natural distribution of lactobacilli is necessary. Work along these lines has been handicapped in the past through the lack of a suitable medium for the direct isolation of lactobacilli. Recently, however, a low pH medium has been developed which promises to render possible a more detailed investigation of the lactobacillal flora of various materials than has previously been carried out. Preliminary results obtained with the use of the new medium show that the various types of lactobacilli present in different milk-supplies can be isolated with comparative ease. Another step forward has been the direct isolation of lactobacilli from the cheese curd during the manufacturing process. By an extension of this work it is hoped to reveal the various sources from which the different types of lactobacilli gain access to milk and to decide whether in practice infection with undesirable types can be prevented.

(2) *By the addition to the cheese-milk of sufficient numbers of desirable types of lactobacilli to outgrow less desirable kinds initially present.* This method has proved successful in the Dairy Research Institute factory over the past several seasons, but it has not yet been tested sufficiently