

development of biological methods of sewage purification. Such methods are eminently satisfactory for normal domestic wastes, but the biological action may be inhibited by large quantities of industrial waste or even by an excessive concentration of domestic detergents. Mr. Watson suggested that new legislation is long overdue to prevent the penalization of local authorities, owing to these novel and sometimes unpredictable hazards.

BACTERIOLOGY OF MILK AND MILK PRODUCTS

THE autumn meeting of the Society for Applied Bacteriology was held in London on October 26, when recent advances in the bacteriology of milk and milk products were discussed. Dr. J. G. Davis (London) was in the chair. The full papers of the symposium will appear in the *Journal of Applied Bacteriology* (18, No. 2).

W. A. Cuthbert (Leeds), introducing his paper on coli-aerogenes bacteria in dairy water supplies, explained that it was a continuation of an investigation, the earlier part of which had already been reported. Discussing sampling methods in farms and dairies, he directed attention to difficulties and dangers due to fire risks often encountered when carrying out the prescribed flaming of taps in farm buildings. A long series of tests has shown that there is no significant difference in coliform contents of samples taken with and without flaming.

Comparative tests made between brilliant green-bile broth and standard MacConkey broth for detecting *Bact. coli* showed that there is little to choose between the two methods, and hence there was no reason for changing from MacConkey's medium. It did not appear essential to limit the initial incubation period in MacConkey broth to twenty-four hours, as the percentage of positive responses obtained with longer incubation periods, either at 37° or 24° C., did not alter significantly. Incubation of the 44° confirmatory tests, however, could not be reduced to less than forty-eight hours, as there was a 7 per cent increase in positive responses during the second twenty-four hour period. Mr. Cuthbert said that the presence of true *Bact. coli* is generally accepted as an indication of recent faecal pollution. He also showed that there is an association between the numbers of *Bact. coli* type I, total coli-aerogenes bacteria and faecal streptococci found. Moreover, except for certain seasonal variations, the 44° and 37° counts vary together. On this basis he doubted whether the 44° confirmatory tests can be justified. There is a natural die-out of *Bact. coli* which varies with temperature and with pH of the water. For example, in water from limestone areas *Bact. coli* persists for forty-five days or more, whereas in acid peat soils it dies out in ten days or less.

A review was given by S. B. Thomas (Aberystwyth) of the incidence and classification of coli-aerogenes bacteria isolated at 37° and 30° from farm milk supplies during the past twenty years, in his paper on coli-aerogenes bacteria in milk. The five thousand strains isolated at 37° by fourteen investigators were about equally divided among *Bact. coli*, intermediate and aerogenes-cloacæ types. On the other hand, aerogenes-cloacæ types constituted about 50 per cent of the strains isolated at 30° at Aberystwyth. Only 15 per cent of the strains isolated at 30° from raw milk

were 37° negative; the proportions were much higher with strains from soil, water, cereals and ungrazed herbage. It was shown that the coli-aerogenes content of farm milk supplies handled in sterilized equipment did not increase appreciably in 24 hr. at 10°–12°, whereas there was a very marked increase in milk produced under unsatisfactory conditions. Under clean conditions, these organisms were generally not detectable in 0.01 ml. even 24–28 hr. after milking. Mr. Thomas considered selective plating media superior to MacConkey's broth for the determination of the coli-aerogenes organisms content of milk, and said that there is an association between the *Bact. coli* and total coli-aerogenes organisms. On this basis, he maintained that the coli-aerogenes colony count at 30° provides valuable information for advisory work when applied to farm milk supplies within 6 hr. of production. The presence of coli-aerogenes bacteria in apparently normal udders was discussed in relation to the increasing use of penicillin in mastitis control.

The laboratory and field evaluation of chemical sterilizers for dairy farms was discussed by Dr. L. F. L. Clegg (Shinfield). He reviewed the different types of tests devised in past years, and divided them into two groups: 'suspension tests', in which the organisms in aqueous suspension are treated with the disinfectant dilutions; and 'surface tests', in which organisms on various surfaces are treated. From the aspect of practical application, particularly when the highly surface-active quaternary ammonium compounds are being considered, surface film tests are the most suitable, and at the National Institute for Research in Dairying three tests are being developed and undertaken: the laboratory Hoy can test and a surface film test, and finally farm trials. Details of the Hoy can test have been described elsewhere; in principle, the procedure consists of treating infected milk cans for a short period with test disinfectant dilutions, and then examining the effect of the rinse on the keeping quality of normal milk at 22°. This type of test is essentially a comparative one, and a hypochlorite-soda ash solution is used as the standard. In the surface film test, metal strips are inoculated with bacteria, treated for short periods with disinfectant solutions and the surviving bacteria enumerated. The effect of detergency can also be measured by agitating the test solutions gently during the disinfecting period. Experience has shown that dry films are disinfected more slowly than are moist ones, and the rate of disinfection is increased by agitation. Results generally are at a lower level than with suspension tests. For the final farm trials, it is essential to have a control disinfectant running at the same time as the test material, and the efficiency of disinfection is assessed by a combination of colony counts, methylene blue tests, and keeping-quality tests on the milks. In evaluating a new preparation it is important to examine not only its disinfectant properties, but also its effect on rubber and other equipment, and its influence on odour and taste of the milk.

J. D. Ridgway (Stockport) discussed some recent observations on the bacteriology of sterilized milk, and said that faults are generally due to sweet curdling and are more numerous on storage at 23° than 37°. There is an unexpectedly high proportion of failures in winter milks, and this is always due to sporing bacteria which had escaped destruction during the normal sterilization process of heating to 106.5° for 35 min. There is a linear relationship

between the logarithm of spore content and the number of samples failing, but there is no relationship between total bacterial content, the thermophilic bacterial content and the spore content of raw milks. Therefore, it is not possible to assess the value of milk for sterilization purposes in terms of good and bad farm milk-production; a good raw milk, or one which pasteurizes satisfactorily, may not give a sterilized milk which will keep well. The source of the spore-forming organisms has not been ascertained with certainty, but they do not appear to be air-borne. Spores have been found in udder milk, presumably originating from straw bedding used. The hygiene of plant is of utmost importance, and steam sterilization is only effective if the plant has been thoroughly pre-cleaned.

The value of the antibiotic nisin in cheese manufacture was described by H. B. Hawley (Yeovil) in a paper on the development and uses of nisin. He described how certain strains of *Strep. lactis* have been found to inhibit lactobacilli under given conditions, and investigations at the National Institute for Research in Dairying led to the discovery of nisin, which is produced by certain strains of the streptococcus. Nisin has a polypeptide structure, and there are several different known types. They have different antibacterial properties, and the types and proportions of each produced depend on the cultural conditions. Because of the particular value of nisin in inhibiting growth of *Cl. welchii*, it has been used effectively in the controlling of cheese, and is particularly valuable with processed cheeses; experimental work is proceeding at present on sweet, low-acid cheeses. Nisin can also be used for control of flat-sour in canning and in the preservation of other foods, particularly meat products. There are numerous and unexpected problems associated with the use of nisin in cheeses because, for example, it upsets the general balance of the bacterial flora and so may produce a cheese of very different texture, odour and taste. Moreover, the presence of certain bacteria appears to nullify the effect of the nisin.

CHARACTERISTICS OF THE BOTTOM ZONE OF LAKES

A SYMPOSIUM on "The Biological, Physical and Chemical Characteristics of the Profundal Zone of Lakes", organized by Prof. V. Tonolli, was held at the Istituto Italiano di Idrobiologia at Pallanza, Lago Maggiore, during July 21-24, under the auspices of the International Union of Biological Sciences with the financial aid of Unesco.

Many advances have been made in recent years in our knowledge of the physical conditions and chemical exchanges at the interface between mud and the bottom water of lakes, thanks to the development of various new techniques, and H. J. Elster (Germany), while emphasizing the services rendered to limnology by A. Thienemann's oligotrophic-outropic classification of lake types, made it clear, using Black Forest lakes and Lake Constance as examples, that a rigid adherence to the classical type concept is not justified, particularly as the chemical turnover in the hypolimnion is to a considerable extent influenced by hydrographical factors. O. Steinböck (Austria) supported this view by his thesis that in the case of upland lakes hydrographical factors are predominant:

there are here no lake types but the waters have geographical characteristics, and are best classified as mountain lakes, perennial pools and temporary pools. In those of the second category, daily meteorological changes affect the whole depth of water, so that there is no stable layering. The oxygen content of the bottom water of the upland lakes depends not so much on the productivity of the lake as on organic material washed into it, so that a pseudo-eutropic condition may arise.

K. Strøm (Norway) and B. Dussart (France) dealt with certain little-known phenomena in the hypolimnion. The temperature of the bottom water with maximal density depends on pressure and hence is below 4° C. in the depths of great lakes. The existence of supposed subaquatic springs is often doubtful, for direct observation, as in the Lac d'Annecy, can seldom be made, and their presence is usually deduced from temperature, bottom conditions and faunistic peculiarities; but it can be shown, for example in Lake Geneva, that the phenomena in question may be caused by special hydrographical conditions.

Exchanges at the mud surface were considered by F. Ruttner (Austria), who reported on a striking natural experiment in one of the lakes at Lunz which illustrates the provisional nature of lake types. This 3-metre deep spring-lake is characteristically oligotrophic, with a sparse plankton and without thermal and chemical layering. In autumn, however, after dry weather, considerable quantities of lime become dissolved as a result of the decay of the macroflora. The resulting solution of a higher specific gravity flows down into the now inactive funnel of the spring, giving a eutropic zonation, with the disappearance of oxygen, formation of hydrogen sulphide and development of an oligo-aerobic plankton. The great extent of mud surface relative to water volume is largely responsible for the very considerable chemical exchanges, with a paucity of oxygen. Such exchanges also take place between water and dissolved colloidal substances, particularly humus. This is an important phenomenon in peaty waters, where the colloids, acting as cation and anion exchangers, control the ionic composition. W. Ohle (Germany) gave a good example of such an action in the case of a magnesium-calcium ratio which was 1:2 in electrolyte-poor water and as much as 1:7 in water rich in electrolytes.

Sedimentation studies were described by Mrs. W. Tutin (Great Britain) and E. Thomas (Switzerland). The latter has made a quantitative investigation of organic and inorganic sediments in various Swiss lakes, comparing oligotrophic with eutropic conditions, considering in particular the nitrogen and phosphorus balance between mud and water in relation to production.

On the faunistic side, H. Järnefelt (Finland) came to the conclusion, from extensive studies of Finnish lakes, that no single factor studied up to the present can account for the nature of populations: a complex of causes must be involved. F. Lenz (Germany) supported this thesis with reference to the bottom fauna of the Lago Maggiore, which varies with meteorological and consequent hydrographical conditions. Contributions to a knowledge of these conditions were made by N. Della Croce and O. Ravera (Italy). The former has investigated oligochaete populations, the density of which depends in part on the particle size of the sediments. Ravera made an experimental study of the quantity of excrement produced in unit time by members of