ABSTRACTS AND REVIEWS

BACTERIOLOGY

General

W. E. Maneval. Staining methods for bacteria and yeasts. *Stain Tech.* **4**, 21–5, 1929. (*Brit. Chem. Abst.* A, p. 357, March 1929.)

In order successfully to stain the flagella of bacteria actively motile organisms 20–24 hr. old must be used. They should be transferred to sterile water, and after 30 min. droplets should be evaporated on slides. These should then be treated for 2–4 min. with the following mordant: 50 c.c. of 10–20 per cent. tannic acid, 10–15 c.c. of 5 per cent. ferric chloride, 5 c.c. of carbolfuchsin (Ziehl-Nielsen), 6–8 c.c. of 3 per cent. hydrogen peroxide. The slides should be washed and then treated for 2–3 min. with a mixture of 10 c.c. of saturated alcoholic basic fuchsin, 5 c.c. of a solution of aniline (1 part) in 95 per cent. alcohol (3 parts), 30 c.c. of distilled water, 1 c.c. of 4 per cent. acetic acid, after which they should be washed with water. Gutstein's methods of staining bacteria and yeasts are satisfactory.

F. Holweck. Production of monochromatic X-rays of long wave-length. Quantitative action on micro-organisms. *Compt. Rend.* **188**, 197–9, 1929. (*Brit. Chem. Abst.* A, p. 356, March 1929.)

X-rays of 4 and 8 Å., emitted from the silver cathode of a Coolidge tube through a silver window 5μ thick and a cellophane sheet 20μ thick, possess a bactericidal action on *B. pyocyaneus*. In the quantitative experiments the technique of Lacassagne (following abstract) is used. Mathematical investigation shows that, when light of 4 Å. is used, one quantum is sufficient to kill one organism and the number of surviving organisms is an exponential function of the time of irradiation. With light of 8 Å. at least four quanta are required and the mathematical relationship is more complex.

A. Lacassagne. Action of X-rays of long wave-length on micro-organisms. Statistics of the mortality of the irradiated bacteria. *Compt. Rend.* **188**, 200–2, 1929. (*Brit. Chem. Abst.* A, p. 356, March 1929.)

An appropriate amount of a culture of *B. pyocyaneus*, suspended in water, is evenly distributed on the surface of gelatin in a Petri dish so that a field of 10 mm. diameter contains 100 bacteria. A number of fields are then irradiated by X-rays (preceding abstract) of known intensity, the dishes incubated, and the resultant colonies in the irradiated fields compared with those in control dishes. It is assumed that each bacterium possesses a sensitive zone, which, if it absorbs a certain minimum of quanta, is destroyed by irradiation; the mathematical development depends on this assumption.

P. Curie. Probability curves describing the action of X-rays on bacteria. *Compt. Rend.* **188**, 202–4, 1929. (*Brit. Chem. Abst.* A, p. 357, March 1929.)

The equations of curves relating the time of irradiation to the probability of survival of bacteria irradiated by X-rays are given (see preceding abstracts).

P. C. Vassiliadis. Recherche du *Bacillus acidophilus* de Moro. (Research on *B. acidophilus* (Moro).) *C.R. Soc. Biol.* **100**, vi, 451–2, February 15, 1929.

Since the discovery of *B. acidophilus* by Moro and of *B. bifidus* by Tissier much work has been done upon the distribution and characters of these organisms. In the intestines they use carbohydrates only.

According to Rettger the numbers of these organisms found in the intestines depend up to a point upon the nature of the intestinal contents and especially on the presence of lactose.

The authors examined the faeces of numerous species of animals in order to get an idea of the distribution of *B. acidophilus*, without reference to the presence or absence of lactose. In all the animals examined *B. acidophilus* was found. In rats, fowls, and horses it was predominant over other organisms. It is suggested that this is because selective growth of the organisms is favoured by the grain fed to these animals.

In man and in sheep the organism is present but the percentage numbers are small.

The strains isolated showed some variations in colony formation and more pronounced differences in agglutinability indicating the existence of distinct strains.

A. T. R. MATTICK

E. C. GREY. The enzymes of *B. coli communis*, VI. The alternative modes by which *B. coli communis* may bring about the anaerobic decomposition of glucose. *Proc. Roy. Soc.* B, **103**, 312–20, 1928. (*Physiol. Abst.* **13**, ix, 544, December 1928.)

One method involves cleavage combined with oxidation and reduction, and resembles alcoholic fermentation by yeast with the exception that formic acid appears instead of carbonic acid. The other method is by cleavage with mere molecular stabilisation, essentially a lactic acid fermentation. *B. coli communis* combines the enzymic properties of yeast with those of a lactic acid bacillus. The second mode of decomposition supplies less energy to the cell, but is less sensitive to alterations in the medium and also seems to make less demands on the resources of the cell; it is the mode adopted when the vitality of the organism is low.

G. W. DUNKIN. A consideration of some members of the group of acid-fast organisms. *Vet. Record*, **9**, xii, 231–4, March 23, 1929.

This paper is an interesting discussion of the possibility that all acid-fast organisms may have been derived from a common ancestor, and that the variations in their cultural and pathogenic characteristics may be due to the differing environments in which they have been living during successive generations.

The author bases his thesis, which he does not put forward as more than a philosophical possibility, on the facts that the diseases which acid-fast organisms may produce are of similar type, and that the cultural characteristics of these organisms only vary within narrow limits.

R. STENHOUSE WILLIAMS

A. S. GRIFFITH. The types of tubercle bacilli in human bone and joint tuberculosis. *J. Path. and Bact.* **31**, iv, 875–96, October 1928.

The author deals with the type of infection found in 598 cases of bone and joint tuberculosis. The proportion of cases infected by the bovine type of bacillus was as follows: all ages, 20 per cent.; under 5 years, 33 per cent.; 5–10 years, 24 per cent.; over 23 years, 0 per cent. The differentiation of the types was determined by cultural characteristics and virulence for rabbits and guinea-pigs.

J. MCCLEMONT

G. J. HUCKER. Further studies on the classification of the micrococci. *Centralbl. f. Bakt.* I. Orig. **111**, 1–3, pp. 9–22, February 1929.

In this paper the author has continued his study of the classification of the micrococci reported in a previous paper (*New York Agric. Exp. Sta. Tech. Bull.* **102**, 1924) in which 16 species were recognised.

Three additional species, making 19 in all, are now described. A revised classification is given in which diagnostic cultural reactions are tabulated.

A. T. R. MATTICK

M. SHAW. Thermophilic bacteria in canned foods. *J. Inf. Dis.* **43**, v, 461–4, November 1928.

Twenty-three cultures of thermophilic organisms were isolated during the examination of sound and spoiled cans of food, and studied in detail. Of these 21 were closely related, probably identical strains. The other two corresponded with each other but differed from the other 21. They seemed unlike any previously described in the literature.

Description of the methods used and discussion of the results are given in detail.

E. R. HISCOX

S. PRICKETT and R. S. BREED. Thermophilic organisms found in culture media. *J. Bacteriol.* **16**, iv, 247–9, October 1928.

Certain batches of media which had been autoclaved at 20 lb. pressure (126·7° C.) for 20 min., and which appeared to be sterile when incubated at 37° C., showed the presence of numerous distinct small colonies in less than 24 hr. when incubated at 56° or 63° C. In order to ensure sterility in such media it was found necessary to autoclave at 20 lb. pressure for 30–35 min.

An investigation of the ingredients used in the preparation of these media showed that whilst the majority were free from thermophilic organisms, the agar and beef extract contained numerous viable spore-forming thermophiles, a circumstance which is favoured by their methods of preparation.

The organisms isolated fell into two groups apparently identical with *Bacillus aero-thermophilus* Weinzirl, and *B. thermophilus aquatilis-liquefaciens* Michaelis.

In order to test the sterility of batches of media representative portions should be incubated at 56° C. as well as at 25° and 37° C.

E. R. HISCOX

R. DUBOS. Observations on the oxidation-reduction properties of sterile bacteriological media. *J. Exp. Med.* **49**, iii, 507–23, March 1929.

Working with sterile meat infusion broth containing Fairchild's peptone at *p*H 7·8 the author has demonstrated an active oxidation reduction system. It was found under vaseline seal that a reduction potential corresponding to reduced indigo di-sulphonate (rH = 10) was reached with the broth used.

All indicators with a more positive E_0' were reduced. Others were unaffected.

The maximum amounts of different indicators which were reduced corresponded to equimolecular concentrations, indicating either that the broth did not contain several "independent" reducing systems in appreciable amounts or that the hypothetical independent systems all had about the same reduction potential.

In respect of time the different indicators of oxidation reduction potential were reduced in the order of the electromotive series.

The system present in broth appeared to be reversible and did not appear to be of the nature of a sugar.

The effect of these phenomena on the growth of bacteria is being investigated.

A. T. R. MATTICK

L. THOMPSON. The value of vegetable extracts in culture media. *J. Bacteriol.* **17**, i, 4–5, January 1929.

Extracts were made of potato, carrot, radish, spinach and of beef heart, the latter for comparison. 150 g. of grated or ground material were added to 200 c.c. of

distilled water. The mixture was shaken for 10 min. and then strained and sterilised by filtration.

Potato extract was found to be the most satisfactory of those tried. It gives a total nitrogen of about 1·2 mg. per c.c. and approximately 0·2 per cent. reducing sugars. Amounts as little as 0·01 c.c. when added to 6 to 7 c.c. of nutrient broth will give growth with many strains of streptococci which will not develop in the broth alone, while 0·2 c.c. is enough to secure a vigorous growth with nearly all strains encountered.

The growth-accelerating factor is not destroyed by heat except when heating causes a precipitate, but is destroyed by the action of certain bacteria. It is thought to be a protein which is easily available to bacteria, and not a vitamine or growth accessory factor, since similar results may be obtained with the products of bacterial decomposition of peptone.

Potato extract is useful as a substitute for blood in growing streptococci. When added to meat infusion media, it allows the growth of *Hemophilus influenzae*. It may also be used in small amounts as an enriching substance in sugar fermentation tubes instead of serum or meat infusion.

H. C. Sweaney. The regeneration of acid fastness in apparently degenerated bacilli. *Amer. Rev. Tuber.* **18**, v, 630–60, November 1928.

By the selection of unusual forms of tubercle bacilli from culture and post-mortem material, these forms have been carried through a cycle to degeneration and back again to typical forms.

One of the degenerate forms developed into a mould-like growth, having short mycelia and semi-acid fast diphtheroids and cocci, which possibly came from the granules found along the mycelial threads, and in the diphtheroid bacilli. After a series of animal inoculations, these degenerate forms assume the typical characteristics of human tubercle bacilli. It is only when the organism assumes a waxy covering, *i.e.* becomes acid-fast, that it is capable of producing a chronic tuberculous condition.

L. J. Meanwell

L. Lowenstein, W. L. Fleming and J. M. Neill. Studies on bacterial enzymes. *J. Exp. Med.* **49**, iii, 475–9, March 1929.

This paper is a continuation of previous work which has been published in the *Journal of Experimental Medicine*, **45**, **46** (1926). The enzyme solution was prepared by making a concentrated suspension of the bacterial cells from the surface growth of agar cultures; the bacteria were washed and resuspended in salt solution. The suspension was distributed into 15 × 200 mm. Pyrex tubes and subjected to repeated freezing and thawing. After about 250 repetitions of the freezing process, microscopical examination showed that the majority of the cells had been at least partially disintegrated. The material was then centrifuged at high speed and the supernatant fluid filtered through a Berkefeld filter.

The final sterile solution was water-clear, but contained a considerable amount of dissolved bacterial substance as indicated by its coagulation when boiled. This solution of the dissolved intracellular substance, entirely devoid of formed cells or fragments, served as the enzyme solution.

Sterility controls were carried out and no antiseptics were added.

The results of the tests showed that this solution was capable of hydrolysing lactose, but was devoid of the property of forming gas or acid either from lactose itself or from the hexoses yielded by the disaccharide hydrolysis. The assumption, therefore, that hydrolysis to hexoses is the first step in the fermentation of

disaccharides by *B. coli* proved to be true, but there is no evidence that it is true for all species of bacteria.

The enzyme solution was also capable of splitting tributyrin suspended in phosphate solution. It, therefore, contained both lactose and lipase which were found to be in heat-labile forms.

R. Stenhouse Williams

J. C. Broom. The exhaustion of media in bacterial culture. *Brit. J. Exp. Path.* **40**, i, 71–82, February 1929.

The authors have been unable to confirm the theory of Eijkman (1904–6) that the inhibitory action is due to the formation of diffusible toxin, or that of Palevici (1927) and others that it is due to the exhaustion of accessory food factors, but bring forward evidence to show that this inhibition is caused by a deficiency of available carbon due to the original growth.

R. Stenhouse Williams

M. W. Mead and C. S. King. Proteolysis and the selective destruction of amino acids by *Clostridium sporogenes* and *Clostridium histolyticum*. *J. Bacteriol.* **17**, iii, 151–61, March 1929.

The degradation of casein, edestin and fibrin by *C. sporogenes* and *C. histolyticum* has been followed by estimations of histidine, tyrosine and tryptophane, and amino N and ammonia N. *C. histolyticum* is more powerfully proteolytic than *C. sporogenes* (amino N) but their putrefactive powers (NH_3 production) are similar. Tyrosine is destroyed to a greater extent than histidine; both are destroyed more by *C. sporogenes* than by *C. histolyticum*. Tyramine but not histamine could be detected in this medium. The final *p*H varied from 7·5 to 8·2.

J. G. Davis

M. Moycho. Sur l'action des enzymes protéolytiques bactériennes. Influence du *p*H sur la protéolyse. (Action of bacterial proteolytic enzymes. Influence of *p*H on proteolysis.) *C.R. Acad. Sci.* **187**, 681, 1928.

The action of a filtered peptone culture of *B. prodigiosus* or *pyocyaneus* adjusted to a given *p*H upon .12 per cent. gelatine has been studied. The optimum *p*H is 8 as for trypsin. The gelatinase of *B. prodigiosus* is still slightly active at *p*H 4.

J. G. Davis

L. T. Anderegg and B. W. Hammer. Proteolysis by *Streptococcus lactis*. *J. Dairy Sci.* **12**, ii, 114–28, March 1929.

Of a large number of strains of *S. lactis* isolated from various milk products, some, including all butter strains, produced an increase in the soluble N of the skimmed milk culture medium. The addition of $CaCO_3$ increased, and of peptone decreased the proteolysis.

Organisms causing proteolysis coagulated milk quickly. The proteolysis was not due to the acidity developed. *S. citrovorus* and *para-citrovorus* did not cause proteolysis.

An increase in soluble N was usually accompanied by an increase in amino N.

J. G. Davis

L. A. Rogers. Inhibiting effects of *Streptococcus lactis* on *Lactobacillus bulgaricus*. *J. Bacteriol.* **16**, v, 321, November 1928.

L. bulgaricus is shown to dominate a culture if equal inoculations of the organism and of *S. lactis* are made. If *S. lactis* preponderates in the inoculum, then a typical *S. lactis* fermentation ensues. The temperature of these experiments is not given.

The inhibitory factor is not acidity, is stable at 100° C., partly removed by filtering through an earthenware filter and dialysable through a collodion sac.

J. G. DAVIS

J. G. MCALPINE and G. D. BRIGHAM. Some chemical studies of commercial bacteriological peptones. *J. Bacteriol.* **16**, iv, 251–6, October 1928.

Four brands of peptone have been analysed for total N, non-protein N, free NH_3 and amino N. Witte and Difco-Proteose contain most protein N and Difco-Bacto and Fairchild's most polypeptide N. The differences are considerable.

J. G. DAVIS

J. E. GREAVES, C. E. DOBELL and J. D. GREAVES. Influence of iodine upon the growth and metabolism of yeasts. *J. Bacteriol.* **16**, vi, 409–30, December 1928.

Yeasts grow very slowly in highly purified salt sugar solutions. Growth may be accelerated by heavy seeding, impure salts, etc. and the presence of other micro-organisms.

As little as one part per million of iodine will stimulate growth. The possible relationship between Wildiers' "bios" and iodine is discussed.

Iodine is held to be essential to yeast growth.

J. G. DAVIS

G. J. HUCKER. Relationship of the various acid-proteolytic cocci. *Centralbl. f. Bakt.* etc., Abt. II. 76, viii/xiv, pp. 161–72, November 1928.

This is a review of the present position of our knowledge concerning the classification of acid-proteolytic cocci, and also contains the results of much work which Hucker has carried out upon a number of strains isolated by different workers. The author points out that a detailed discussion of this work is contained in the *New York State Agric. Exp. Sta. Tech. Bull.* **144**. He also states that the work of Frazier and Rupp (*J. Bacteriol.* **16**, 57–8) was done after he had revised the proof of this paper.

The author has endeavoured to clear up the confusion in the classification of these bacteria which had arisen owing to the fact that many workers had included in one group different types of cocci which were capable of liquefying gelatine and producing acid proteolysis in milk. As a result of the study which Hucker has made of the strains which he has investigated he concludes that there are two distinct groups of cocci which possess these characters. The larger group consists of micrococci and includes the *Mammococcus*, *Enterococcus*, *Caseococcus* and *Gastrococcus* of Gorini, *Tetracoccus casei* and *T. liquefaciens* Orla Jensen, and *Micrococcus caseolyticus* Evans (*M. casei* Hucker); the smaller group includes acid proteolytic streptococci and appears to be much more homogeneous than the micrococcus group.

This review is of considerable value to those who are interested in studying bacteria of these types. It also contains a useful bibliography.

R. STENHOUSE WILLIAMS

Illinois Tuberculosis Problem. *Illinois Health Quarterly*, **1**, i, 3–79, January–March 1929.

This deals with the tuberculosis problem in Illinois and the different methods which are adopted in order to reduce the extent of this disease. The most interesting part of it is that section which deals with the consumption of milk, and gives an account of the effect of the ordinance appointed by the Health Commissioner in December 1925, "that all liquid milk coming into Chicago should be produced from cows free from tuberculosis as proven by the tuberculin test." He insisted that such a measure should become operative by April 1, 1926.

The milk trade of the Chicago district and the State Department of Agriculture pointed out "that such an ordinance would disarrange the well-planned program of the State, which had been inaugurated in 1919, for the eradication of tuberculosis in dairy cows and might eventually cause it to fail."

A committee was formed and a report presented but none-the-less the ordinance was enforced. The bulletin then shows how seriously the ordinance affected the quantity of milk which was shipped into Chicago from Illinois during 1927. In order to meet the emergency the State government threw into the district approximately 50 veterinarians for the purpose of expediting tuberculosis testing. This programme absorbed practically all of the State's available resources for bovine tuberculosis work, but was necessary in order to prevent ruin to a large group of citizens and to a large and important section of the State. As it was the Chicago milk supply was kept up in part by liquid milk from the dairy district in Illinois and in part by milk shipped from outside the State. By November 1928 the proportion of herds in Illinois furnishing milk to Chicago was nearly as great as before the ordinance. An effect of the eradication of tuberculosis in the dairy cows of the Chicago district has been a definite increase in the average quantity of milk produced per cow.

The chief object of the ordinance was to reduce the possibility of infection by the bovine type of *B. tuberculosis*. The report shows that there had been a steady fall in this type of infection ever since 1917, when pasteurisation "became relatively complete and effective in Chicago," and that up to the present time there has been no evidence of any material decrease in tuberculosis in children as a result of the enforcement of the ordinance. The period, however, since the ordinance came into force is too short for any competent opinion upon its effect to be given.

R. Stenhouse Williams

Dairy Bacteriology

W. Sattler. Untersuchungen über die Absterbegeschwindigkeit, die Wärmebeschleunigung und den Resistenzwechselpunkt einiger für den Molkereibetrieb wichtiger Bakterien unter verschiedenen Bedingungen und ihr Verhalten bei den Pasteurisierungstemperaturen und bei raschem Temperaturwechsel. (Rate of destruction, temperature coefficient, and critical resistance, of some bacteria important to the dairy industry under various conditions and their behaviour at pasteurisation temperatures and at sudden changes of temperature.) *Milchw. Forsch.* **7**, i/ii, 100–70, November 1928.

The author has determined the rate of destruction at definite constant temperatures, and under conditions of alternate heating and cooling of certain micro-organisms frequently present in milk.

From his data he shows the possibility of calculating the death-rate of bacteria and its temperature coefficient by means of the equation for a mono-molecular chemical reaction; so that the number of bacteria which survive heating at any chosen temperature for a given period of time can be calculated if the temperature coefficient and the constant K for one temperature are known.

In a factory where, for instance, pasteurisation of milk is carried out under bacteriological control, the use of this formula provides a means of determining whether or not the process of heating has been carried out at a sufficiently high temperature and for a sufficient length of time.

Although the destruction of 99 per cent. of the organisms may be obtained by the maintenance of a given temperature for a definite length of time whether the original number present be great or small, yet the 1 per cent. surviving in clean milk will represent a much smaller number than for milk which had a high original bacterial content.

The actual figures quoted in this paper cannot be applied to dairy practice without further research, for the death-rate in large quantities of liquid must be influenced by the type and amount of machinery through which the liquid has to pass. Chemical and physical changes occurring during the heating process may affect the destruction of the bacteria.

The values found in practice should however show a certain analogy to the figures given in the paper.

E. R. Hiscox

H. L. Templeton and H. H. Sommer. Use of citric acid and sodium citrate in starter cultures. *J. Dairy Sci.* **12**, i, 21–36, January 1929.

The authors, basing their investigations on the work of Hammer and his associates, have sought to determine whether any advantage accrues from the addition of citric acid or of sodium citrate to starter cultures. They find that the addition of 0·2 per cent. citric acid (or its equivalent as sodium citrate) to the "starter" milk increases the volatile acidity of the culture by approximately 50 per cent. They conclude from the results of a large number of trials that the treatment of "starter milk" in this way produces very satisfactory results, enhancing the flavour and aroma of the starter. The authors propose to determine the utility of such "citrated" starters in butter-making.

R. H. Leitch

R. S. Breed. The Newman combined fat extraction, fixing and staining solution for use in the direct microscopic technique for counting bacteria in milk. *Amer. J. Pub. Health*, **19**, i, 99–100, January 1929.

In the author's laboratory, work on the three methods of Newman, designed to simplify the technique of staining in the Breed method for counting bacteria in milk, has shown that the following formula gave the most satisfactory results.

Formula No. 2.

Methylene blue powder, certified ...	1–1·12 g.
Ethyl alcohol, 95 per cent.	54 c.c.
Tetrachlorethane, technical	40 c.c.
Acetic acid, glacial	6 c.c.

"Add alcohol to the tetrachlorethane in a flask and heat to a temperature not to exceed 70° C. (if it is desired to use methyl alcohol, the temperature should not exceed 55–60° C.). Add the combined solution to the powdered methylene blue. Shake vigorously until the dye is completely dissolved. Cool the solution and add the glacial acetic acid very slowly. Avoid further heating of the acid solution. Filter and keep in a tightly stoppered bottle."

Directions for use.

1. Prepare the milk smear.
2. When dry, immerse the smear in the solution and withdraw immediately.
3. Drain until dry (30 sec.).
4. Wash in water.
5. Dry and observe.

It is necessary to dry the smears well before washing but to avoid too rapid drying, which causes a spongy appearance. Dipping in 70 per cent. alcohol will prevent this trouble.

In preliminary field work, for instance, in detecting supplies which call for more careful work later, the authors have found the following method satisfactory.

Thoroughly rinse the dipper to be used in the milk to be sampled and then withdraw a sample. With the 0·01 c.c. pipette withdraw milk from the dipper.

Smear immediately on a slide and dry on a level warm plate (a tin box containing an electric light bulb may be used). In this way 200 samples per day may be dealt with by one person.

A. T. R. Mattick

E. L. Fouts. A study of the effectiveness of sodium hypochlorite in sterilising creamery equipment. *J. Dairy Sci.* **12**, i, 51–59, January 1929.

This paper does not deal with the subject indicated by its title, but gives some experiments which demonstrate that the addition of chlorine to milk tends to reduce the bacterial count. No reference is made to the work of Hoy and Rennie (*J. Hygiene*, **26**, 127, 1927).

R. Stenhouse Williams

W. C. Frazier and P. Rupp. Studies on the proteolytic bacteria of milk. iv. Action of proteolytic milk bacteria on amino and other simple nitrogenous compounds. *J. Bacteriol.* **16**, iv, 231–45, October 1928.

The ability of 229 cultures of proteolytic organisms to utilise N from ammonium salts, urea, asparagine and amino acids has been tested. With urea, NH_3 may or may not be liberated. Organisms able to use NH_4 can use any simple amino acid if a fermentable carbohydrate is present. Bacteria may be differentiated according to their ability to use amino acids, etc. as sources of N and C.

J. G. Davis

H. A. Harding and A. R. Ward. The bacterial flora of pasteurised milk. *J. Bacteriol.* **17**, i, 35, January 1929.

Milk which has been efficiently pasteurised should contain no pathogenic bacteria. The bacteria which grow under ordinary culture conditions are reduced in number during the process of pasteurisation, but the presence of a thermophilic flora can be demonstrated by incubation at 62·5° C.

Thermophilic organisms have been found in varying numbers in raw milk, they enter the pasteurising plant, multiply rapidly in the apparatus in which the milk is held at pasteurising temperature and cause increasing infection of the milk during the course of the process.

There is no evidence that these organisms have any sanitary significance.

E. R. Hiscox

G. J. Hucker. A study of the cocci resisting pasteurisation temperatures. *New York Agr. Exp. Sta. Tech. Bull.* **134**, March 1928.

As the result of the examination of large numbers of samples of milk maintained at temperatures of 10° C., 22° C. or 30° C. for 4 hr. between the time of milking and experimental pasteurisation, it was found that the milk which had been held at the higher temperatures showed, on the average, a slightly higher bacterial content than those stored at the lower temperatures, but there was no marked difference in the numbers of organisms surviving pasteurisation.

In the samples examined *S. thermophilus* (Orla Jensen) was the predominating type, though other streptococci and micrococci were also found. *S. thermophilus* was almost exclusively present in samples of milk which had been held at 30° C.

A number of strains of *S. thermophilus* isolated had the power to haemolyse blood, but they were not of a pathogenic nature.

E. R. Hiscox

R. S. Breed, P. S. Prickett and W. W. Yale. The significance of thermophilic spore-forming bacteria in pasteurised milk. *J. Bacteriol.* **17**, i, 37, January 1929.

Investigations have shown that true thermophilic bacteria frequently find favourable conditions for growth during the pasteurisation of milk, especially where the plant is in continuous use for several hours.

Organisms of the type present in pasteurised milk are almost universally distributed in soil, fodder, etc. and their spores may enter the raw milk from the dust in the air of the cow-sheds. Thermophilic organisms may occur in milk cans which are allowed to become warm by exposure to the sun: but conditions specially favourable for growth are not normally reached until the milk is in the pasteurising plant.

The presence of large numbers of these thermophilic organisms in the pasteurised milk may affect its flavour, but there is no evidence that they are intimately connected with insanitary practice or that they are pathogenic.

E. R. Hiscox

G. Spitzer and E. H. Parfitt. A study of the proteolytic action of specific organisms and groups of organisms in butter made from graded cream. *J. Dairy Sci.* **12**, i, 1–20, January 1929.

Butter has been shown to deteriorate in store in proportion to the increase in amino N. The effect of artificial inoculation of proteolytic organisms into butter is described. Both trypsin and pepsin exert least proteolytic effect at *p*H 4·8. Butters kept at or near this *p*H deteriorate less rapidly than those kept at other reactions.

J. G. Davis

M. L. Irwin and F. C. Harrison. Bactériologie du fromage rénové. (Bacteriology of process cheese.) *Le Lait*, **8**, lxxx, 881–4, December 1928.

Process cheese in Canada contains more moisture and casein and less fat than Canadian Cheddar. It contains fewer bacteria. An account of the flora is given. A new organism *Micrococcus buteolus* is described.

J. G. Davis

H. Macy. Observations on the bacterial content of dried milk. *J. Dairy Sci.* **11**, vi, 516–26, November 1928.

The bacterial content of typical commercial samples of dried milk has been investigated, 31 samples by the spray process gave contents of 4000–5,000,000, and 13 by the drum process, 40–8000. Both types experienced a large decrease after a year's storage. Maximum reduction in bacteria in dried milk prepared by the spray process was 99·9 per cent. (5 years) and by the drum process 97·9 per cent. (3 years). There is a significant difference in the types of bacteria found in the milk prepared by the two processes.

J. G. Davis

W. Sadler. Further data on the *Streptococcus lactis* strain that produces "caramel" flavour and odour in dairy products. *Trans. Roy. Soc. of Canada*, **5**, 243, 1928.

A detailed cultural study has been made of a *Streptococcus lactis* type organism producing a caramel flavour in dairy products. The substance responsible for the flavour is ether-soluble.

J. G. Davis

C. D. Kelly. A study of some types of bacteria which produce a "caramel" flavour in milk. *Trans. Roy. Soc. of Canada*, **5**, 227, 1928.

A cultural study has been made of *Streptococcus lactis* type organisms producing caramel and "cooked" odours in milk. The strains studied possess similar properties to those of Sadler, Hammer and Cordes.

J. G. Davis

C. Barthel and W. Sadler. The casein splitting properties of starters. *Trans. Roy. Soc. of Canada,* **5**, 233, 1928.

A comparison has been made of the casein splitting properties of starters and pure cultures of the Streptococci group.

Flasks of skimmed milk, containing chalk and maintained in an atmosphere of CO_2 and H_2 were kept at room temperature for 2 months, and amino N as against inoculated controls was determined.

Starters: Soluble N 32–36, amino N 17–33.
Pure cultures: 14–36 and 1·6–16.
(Result as percentage of the total N.)

J. G. Davis

O. Rahn and H. H. Boysen. Die Verteilung der Bakterien in der Butter. (The distribution of bacteria in butter.) *Milchw. Forsch.* **7**, i–ii, 214–232, November 1928.

The authors conclude from work on the distribution of water and bacteria in butter and the relation of these to the velocity and extent of acid formation that a considerable amount of the water in butter must be free from bacteria.

In sour cream-butter 40–50 per cent. of the liquid is free from organisms and in pasteurised sweet cream-butter 90–99 per cent. of the liquid is without bacteria.

The amount of cell-free liquid depends upon the number of bacteria in the butter as well as upon the "fineness" of the water distribution. The more the butter is worked the greater is the amount of the liquid which is cell-free.

The amount of acid formed in the liquid incorporated in the butter is distinctly less than that formed in the same time in similar liquid free from fat. However, only for a few days after making does the quantity of the acid remain below the calculated maximum.

Later, more of the liquid in the butter is decomposed than corresponds to the amount of liquid containing bacteria. Since migration of bacteria from droplet to droplet is excluded a limited slow diffusion of lactic acid must take place. Separate experiments showed no diffusion of lactic acid through fat and the theory that droplets in butter are in contact is therefore a probable one.

The favourable influence of washing on butter is to be explained on the ground that all the butter-milk on the outside of the butter granules is washed away and the large droplets resulting from salting and working therefore contain nearly pure water. The smallest droplets which are mostly cell-free are, however, not reached by the washing water.

The small drops always contain only very few bacteria—nearly all small droplets are cell-free. On the other hand, the large droplets nearly all contain bacteria which cannot grow for lack of nutriment.

In spite of the fact that during washing scarcely a quarter of the protein is removed, most bacteria will not grow well because in the large droplets the water is almost pure.

The observations and conclusions in the relation between the distribution of bacteria and butter decomposition do not apply to moulds which are able to force their way from droplet to droplet.

In order to produce butter of good keeping quality, four conditions are necessary:

1. Pasteurised cream, or cream not too much soured with a pure culture.
2. Bacteria-free butterfat.
3. Thorough washing with pure water.
4. Thorough working as far as the texture of the butter permits.

An increased keeping quality of butter by the use of soured cream is not likely

to result if correct pasteurisation and above all cell-free butterfat and pure water are obtainable.

Salting helps to suppress bacteria and moulds, but accelerates slow chemical changes in the butter. Butter with few micro-organisms should keep better without salt, and heavily infected butter, better with salt.

A. T. R. MATTICK

D. B. SHUTT. Contaminated water as a source of surface flavour in pasteurised creamery butter. *J. Bacteriol.* **17**, i, 39, January 1929.

The authors have found that surface flavour in butter is due to the presence of *Pseudomonas fluorescens* in the water supplies.

R. STENHOUSE WILLIAMS

F. C. HARRISON. Cheese torulae. *Trans. Roy. Soc. of Canada Biol. Sci.* **21**, 341–80, 1927.

In 1926 about 216,000 cheese were tested for quality in Montreal. In the course of the work about 50–60 per cent. of cheese having various off flavours (fruity, not clean, bitter, yeasty) and therefore of inferior quality were found, and caused a severe pecuniary loss.

The causes of the various flavours were associated with the micro-flora by appropriate examination.

Cheese with off flavours contained a large number of yeasts (several million per gram of cheese). Cheese of the best quality also contained yeasts but only in very small numbers. All the Canadian cheese examined contained yeasts. Two samples from New Zealand contained no yeasts. Altogether 27 different kinds of yeasts were found and studied.

Only one true Saccharomycete was found. Nearly all the others were Torulae. It is evident that many of the off flavours of cheese are the result of the presence of yeast, and the formation of ethyl-butyrate, ethyl-acetate, ethyl-formates and other esters by the yeasts.

A. T. R. MATTICK

E. M. WADE and L. SHERE. Longevity of typhoid bacilli in Cheddar cheese. *Amer. J. Pub. Health*, **18**, xii, 1480–8, December 1928.

An epidemic of typhoid fever as the result of the infection of Cheddar cheese by a carrier led the authors to investigate the viability of typhoid bacilli in Cheddar cheese.

Eighteen tests were made, fourteen from raw milk and four from pasteurised. In some cases commercial starter was used, in others pure cultures of *Streptococcus lacticus*.

In the majority of cases living typhoid bacilli were not found after 7 days, but in two cheese they were found after 34 and 36 days respectively, by which time no further cheese remained to be tested.

The authors were unable to establish any relationship between the acidity of the cheese and the viability of the typhoid bacillus and were led to the conclusion that although acidity was probably an important factor, the effect of different types of acid on the bacterial flora of the milk and the chemical constitution of the milk had probably considerable influence.

In this connection they investigated the destruction of typhoid bacilli by different acids which may be found in cheese. Their investigations demonstrated that caproic acid was the most lethal in its effect followed by lactic and butyric acids. The lethal effects of propionic and acetic acids were not so marked.

R. STENHOUSE WILLIAMS

J. WEINZIRL. The bacterial count of ice cream held at freezing temperatures. *J. Bacteriol.* **17**, i, 38, January 1929.

The authors kept samples of ice cream at − 3° C., − 6° C. and − 10° C. and studied the variations in their bacterial content during storage. They found that the storage of ice cream at − 10° C. or above did not prevent all bacterial multiplication.

R. STENHOUSE WILLIAMS

J. G. WAHLIN. Studies on rennin. Effect of rennin on sodium caseinate. *J. Bacteriol.* **16**, v, 356–73, November 1928.

The degree of precipitation of protein in milk and sodium caseinate solution by rennin with various concentrations of the chlorides of Ca, Ba, Mg and Al, and HCl has been measured. The salts give maximum precipitation at definite concentrations. $MgCl_2$, $AlCl_3$ and HCl exert a solvent action in certain concentrations.

Rennin increases the precipitation. Certain proteolytic bacteria when grown in sodium caseinate media also increase the precipitability of the protein.

J. G. DAVIS

V. READER. Relation of the growth of certain micro-organisms to the composition of the medium. IV. Addition of mannitol. *Biochem. J.* **23**, i, 61–67, 1929.

Certain anomalous results obtained when using impure concentrates of yeast as a source of vitamin B in the technique described earlier (*Biochem. J.* **22**, 440) have been found to be due to the presence of mannitol, which the author regards as a specific source of food rather than as a true "growth promoting factor." Purified mannitol and reduced mannose stimulated growth in the same way. Increase in growth was determined gravimetrically and was not due to fat formation.

J. G. DAVIS

G. J. HUCKER. Studies on the coccaceae. XII. Action of the streptococci upon casein. *New York Agr. Exp. Sta. Tech. Bull.* **141**, July 1928.

A series of selected strains were grown in milk and by the determination of the amino nitrogen present according to the Van Slyke method it was noted that certain types had the ability to increase, after prolonged incubation, the amino nitrogen content of the milk.

When furnished chemically pure casein as the only source of nitrogen, these strains did not produce visible growth if washed cells were used as the inoculum. If large amounts of unwashed cells were used as an inoculum, the streptococci associated with milk and milk products generally produced growth. Under no conditions did the pyogenic streptococci produce growth when chemically pure casein was furnished as the only source of nitrogen.

Paracasein and casein appeared to be equally available as sources of nitrogen for the streptococci.

(AUTHOR'S ABSTRACT)

G. J. HUCKER. Studies on the coccaceae. XIII. Production of carbon dioxide by the streptococci. *New York Agr. Exp. Sta. Tech. Bull.* **142**, July 1928.

A representative number of strains of streptococci were secured and their ability to produce carbon dioxide from either peptone or carbohydrates was studied. Most of these strains, with the exception of *Streptococcus citrovorous* Hammer and *S. kefir* Migula, showed an increase in the amount of carbon dioxide produced as the amount of peptone in the medium was increased. *S. citrovorus* and *S. kefir* produced no carbon dioxide from peptone but formed relatively large amounts from glucose. This ability to produce carbon dioxide from glucose and not from peptone was confined to these two species in this study and further indicates that they are identical

or closely related. One strain of *S. ignavus* Holman apparently produced carbon dioxide from both peptone and glucose, while certain strains of *S. mitior* Schotmüller, *S. cremoris* Orla-Jensen and *S. stenos* Bergey, produced only small amounts from peptone which were slightly increased upon the addition of glucose.

(AUTHOR'S ABSTRACT)

G. J. HUCKER. Certain biochemical reactions produced by the streptococci. *Centralbl. f. Bakt.* I. Orig. **111**, i–iii, 31–64, February 1929.

As a result of very comprehensive studies of the biochemical reactions of the streptococci, the author concludes that these supply a basis whereby these organisms may be separated into definite groups.

Two main groups are recognised on the basis of the type of acid produced. The aroma group (*S. kefir* type) produced laevo-lactic acid and considerable volatile acid, and hydrolysed lactose faster than acid was produced. The addition of traces of yeast extract produced increased activity but as a rule large quantities of acid were not produced in any of the test media. The laevo-lactic acid producing type fermented laevulose more readily than glucose. The other large group embracing all the types such as *S. lactis* and *S. pyogenes* produced dextro-lactic acid. Lactose was not hydrolysed in milk more rapidly than acids were produced. The addition of yeast extract did not result in greater activity. Large amounts of acid were produced in certain media.

After long incubation it was found that nitrogenous constituents of milk containing an excess of calcium carbonate were attacked, with the production of increasing amounts of water soluble nitrogenous substances.

Some of the streptococci, particularly *S. lactis*, produced less than 10 per cent. of the total acidity as volatile acid. Certain haemolytic strains, *S. kefir* and the aroma producing types, yielded as much as 40 per cent. volatile acid.

Variations in the total quantity of acid produced did not affect the relative proportions of volatile and non-volatile acids, which remained constant.

S. lactis and most of those streptococci associated with milk and dairy products produced volatile acids consisting of acetic with traces of propionic or other volatile acid yielding distilling constants higher than that of acetic acid.

The haemolytic and *S. viridans* types yielded in addition to acetic a lower acid probably formic, a fact which may offer a basis for further sub-division of the two main groups of streptococci.

The acidity determinations in various test media yielded fairly constant figures and it was concluded that acidity determinations are of value in separating species or groups provided that acid production and other characters can be correlated.

A. T. R. MATTICK

G. J. HUCKER. Studies on the coccaceae. XV. Relationships of the various acid-proteolytic cocci. *New York Agr. Exp. Sta. Tech. Bull.* **144**, July 1928.

Twenty-five strains of acid-proteolytic cocci were secured from various laboratories and studied to determine the relationships of the types which have been described, some of which have been stated to play an important part in both the normal and abnormal changes in ripening cheese and other dairy products.

It was found that there are two distinct types of acid-proteolytic cocci being studied in various laboratories. One type comprised strains which proved to be micrococci. Belonging to this group were *Micrococcus caseolyticus* Evans 1916 (*M. casei* Hucker 1924), *Tetracoccus casei* Orla-Jensen 1919, *T. liquefaciens* Orla-Jensen 1919, as well as *Mammococcus*, *Enterococcus*, *Caseococcus*, and *Gastrococcus* described by Gorini 1926.

The remaining type comprised strains by streptococci which included *S. liquefaciens* Orla-Jensen 1919 and many of the acid-proteolytic types studied by Gorini. It is possible that all the gelatin liquefying streptococci belong to one species with *S. liquefaciens* Orla-Jensen as the central type.

It is concluded that the acid proteolytic cocci should not be considered from a systematic standpoint as a separate genus. Many of the organisms of this type being studied in bacteriological laboratories are true cocci while certain others are cocci identical with well recognised and common species of the genus *Micrococcus*.

(Author's Abstract)

H. Gloy and O. Bischoff. Reliability of the brom-thymol test for the early detection of udder disease. *Zeits. f. Fleisch und Milchhyg.* **39**, vii, 113–23, January 1929.

Two hundred and sixty-two samples of milk direct from the udders of 68 cows from five different herds were examined for infections of the udder by means of the brom-thymol blue test. The hydrogen-ion concentration, the chlorine numbers, and the microscopical and cultural characteristics were also determined and served as controls.

The results of these experiments demonstrated that the brom-thymol test is not reliable in every case, for although it detected existing udder disease in 75 per cent. of the cows examined it failed in the case of 16·2 per cent. in which the disease was in its initial stages. It is, however, just as suitable as the chlorine number when compared with the microscopical and cultural examination, which is taken as the standard method.

E. R. Hiscox

W. Sadler, S. Orla-Jensen and A. D. Orla-Jensen. Cheshire cheese. Part I. A preliminary study of the bacterial content. Part II. The classification of certain organisms isolated. *Scientific Agric.* **9**, vi, 346–62, February 1929.

Part I of this paper is devoted to a description of the characteristics of a typical English Cheshire cheese, together with an account of the methods employed and the organisms isolated in the course of a bacteriological study.

It was found that when the cheese used was 9 months old the total bacterial content was 15,600,000 per g. The whole of the 60 cultures isolated proved to be rod forms of which many were active in milk.

Re-examination after 1 year's cold storage, when the cheese was 21 months old, showed that the number of bacteria per g. was reduced to 93,400, but all the colonies then isolated again proved to be rod forms.

In Part II a random selection of the organisms isolated as described in Part I were classified according to the methods of Orla-Jensen (*The lactic acid bacteria*, S. Orla-Jensen, København, Høst and Son, 1919). Of the four cultures for which complete data were obtained three were classified as strains of *Streptobacterium plantarum* and one as a strain of *S. casei*.

The number of strains examined is small and no conclusion as to the organisms predominating in Cheshire cheese can be drawn from the data at present available.

Further work is in progress.

A. T. R. Mattick

N. S. Golding. The proportion of citrates of milk incorporated in the curd during cheese making. *Trans. Roy. Soc. of Canada*, 3rd ser. **22**, sect. v, 237–42, 1928.

In the course of investigations of the growth of *P. Roqueforti* in blue veined cheese, the author has had occasion, in view of the effect of the growth of citrate fermenting organisms, particularly *Streptococcus paracitrovorus* (Hammer), on the flavour of

Cheddar cheese, to determine the distribution of the citrates of the milk in the whey and in the curd during cheese manufacture.

The experimental Wensleydale cheese were made from pasteurised milk.

One series was made without the addition of citric acid, and it was found using Beau's modification of Deniges' method for citric acid determinations, so that no citrates except those in the incorporated whey remained in the curd.

Similar results were obtained when sodium citrate and citric acid were added to the milk used in a second series of experimental cheese.

The author concludes, that in view of the very small amount of citrates remaining in the curd, that the citric acid fermentation is unlikely to have significance in cheese ripening. This work supports the previous conclusions of Hucker and Marquardt.

A. T. R. Mattick

P. S. Prickett. Thermophilic and thermoduric micro-organisms with special reference to species isolated from milk. v. Description of spore-forming types. *New York Agr. Exp. Sta. Tech. Bull.* **147**, October 1928.

This *Bulletin* is the fifth of a series for which the author has been responsible and is devoted largely to the determination of the species of thermophilic spore formers which are associated with the formation of the "pin point" colonies upon agar plates made from pasteurised milk.

A large number of cultures secured from a variety of sources was studied and include thermophilic and thermoduric organisms of a number of types in addition to spore formers, viz. streptococci non-spore forming rods, micrococci, actinomyces, sarcina and a yeast. Of these only the spore formers and some actinomyces are truly thermophilic, the remainder being thermoduric.

The cultures of the spore forming bacteria have been divided into ten groups and named. Two species only are described in this *Bulletin*, the remainder having been previously described.

In addition to their thermophilic characters it has been found that most of the thermophilic spore formers are aerobic and have terminal spores.

All except two of the types described were isolated from dust, grain, hay, etc., taken from dairy farms as well as from milk before and after pasteurisation. The author is therefore of the opinion that the thermophilic spore formers are brought into the milk plants in the raw milk, but considers that more information as to the true sources of these organisms is needed.

The flora of some of the raw milk examined contained such a high proportion of spore formers, either thermophilic or thermoduric, that pasteurisation caused a very small reduction in the numbers of the organisms present.

The growth of thermophilic bacteria in pasteurised milk reduced the keeping quality of the milk, but no evidence was obtained which indicated that they are of importance from the public health standpoint.

The organisms dealt with were secured by a variety of methods of isolation which are described.

In the course of the work it was found that some of the thermophilic organisms are difficult to cultivate, cultures dying out quickly.

A. T. R. Mattick

W. R. Albus. Some observations on the plate count method of enumerating bacteria in milk. *J. Bacteriol.* **16**, iv, 269–77, October 1928.

The paper discusses the probable sources of the "gross discrepancies" that have been reported in the plate counts of milk.

It was demonstrated that there was a considerable increase in the bacterial

count when the measured quantity of dilution was left in the Petri dish at room temperature for 15 min. before pouring on the agar, and an even greater increase when the dilution itself was kept at room temperature for 15 min. before the plates were made. The time taken in the plating process may thus markedly affect the accuracy of the counts and the variations appear to be greatest when the original count of the milk is low and the bacterial activity correspondingly high.

The temperature at which the samples are stored also markedly affects the bacterial count.

The author considers that with proper care and the use of really standardised methods, consistent plate counts of milk can be obtained.

E. R. Hiscox

C. M. Carpenter. Effect of heat produced by an alternating electric current on tubercle bacilli in milk. *J. Bacteriol.* **17**, i, 38, January 1929.

Milk heavily infected with human and bovine tubercle bacilli was subjected to 220-volt 60-cycle alternating current by pumping the milk between two carbon electrodes. By this means the temperature was raised to 150° F., 155° F. and 160° F.

Guinea-pigs which were inoculated with milk which had been treated at 150° F. developed typical tuberculous lesions, those inoculated with milk treated at higher temperatures showed no evidence of tuberculosis. The length of exposure to the different temperatures is not stated.

R. Stenhouse Williams

K. Katrandjieff. Des facteurs qui influent sur la destruction par la chaleur du bacille tuberculeux dans le lait. (Factors influencing the destruction of *B. tuberculosis* in milk by heat.) *C.R. Soc. Biol.* **99**, xxxii, 1478–81, November 16, 1928.

The factors investigated are: (1) temperature, (2) fat percentage, (3) concentration of hydrogen ions.

The experiments fall into two groups: (*a*) milk heated at 58° C. (136·4° F.) for 30 min.; (*b*) milk heated at 60° to 63° C. (140° F. to 145° F.) for 30 min.

At each temperature whole milk with a fat percentage of 3·5 and skimmed milk were used and the *p*H was adjusted by addition of lactic acid to 6, 6·3 and 6·7; 15 per cent. of sugar was added and the milk was then artificially infected with measured doses of a 20 days' old glycerine potato culture of the bovine tubercle bacillus. The milk was heated in a glass vessel in which the pressure had been reduced by vacuum pump to 160 mm. of mercury.

One c.c. of the heated milk was injected into guinea-pigs and at the same time 1 c.c. of the same milk unheated was injected into other guinea-pigs which were used as controls.

The results are most easily expressed in a table.

	58° C. 136·4° F. for 30 min.				60–63° C. 140–145·4° F. for 30 min.			
	Whole milk		Skimmed milk		Whole milk		Skimmed milk	
*p*H value	Control	Exp.	Control	Exp.	Control	Exp.	Control	Exp.
6	+		+	−	+	−	+	−
6·3	+	+	+	+	+	−	+	−
6·7	+	+	+	+	+	−	+	−

\+ Guinea-pigs showing evidence of tuberculous infection on post-mortem examination.
− Guinea-pigs showing no evidence of tuberculous infection on post-mortem examination.

It is not clear what result was obtained with whole milk which had been heated at 58° C. for 30 min.

J. McClemont

A. R. WARD. Thermophilic bacteria and pasteurisation plant. *Cherry Circle*, **10**, x–xi, 7, December 1926. (*Le Lait*, **9**, lxxxii, 171–2, February 1929.)

Pasteurisation is generally regarded as a means of destroying bacteria. During recent years it has been discovered that there are thermophilic bacteria which multiply on the walls of the pasteurisers, and which, under favourable conditions, are added to the milk in such proportions that after pasteurisation the bacterial content of the milk is sometimes much greater than it was before.

It has been established that any temperature between 100 and 145° F. (37·8 and 62·8° C.) favours the development of thermophilic bacteria (Holder pasteurisation for 30 min. at 142–145° F. (61·1 to 62·8° C.)). As a general rule the effect of the presence of these bacteria is not noticed when the plant has only been running for a short time, as they have not been able to multiply sufficiently; usually they are only noticed after 2 hr., and reach their maximum effect after 5 or 6 hr. running.

The observations tend to show that the percentage efficiency of pasteurising plants may depend to a great extent on the length of the run. Another fact which has been established is that the lengthy preservation, at a low temperature, *e.g.* in ice water, of samples of pasteurised milk containing these bacteria, reduces the bacterial content, as determined by the plate count; the bacterial content will be much greater on the same day than on the following day.

These thermophilic bacteria may occur in all types of pasteuriser and their demonstration requires a medium of suitable composition.

Hitherto it has not been possible to show that an increased bacterial content due to thermophilic bacteria is capable of making pasteurised milk unsafe; up to the present no other disadvantage has been perceived than that their presence makes it difficult to conform to the regulations as to pasteurisation which were laid down before their existence was recognised.

(Translated by D. KNIGHT)

H. R. THORNTON. The reduction of Janus green B in milk. *J. Bacteriol.* **17**, i, 34, January 1929.

Janus green has been suggested as a reductase test in milk in substitution for methylene blue.

It reduces in milk to a red or pink compound believed to be safranin. This reaction is not reversible. The reduction of this red compound to the leuco-base is reversible.

These reactions take place over potential ranges more negative than those at which methylene blue reduces.

With 157 samples of milk it was found that with one exception Janus green reduction times were longer than those for methylene blue. In one sample the times were the same.

When the methylene blue reduction times were less than 1 hr., the average time taken to reduce Janus green was 35 min. more.

When the methylene blue reduction time was 6 hr. or more, the extra time taken to reduce Janus green was 85 min. Differences in potential ranges and the marked poising action of Janus green account for the differences in reduction times.

The end-point of Janus green reduction is less definite than that of methylene blue. This is due to the poising action of Janus green and the difficulties in reading caused by the mixture of colours present.

Atmospheric oxygen does not diffuse into the milk tubes sufficiently rapidly to affect the reduction times of methylene blue, Janus green B or litmus. Janus green B showed no advantage over methylene blue as an indicator of milk quality, but several disadvantages were observed.

A. T. R. MATTICK

J. H. Jones. Milk containing tubercle and diphtheria bacilli. *Vet. Rec.* **8**, xlv, 967-8, November 10, 1928.

C. J. McSweeney and W. Parry Morgan. Milk-borne diphtheria associated with diphtheritic infection of cow's udders. *Lancet*, p. 1201, December 8, 1928.

CHEMISTRY (ORGANIC, INORGANIC AND PHYSICAL)

General.

D. Brocq-Rousseu, Z. Gruzewska and G. Roussel. Les peptones donnent-elles par hydrolyse acide directe substances réductrices? (Do peptones give reducing substances by direct acid hydrolysis?) *C.R. Soc. Biol.* **100**, xi, 791–2, April 8, 1929.

The authors are of opinion that the demonstration of the presence or absence of sugar-reducing substances in commercially prepared albumoses, peptones and peptides may be used as a method of indicating their purity.

R. Stenhouse Williams

H. B. Vickery and T. B. Osborne. A review of the hypotheses of the structure of proteins. *Physiol. Rev.* **8**, iv, 393–446, October 1928.

Various hypotheses which have been proposed to account for the behaviour of this complex and important group of compounds are reviewed. The speculations advanced for protein structure are dealt with chronologically, the first chapters dealing with early theories and the "group" and "nucleus" speculations which held the field until Fischer (1903–6) published his classical works on the separation of the amino acids formed by protein hydrolysis. The fundamental facts of protein chemistry are then discussed at length, the constituent amino acids being classified, while much space is devoted to proteolytic enzymes. "Amide nitrogen" or the nitrogen bound up in the simplest manner is first accounted for, and Hofmeister and Fischer's peptide linkage hypothesis clearly reviewed. Finally the possibilities of cyclic structures are discussed, Abderhalden's diketopiperazine hypothesis being critically examined, Bergmann's and Karrer's works being described and Lippich's ureide hypothesis and Froensegaard's pyrrole hypothesis being criticised. The importance of the enzyme studies of Waldschmidt-Leitz and their bearing on the structure of proteins is pointed out.

It is also pointed out that the future development of protein structure theory may be looked for in the direction of an expansion of the peptide hypothesis which is still the foundation stone of protein chemistry.

W. L. Davies

Dairy Chemistry.

Fonzes-Diacon and Laforce. "Chromiform," a new preservative for milk samples. *Ann. Fals.* **21**, ccxxxix, 536–9, November 1928.

The substance "Chromiform" which is recommended by the authors as a preservative for milk samples is a mixture of potassium dichromate and paraformaldehyde. They claim that the addition of a pellet consisting of 0·25 g. of dichromate and 0·25 g. of paraformaldehyde to 250 c.c. of milk is sufficient to keep this quantity in a condition suitable for analysis for 2 months.

A table of the results of analyses at intervals of time from 3 weeks to 2 months is given showing that the changes in the various properties investigated are in general so slight as to be within the limits of experimental error.

E. C. V. Mattick

E. Tchetcheroff and E. A. Charliers. A new method for the analysis of cow's butterfat and its substitutes. The butyric number. *Bull. Soc. Chim. Ind.* p. 44, August–September 1927.

A critical study of the Kuhlmann-Grossfeld method of estimating butyric acid in butter and its substitutes has been carried out, the method having been put to the test for over a year with quite satisfactory results. This method (*Z. Untersuch. Lebensm.* **51**, 31–42, 1926) consists of the titration of a steam distillate from an acidified solution of saponified fat from which the higher soaps have been previously salted out with sodium sulphate. The number of c.c. of 0·1 alkali required is the butyric acid number, the average for butterfat being 20. Tables are given showing the analyses of about a hundred samples of butter both pure and adulterated, comparing the results obtained by the above method and the Reichert-Meissel and Lefmann-Beam methods. It is claimed that the butyric acid number method is more rapid and satisfactory in yielding evidence of the adulteration of butterfat.

W. L. Davies

H. Büning. Increasing the percentage of fat in milk and the production of artificial creams. [B.P. 299,617.] (*J. Soc. Chem. Ind.* **47**, li, 942, December 21, 1928.)

A process for the preparation of enriched milks and artificial creams is described whereby hardened arachis and sesame oils are homogenised with fresh milk; 10 parts of oil to 90 parts of milk are recommended for milk and sufficient oil to make 35 per cent. fat content for cream. Pressures for homogenisation are given.

W. L. Davies

H. Lührig. The estimation of butterfat in foodstuffs by the Reichert-Meissel value. *Pharm. Zentr.* **68**, 177–9, 1927.

A semi-micro method using 0·5 g. of the material is described.

W. L. Davies

G. W. Monier-Williams. Polarimetric determination of sucrose in mixtures of milk and sucrose. *Analyst*, **53**, No. 632, 569–82, November 1928.

The paper is a valuable contribution to the pressing question of the analysis of condensed milk.

The investigations reported have been carried out on mixtures of milk and sucrose. The application of a correction for the volume occupied by proteins and fat is obviated by determining the total water present in the diluted milk and sucrose mixture, defecating with dry reagents, and subsequently determining the ratio of sucrose to water in the clear filtrate.

The polarimeter was used with a sodium flame as a source of light.

The casein is coagulated with powdered citric acid followed by a mixture of phosphotungstic acid and dry sand. Dry ammonium chloride is added to the liquid before it is polarised in order to make conditions comparable in the uninverted portion of the filtrate with a second portion which, after inversion with hydrochloric acid, is neutralised with ammonia.

The original paper should be consulted for the exact technique; maintaining a constant temperature for instance is most important. The notes on the method and on the derivation of the formula employed are most helpful and include experimental determinations of sources of error.

J. Golding

V. Pertzoff. Behaviour of casein in partial solution in calcium hydroxide. *J. Biol. Chem.* **79**, ii, 799–813, October 1928.

In studying the system composed of casein and $Ca(OH)_2$ it was found that the solubility as well as the amount of base in solution depended not only upon the

amount of $Ca(OH)_2$ added but also upon the concentration of casein. From the experimental results it was concluded that the behaviour of casein towards $Ca(OH)_2$ could be interpreted in terms of physiochemical constants which are characteristic of casein and which had been previously derived by various investigators. The solubility of casein in large amounts of NaOH was also studied and found to possess the same properties as the system of casein and $CaOH_2$ at 25° C., and to follow the same equation as that derived for this system.

E. C. V. MATTICK

M. T. HANKE. Determination of tyrosine content of proteins. *J. Biol. Chem.* **79**, ii, 587–609, October 1928.

The author believes that the tyrosine content of a protein can be accurately estimated by a colorimetric Millon determination and the mercury precipitate fraction from a crude protein hydrolysate, and gives an outline of the method. He acknowledges that his previously published figures were too low and points out that this was due not to the presence of tryptophane but to the loss of a small amount of tyrosine.

He believes that crude protein hydrolysates contain some substance other than tyrosine (or tryptophane) which interferes with the colorimetric determinations, but that this substance disappears during the course of the mercury precipitation process. He further states that the tryosine content of a given protein appears not to be absolutely constant.

E. C. V. MATTICK

A. L. ANDREW. The cryoscopic method for the detection of added water in milk. *J. Soc. Chem. Ind.* **48**, xii, 296, March 22, 1929.

The determination of the freezing point affords a simple and reliable means of detecting added water in milk. The results of thousands of determinations, extending over 17 years, have shown that genuine milk has a freezing point not higher than − 0·550° C., when determined by the method in use in the New Zealand Dominion Laboratory. If the freezing point rises to − 0·530° C. watering may be suspected, and if to − 0·520° C. the milk has certainly been adulterated with 5 per cent. of added water.

L. L. VAN SLYKE. A summary of research studies relating to casein and some of the applications. *New York State Agr. Exp. Sta. Tech. Bull.* **139**, 1928.

This publication reviews the work done by the author and his collaborators at this Station during the past 30 years, and includes especially the practical application of the studies to the cheese industry. The chemistry of sour milk is similarly treated in *Tech. Bull.* **140**.

G. M. MOIR

B. J. HOLWERDA. Accurate estimation of the protein content of butter. *Chem. Weekbl.* **25**, vii, 102–3, 1928.

This method embodies solution of the curd in sulphuric acid, the fat being extracted with petroleum ether, subsęquent estimation of the nitrogen being carried out by a micro-kjeldahl digestion and distillation. 0·8 to 1·0 g. butter is melted at 40° C. in a micro-kjeldahl digestion flask, 1 c.c. of 50 per cent. sulphuric acid is added and well shaken and allowed to stand at 40° C. for half an hour, 15 c.c. of petroleum ether are added to dissolve the fat and decanted off the aqueous layer after centrifuging. This extraction is repeated, the residue being digested with the sulphuric acid and the nitrogen estimated in the usual manner as for a micro-kjeldahl estimation.

W. L. DAVIES

P. ARUP. The composition of Irish butter. The distribution of the volatile acid groups among the glycerides of butterfat. *Analyst*, **53**, 641–4, December 1928.

Butterfat has been fractionated by crystallisations at different temperatures, the solid and liquid fractions at 27° C. being the starting points to further fractions obtained by slowly raising or lowering the temperature for successive crystallisations respectively. The fractions isolated were: liquid at 10° C.; liquid at 15° C.; solid at 15° C.; 20, 27, 37. Three samples of butterfat taken from Irish butters in March, April and May 1927 were thus treated and the R.-M., Polenske, Kischner, and iodine values of each fraction determined. These values decreased steadily with increasing melting points of fractions. The constancy of the relations between the three values (R.-M., P. and K.) indicated an even distribution of the volatile acid groups between the solid and liquid glycerides and lends support to the theory of impartial mutual distribution of the acid groups among the different glycerides. The iodine values indicated that in the higher melting point fraction, the mon-olein type of glyceride was approximated, that in the lowest melting point fraction approaching the di-olein type.

W. L. DAVIES

E. S. NASSET and D. M. GREENBERG. The rate of hydrolysis of casein in acid solutions as measured by the formation of amino nitrogen. *J. Amer. Chem. Soc.* **51**, iii, 836–41, March 1929.

On the basis of 70 per cent. of the total nitrogen of hydrolysed casein being amino nitrogen and measuring the amount of amino nitrogen formed by hydrolysis for different times at constant acid concentration and temperature, the rate of the hydrolysis of casein by acids has been studied. Measurements were made at 127·5° C., 117·5° C. and 105·5° C. using different concentrations of hydrochloric, sulphuric and phosphoric acids. The rate of hydrolysis of casein by acids measured thus was found to conform to the equation for a reaction of the second order. The catalytic effect of the acids was proportional to the hydrogen-ion activity of the acids. The change of the rate of hydrolysis with temperature has been expressed on a quantitative basis.

W. L. DAVIES

A. KNETEMANN. Duclaux method for the determination of volatile fatty acids and its application to the determination of butterfat in margarine. *Rec. trav. chim.* **47**, 950–70, 1928. (*Brit. Chem. Abstr.* B, **47**, xlvii, 875, November 23, 1928.)

In the Duclaux method for the determination of volatile fatty acids (A, **2**, 504, 1896) the relation between the concentration of the acid in the vapour and the liquid (distillation value = C) is constant at each stage of the distillation and varies with the acid used. This value has been determined experimentally for formic, acetic, proprionic, butyric, valeric, hexoic, and octoic acids, and it increases regularly with increase of the carbon chain. Distillation curves are plotted for the above acids, and for benzoic and salicylic acids. The constants deduced by Duclaux and by Boekhout and de Vries (A, **2**, 50, 1917) are shown to be erroneous. For the determination of butterfat in margarine the fat is hydrolysed with concentrated potassium hydroxide solution in presence of glycerol at 135° C. (higher temperatures must be avoided as volatile acids are produced), and after dilution and acidification the solution is extracted with light petroleum. The filtered aqueous solution is distilled and two consecutive portions (100 and 200 c.c.) of the distillate are titrated with standard alkali. Substitution of these titration values in a formula deduced experimentally from the results obtained, using artificial mixtures of butterfat, oleo oil and coconut oil, gives the percentage value. The results appear to be trustworthy even when abnormal coconut oil is present.

O. W. CHAPMAN. Effect of lecithin in dairy products upon butterfat determinations. *J. Dairy Sci.* **11**, vi, 429, November 1928.

E. GREWE and G. E. HOLM. Effect of variation in the method of manufacture on the baking quality of dry skim milk. *Cereal Chemistry*, **5**, vi, 461–9, November 1928.

Previous to drying by the spray process at chamber temperature of 160° C. (320° F.), six comparable batches of milk were held for 30 min. each at one of the following temperatures: 50° C. (122° F.), 63° C. (145·4° F.), 73° C. (163·4° F.), 83° C. (181·4° F.), 93° C. (199·4° F.), 100° C. (212° F.).

Three kinds of flour were used in studying the baking qualities of the six lots of dry skim milk, 4 per cent. of the milk powder being used.

The greatest improvement in baking as the result of the use of dry skim milk was with the soft winter wheat flour. The least improvement was noted with the flour made from hard winter wheat.

The range of fermentation time at 27° C. (80·6° F.) in which doughs give good bread is increased by the use of dry skim milk. This is a very important factor as it adds to the ease with which the doughs are handled in the bakery.

Loaf volume, period of fermentation tolerance, grain texture, and break were used in scoring the bread.

The most marked improvement was obtained with any one of the four higher temperatures. Heating to the two lower temperatures was not so good, though fore-warming to 63° C. gave a slightly better result than fore-warming to 50° C.

J. GOLDING

A. J. PARKER and L. S. SPACKMAN. Investigations on the relations between the acidity and freezing point of milk. *J. Soc. Chem. Ind.* **48**, xii, 296, March 22, 1929.

Determinations of the variations of the freezing points of milk with increasing acidities have been made on samples, both unadulterated and containing definite amounts of added water. The value 0·02 per cent. acidity, given by the *Connecticut Agric. Experimental Station, 27th Report on Food Products* (1922), as the normal acidity of fresh milk is criticised, and a value of 0·14 per cent. is suggested as being nearer the truth. The correction factor of 0·003° C. for each 0·01 per cent. excess acidity is shown to hold between acidities of 0·17 per cent. and 0·60 per cent. and a value of 0·010° C. has been suggested for acidities ranging from 0·14 to 0·17 per cent. lactic acid. Results with milk containing added water are tabulated, which tend to show that when the cryoscopic method is used for the determination of added water in milk it can be applied with accuracy only when the samples are quite fresh.

G. JORGENSEN. Auxiliary tables in the determination of nitrogen in cattle foods. *Ann. Falsif.* **21**, 601–4, 1928. (*Brit. Chem. Abstr.* B, **48**, xiii, 263, March 29, 1929.)

For 1 g. sample of food the number of c.c. (ranging from 5·7 to 60·5) of 0·1 *N* acid used in the Kjeldahl titration are tabulated and arranged in consecutive horizontal lines.

By direct reading from other horizontal or vertical columns corresponding values may be obtained from which the percentage of nitrogen and of protein in the sample may be deduced.

L. BARTHE and DUFILHO. Determination of chlorine and sodium in sheep's milk. *Ann. Falsif.* **21**, 578–9, 1928. (*Brit. Chem. Abstr.* B, pp. 262–3, March 29, 1929.)

Analysis of a series of samples of milk from sheep showed that the chlorine and sodium present per litre were: colostrum period, 0·994, 0·191; 1 month, 1·207, 0·212; 2 months, 1·065, 0·193; and 4 months, 1·136, 0·338 g. respectively. The chlorine is

present in the same proportion as in cow's milk, and the sodium, varying round 200 mg. per litre at first, then increases to the amount in cow's milk. Sheep's milk in respect of chlorine and sodium approaches most nearly to cow's milk, and ruminants' milk appears to be distinct from other mammalian milk in the high proportion of sodium.

A. Schneck. Alkali numbers in the milk ash of various animals. *Milchw. Zentralbl.* **57**, xxiv, 373, December 31, 1928.

The value of the alkali numbers (the ratio K_2O : Na_2O) of the milk of different mammals is tabulated and shown to vary from 5·6 for the camel to 0·5 for the dolphin. For the cow the value varies with lactation period, diet, and health. The normal value for colostrum is 1·7; for normal milk 2·8; falling to 1·2 at the end of the lactation period. Decided variations from these indicate diseased udder or a diet deficient in sodium.

W. J. Wiley

A. Tapernoux. The relation between actual and potential acidity of milk. *Le Lait*, **8**, lxxvii, lxxviii, lxxix, 686, 795, 916, 1928.

The relation between the acidic and basic components of milk is briefly discussed. The different titratable acidity tests and the determination of *p*H by the hydrogen and quinhydrone electrode and colorimetric methods are summarised. The quinhydrone electrode method is recommended for general use and the colorimeter method for approximate purposes if suitably applied. The effects of the following agents on the titratable acidity and *p*H of milk are discussed: lactic and putrefactive fermentation, pasteurisation, sterilisation, chilling, dilution and the addition of hydrochloric, acetic, and lactic acids, calcium chloride sodium carbonate, bicarbonate and hydroxide, hydrogen peroxide formaldehyde, potassium bichromate and rennin, also the variations due to lactation period, retention of milk and disease. The author concludes that there is no close relationship between titratable acidity and *p*H except when acidity is developed by lactic fermentation. For industrial use the determination of *p*H has no advantages over titratable acidity, although rapid colorimetric *p*H determinations may be of some use.

W. J. Wiley

E. J. Soloman and G. N. Quam. Solubility of copper in milk. *Proc. Iowa Acad. Sci.* **34**, 216–17, 1927.

The solubility of copper in milk increased with a rise of temperature to a maximum at 85–90° C. with a slight decrease for higher temperatures (up to 100°). At 30° C. in 30 min. 0·26 mg. per square decimetre of copper was dissolved by milk, 1·96 mg. per square decimetre being dissolved in the same time at 90° C. The decrease of solubility above 90° C. is attributed to the decreasing solubility of oxygen, which is one of the factors governing the rate of solution.

W. L. Davies

W. Grimmer and H. Benduski. Contribution to the physical examination of milk. *Milchw. Forsch.* **7**, i–ii, 76–99, November 1928.

As the result of studying the changes in the titratable acidity, the hydrogen-ion concentration and the refraction of the calcium chloride serum of souring milk, the authors have concluded that the increase in hydrogen-ion concentration is at first almost parallel to the titratable acidity, but that later it increases much more rapidly. The relationship may possibly be expressed by the equation of $y = ax^c$, where y = the hydrogen-ion concentration, x the titratable acidity and a and c are constants having the values 1·325 and 0·370 respectively. Three experiments indicated

that between the ranges of acidities 8 to 10 and 9 to 11 respectively (Soxhlet-Henkel) the increase of the hydrogen-ion concentration was very much less than on either side of these ranges. With increasing acidity, the refraction of the calcium chloride serum also increases, but may follow any one of three courses: (*a*) the increase of the refraction may decrease more and more with increasing acidity; (*b*) the refraction may increase at first more quickly and later more slowly than the acidity; (*c*) the refraction may increase at first more slowly and then more quickly than the titratable acidity.

Since the hydrogen-ion concentration increases more quickly than the titratable acidity, the increase of refraction decreases more quickly with increasing hydrogen-ion concentration than with titratable acidity.

E. C. V. MATTICK

G. SCHROETER. Über die Guajacreaktion der Milch. (The guaiacum reaction of milk.) *Milchw. Forsch.* **6**, v–vi, 533–7, September 1928.

The mechanism of colour formation in the system guaiacum-peroxide-peroxidase is explained, and the value of commercial acetone as a source of the peroxide is discussed. The guaiacum reaction has been standardised for milk with a view to distinguishing between raw and heated milk. Ten c.c. of milk are vigorously shaken with 0·5 c.c. of a 5–10 per cent. alcoholic solution of guaiacum resin and 1 c.c. of acetone. Raw milk immediately gives a blue colour, slowly increasing in intensity, whereas heated milk gives a blue of much lesser intensity according to the temperature to which the milk has been heated. A method is given whereby the peroxidase content of milk is gauged by the development of a standard depth of colour in a standard time, milk of high peroxidase content being diluted down with distilled water. No figures are given to demonstrate loss of peroxidase activity with temperature of heating of milk, and no account is taken of the strong peroxidase effects of traces of iron and copper foreign to the milk. The peroxidase content of milk varies with the feeding and the state of the health of the cow.

W. L. DAVIES

G. SCHWARZ. Einfache Methode zur Bestimmung der Wasserstoffionenkonzentration der Milch. (A simple method for the determination of the hydrogen-ion concentration of milk.) *Milchw. Forsch.* **6**, v–vi, 458–63, 1928.

The author proposes a colorimetric method for the determination of the hydrogen-ion concentration of milk, which can be used for raw or heated whole milk, separated milk or butter milk. It is not suitable for sweet cream containing more than 15 per cent. butterfat, but may be used for ripened cream.

The method is as follows: 20 c.c. of milk is well shaken in a 50 c.c. stoppered cylinder with 92–95 per cent. methyl alcohol, which has been once distilled over alkali. The mixture is well shaken for 5 to 10 min., and then filtered through a dry fluted filter paper. To 6 c.c. of the clean filtrate 1 c.c. of the selected Michaelis indicator is added and the *p*H determined by matching the colour in a comparator.

A table giving values obtained both by the colorimetric and electrometric method shows in general good agreement.

E. C. V. MATTICK

T. MOJONNIER. Transmission of heat by metals and alloys. *Le Lait*, **8**, lxxix, 859, November 1928.

BIOCHEMISTRY

DIBBERN and EICHSTADT. Der Einfluss des Dorschmehls auf die Konstanten der Milch und des Butterfettes. (Effect of cod-fish meal on the constants of milk and butterfat.) *Milchw. Forsch.* **6**, v–vi, 498–504, 1928.

The milk of cows fed on cod-fish meal varied very slightly in composition from that obtained with the cows fed on an ordinary ration. The specific gravity, total solids, fat, solids-not-fat and the fat content of the total solids showed the same tendency to variation as when the animals were fed on a normal ration. There was a higher number of large fat globules in the milk when the cows were fed on the fish meal.

No change other than raising the melting and the solidifying points was observed in the constants of the butterfat. The character of the butter was greatly changed when the cows were given increasing amounts of fish meal. The butter was brittle and later gave a bitter taste, being tough and sticky to the tongue like margarine, and could not possibly be called good butter.

W. L. DAVIES

M. M. KRAMER, E. LATZKE and M. M. SHAW. A comparison of raw, pasteurised, evaporated and dried milk as sources of calcium and phosphorus for the human subject. *J. Biol. Chem.* **79**, i, 283–95, September 1928.

Metabolism experiments were carried out both with children and adults in an endeavour to learn whether the calcium and phosphorus in various forms of milk were equally available for human nutrition. As the result of experiments both with children and with adults it was evident that they retained more calcium when it was supplied by raw than by dried milk, although equal quantities were given, and other factors remained unchanged.

The calcium balance of adults using pasteurised milk and also milk from cows which had been kept for some months in a byre without sunlight was less favourable than that obtained with fresh milk. On the other hand, adults using evaporated milk (a popular brand of unsweetened condensed milk) showed balances at least as good as those for fresh milk.

In general phosphorus balances followed the trend of the calcium balance figures.

E. C. V. MATTICK

C. H. HUNT and W. E. KRAUSS. Relative antineuritic and antipellagric potency of cow's milk. *J. Biol. Chem.* **79**, ii, 733–8, October 1928.

H. C. SHERMAN. Nutritional significance of our present knowledge of the multiple nature of vitamin B. *J. Nutrition*, **1**, ii, 191–9, November 1928.

In an editorial review in the first volume of the new *Journal of Nutrition*, Prof. H. C. Sherman sets forth in a brief and non-technical manner the nutritional significance of knowledge (to the summer of 1928) of the multiple nature of vitamin B.

The review is followed by a good bibliography which includes references to Sherman's own considerable contributions to this subject, among which may be mentioned the marked supplementary relationship between wheat and milk, wheat being relatively richer in the antineuritic, and milk relatively richer in the more heat-stable factor. Although relatively richer in the more heat-stable factor milk is spoken of as a good source of both of the factors.

This heat-stable factor may be selectively destroyed by exposure to ultra-violet irradiation, as Hogan and Hunter have recently shown.

Mention is made of the work of Underhill and Mendel, who have shown that pellagra-like symptoms in the dog can be prevented by what appears to be an entirely different substance—a fat-soluble factor occurring in butterfat and carrots and experimentally replaceable by carotin.

The multiple nature of vitamin B is now established and the two (or more) essential substances of the vitamin B complex are doubtless of much nutritional significance.

J. GOLDING

B. SURE. Vitamin requirements for nursing young. III. A quantitative biological method for the study of vitamin B requirements of nursing young of the albino rat. IV. Vitamin B versus vitamin A and D requirements for the growth of nursing young of the albino rat. *J. Nutrition*, **1**, ii, 139, 155, November 1928.

B. REWALD. Lipoidgehalt der Butter. (The lipoid content of butter.) *Biochem. Zeits.* **202**, 391–3, 1928.

The lecithin content of three samples of butter (calculated from the phosphorus content of the well-washed butterfats, $P \times 25{\cdot}44$ = lecithin) amounted to 1·17, 1·27 and 1·73. These values are much higher than those which have generally been regarded as the range of lecithin content of butter, namely, 0·017 to 0·38 per cent. Conditions likely to affect the lecithin content of butter are enumerated.

W. L. DAVIES

F. E. HAAG. Die Zersetzung der Fette durch Bakterien. (The breakdown of fats by bacteria.) *Archiv. f. Hygiene*, **100**, v–vii, 271–308, 1928.

A study of the action of micro-organisms on fats and fatty acids has been carried out by determining the carbon dioxide formed in cultures with a view to ascertaining the source of carbon for the organism and the conditions for making this source of carbon available. The breakdown of oleic acid and erucic acid as against the immunity to attack of elaidic and brassidic acids has been put down to structural configuration (Cis forms) of the former and not to the lower, the melting point or specificity of the organisms. Besides the fungi, only one organism (*B. pyocyaneum*) was able to attack the higher saturated fatty acids, this being due to the dehydrogenating capacity of the organism working in conjunction with its higher oxidase content.

The sources of carbon in butter were found to be lactic acid (and lactose), glycerine and oleic acid, and of the higher fatty acids, oleic is the only source of carbon for bacteria. The bearing which this selective action on oleic acid has on the development of rancidity has been extensively studied, the double bond of that acid being regarded as the point of attack from which emanate all the products responsible for rancid odours. The view that free higher fatty acids are toxic to bacteria is contended, oleic acid being found a suitable source of carbon for a variety of species.

Much space has been allotted to lengthy but comprehensive reviews on cognate work, that on the auto-oxidative breakdown of fatty acids being particularly complete.

W. L. DAVIES

E. MUNDINGER. Über die chemischen und bacteriologischen Vorgänge beim Verderben des Butterfettes. (Chemical and bacteriological processes in the deterioration of butterfat.) *Milchw. Forsch.* **7**, iii–iv, 292–331, 1929.

Recent work connected with the auto-catalytic oxidation of fats has been extensively reviewed in an attempt to clear up the diversity of opinions on the subject and a large number of butter samples in various stages of deterioration have been examined. In purely chemical deterioration it is contended that free acidity plays

only a subordinate part, but that the decomposition proceeds through the agency of air and light by attacking oleic acid at the double bond. The chemical detection of rancidity by colour reactions has been well studied, particularly the Kreis test which is a test for free epihydrinaldehyde. The decolorised fuchsin test (Fellenberg test) for free aldehydes was found more sensitive, but all colour reactions were not as sensitive as taste and smell in detecting the slightest traces of products of oxidation.

The presence of small amounts of iron and copper in the butter was found to have the same effect on butter deterioration as light and air.

With most micro-organisms acting on butterfat various peptones can be detected by steam distillation and the formation of a precipitate when 2 : 4 dinitrophenylhydrazine is added to the distillate.

Conditions necessary for the conferment of good keeping qualities on butter are enumerated.

W. L. Davies

O. Acklin. Zür Biochemie des *Penicillium glaucum*. (The biochemistry of *Penicillium glaucum*. A contribution to the problem of methyl ketone formation from triglycerides or fatty acids during the metabolism of mould fungi.) *Biochem. Zeits.* **204**, 253–74, 1929.

The ability of *P. glaucum* to break down fatty acids to methyl ketones containing one less carbon atom has been demonstrated. Butyric and valeric acids do not give methyl ketones owing to the special properties of the intermediate compounds (*e.g.* acetoacetic acid), whereas caproic to myristic acids inclusive give the corresponding methyl ketones. The mechanism of this oxidation has been compared with Dakin's synthesis of methyl ketones and with the breakdown of fatty acids in the animal organism.

A study of the actual ketone formation has been carried out on caproic acid and tricaproin. The actual amount of ketone formed was found to depend on the concentration of the acid (or ester), the concentration of the nutrients in the medium and on the *p*H of the medium. The highest yields of ketone estimated as *p*-nitrophenylhydrazone was found by using a 0·25 per cent. solution of caproic acid, a medium containing 2 per cent. each of mannitol and peptone, working at a *p*H of 7·6. With tricaproin, 30 per cent. of possible ketone formation took place on the acid side of neutrality and 35 per cent. on the alkaline side and the maximum yield of ketone obtained (48 per cent. if possible) was by the use of an unbuffered medium. A possible catalytic action of iron (as a solution of haemin) in increasing ketone formation could not be established.

W. L. Davies

G. M. Clark. Irradiating milk solids with ultra-violet rays. [B.P. 298,585.] (*J. Soc. Chem. Ind.* **47**, xlix, 911, December 7, 1928.)

By agitation of milk either in the dry or liquid form, *e.g.* by spraying, and exposure to ultra-violet rays, antirachitic properties are conferred on the material. By ranging the intensity of the rays and time of exposure so that the material does not acquire a disagreeable taste and smell it is claimed that 75 per cent. of the total possible antirachitic properties can be produced in the milk.

W. L. Davies

G. H. Leighton and M. L. Clark. Report on milk consumption and the growth of school children. *Lancet*, pp. 40–3, January 5, 1929.

In these tests 1157 children were under observation from November 1927 to June 1928, divided into three age groups, 13–14, 9–10 and 6–7 years, three ration groups and one control group. The rations were 1 pint of whole milk, 1 pint of

separated milk and biscuits of an equal calory to 1 pint of separated milk to the children of 9–13 years of age. To those of 6–7 years ¾-pint of separated milk and biscuit ration accordingly. These rations were supplementary to the ordinary food of working class homes. The greatest increase in height was found with whole milk in the 6-year-old group and the greatest increase in weight was among the 15-year-old group receiving the separated milk. The average increase in height of the milk-fed groups was 23·5 per cent. greater than that of the non-milk-fed groups, and in weight 45·37 per cent. Besides the proofs of the tables Dr Douglas observed that the milk groups had the appearance of well nourished animals. Dr Simpson, though unaware of the grouping, could pick out the milk-fed groups, and the teachers had no doubt as to their increased mental and bodily alertness.

E. C. G. MADDOCK

R. W. TITUS and J. S. HUGHES. The nutritional value of copper in powdered whole milk. *J. Dairy Sci.* **12**, i, 90–3, January 1929.

PHYSIOLOGY

W. W. SWETT, R. R. GRAVES and F. W. MILLER. Comparison of conformation, anatomy and skeletal structure of a highly specialised dairy cow and a highly specialised beef cow. *J. Agric. Res.* **37**, xii, 685–717, December 15, 1928.

This is the report of a careful study of the factors mentioned in the title.

The authors conclude that although the external forms of the two cows differ greatly, their internal structure did not indicate significant differences in function, and that the differences in type are due to extreme fleshing on the one hand and to udder development on the other.

R. STENHOUSE WILLIAMS

E. MAURER and H. DUCRUE. The effect of iodine on milk secretion. *Münch. med. Wochschr.* **75**, 249–51, 1928. (*Chem. Abstr.* **22**, xxii, Part I, 4611, November 20, 1928.)

Tests were made to determine possible changes in milk composition due to a single large dose of iodine. A nurse was tested three days for the quantity of milk secreted daily. Then 0·6 g. KI was given daily for seven days. The quantity of excreted milk was not changed, but the iodine content far exceeded the normal 2·6 per cent. During the first three days 15 per cent. of the administered iodine was eliminated. The milk participated in the iodine output. During the last five days the iodine content of the milk was above normal. The quantity of fat-free dry mass was slightly increased; this is attributed to an increase in protein content. The blood sugar content was increased. The increase in ash was most marked and indicates that the addition of iodine to the food stimulates the elimination of mineral matter in the milk. Fat was decreased. There is no reason to believe that fat decrease runs parallel with the increase in iodine dosage.

L. S. PALMER, C. H. ECKLES and D. J. SCHUTTE. Magnesium sulphate as a factor in retention of calcium and phosphorus in cattle. *Proc. Soc. Exp. Biol. and Med.* **26**, i, 58–62, October 1928.

The authors had previously observed that the drinking water in regions in which cattle suffered from phosphorus deficiency contained unusually large quantities of $MgSO_4$. In view of the close relationship between Ca and P in metabolism, and the well-known antagonism between Mg and Ca, balance experiments were carried out in order to determine whether the presence of $MgSO_4$ affected Ca and P retention.

It was found that the presence of $MgSO_4$, in quantities which were normally contained in the drinking water of affected regions (156 g. Epsom salts per cow per day), caused serious and continuous losses of Ca from the body when fed to cows on a basal ration containing low quantities of P. The addition of NaH_2PO_4 overcame the detrimental effects of Mg feeding. The $MgSO_4$ had no significant effect on the P balance, nor did it affect the level of Ca and inorganic P in the blood. There was found to be a relatively large storage of Mg in the body during the $MgSO_4$ feeding

N. C. WRIGHT

B. HAMILTON and M. MORIARTY. Factors influencing the excretion of calcium. *Amer. J. Dis. Children*, **36**, 450, 1928.

Experiments were carried out to determine the influence of the inorganic constituents of milk on the excretion of Ca by an infant fed with human milk. It was found that the Ca excretion could not be correlated with the intake of any individual basic constituent, but that it could be correlated with the intake of total fixed base. Since the greater portion of the total fixed base is bound to phosphates and to weak acids (organic acids, carbonic acid and protein), the Ca excretion could also be correlated with the buffer of the milk. The authors consider that the variations in the buffer value of the milk were responsible for the observed variations in Ca excretion. Experiments in which acid and alkali were added to the milk supported this conclusion.

In view of the fact that practically the whole of the mineral constituents of milk, other than calcium, are completely absorbed, and that these constituents have been found by the authors to govern the level of Ca excretion, the opinion is expressed that the insoluble faecal Ca must be formed prior to absorption of other minerals—namely, in the small intestine.

N. C. WRIGHT

DAIRY HUSBANDRY

A. D. IMPER. A survey of dairy farming in Aberdeenshire. *Scot. J. Agric.* **12**, i, 59–65, January 1929.

This survey covered about 100 farms supplying milk to the city of Aberdeen. Farms of all sizes and types were visited where the main object was milk production. As a rule a six-course rotation, including two straw crops, one root crop and three years grass was followed, and usually about half the new grass was cut annually for hay. The chief grain crop was oats, grown mainly for home use, and the chief root crop was turnips.

The dairy herds were managed under two systems. In the first the herd was maintained by purchase and in the second by breeding. The adoption of the first was mainly due to the prevalence of abortion and about 50 per cent. of the cows were replaced annually. Under the second the number replaced annually was about 25 per cent. No detailed figures as to relative costs could be obtained, but when the loss of calves and decrease in milk yields under the first system are considered it would appear that the second is more advantageous.

Feeding methods varied greatly, home-grown foods were supplemented mainly by wet brewer's grains, bran treacle, etc., and there was evidence that better balancing of the rations would result in more economical feeding. The quality of management varied greatly both as to the general system and the control of details; there were

instances where the staff could be reduced or minor enterprises such as pig and poultry keeping enlarged. The final conclusion is that the main factor influencing the financial results was the personal efficiency of the farmer.

J. MACKINTOSH

S. BARTLETT. Breeding records for a dairy herd. *J. Min. Agric.* **35**, vii, 637–43, October 1928.

This article discusses the advantages of keeping systematic breeding registers for a dairy herd, also some points for consideration when choosing the type of register to be kept.

The items which may be recorded are classified under five heads:

(1) Records of ancestry in which a short extended pedigree is recommended in addition to the usual method.

(2) Progeny records, including remarks regarding systems of naming calves.

(3) Milk records.

(4) Records of type, for which photographs and a simple score card are suggested.

(5) General information, such as dates of service, tests for such diseases as tuberculosis and abortion, and reasons for the disposal of the animal.

A specimen of a herd record book which has been found in practice to be highly satisfactory is included.

S. BARTLETT

S. BARTLETT. Studies in milk secretion based on the variations and yields of milk and butterfat produced at morning and evening milkings. *J. Agric. Sci.* **19**, i, 36–47, January 1929.

The basis of the work is an analysis of records of the milk and butterfat production of cows in the herd of the National Institute for Research in Dairying, for the five complete years 1922–6. The average night and day milking intervals were 15¼ hr. and 8¾ hr. respectively.

Material is presented which shows month by month the lactation yields of cows in respect of milk and fat. Morning and evening yields are treated separately and differences in relative proportions found.

Smaller proportions of milk and of fat at the morning milkings are yielded in early lactation by all cows, but this point is most pronounced in heifers and also in heavy yielding cows with relatively small udders, so that this phenomenon seems closely correlated with high udder pressure. A possible theory to account for the facts is that cows which develop high pressure in the udder during a long night interval actually reabsorb part of the milk which has been secreted, but further work would appear necessary to verify this point.

Seasonal variations in yield of milk and fats are shown. It is found that the morning milking does not respond as much as the evening milking to the stimulus to secretion which functions during May and June.

The quality of milk at different seasons of the year is discussed.

S. BARTLETT

Clean Milk Competitions. April 1926–March 1927, April 1927–March 1928. *J. Min. Agric.* **35**, x, 908–9, January 1929.

The progress of Clean Milk Competitions held in the counties of England and Wales during the past two years is indicated in tabular form. The number of competitors increased by 82 to a total of 1144, for the year 1927–8; 596 of these were producers competing for the first time. The percentage of samples reaching Grade A standard in 1926–7 was 65·3 per cent., and in 1927–8 was 72·8 per cent. These competitions are organised by Local Authorities for Agricultural Education on the

lines of the scheme set out in the "Guide to the Conduct of Clean Milk Competitions" (*Min. Agric. Mis. Pub.* No. 43).

In addition to these competitions other educational work is carried on in connection with the production of clean milk. Clean Milk Competitions are held for milkers at local farms and at shows, and instruction and demonstrations in the methods of clean milking are given to competitors by the county staff prior to these competitions.

J. McClemont

Inter-county Clean Milk Competition, 1927–8. *J. Min. Agr.* **35**, x, 903–5, January 1929.

A. Macneilage, junr. Surplus milk and milk residues. *Bull. No.* 1 *Hannah Dairy Research Institute, Scotland*, 1929.

This report gives the results of an investigation into the utilisation and marketing of surplus milk and milk residues in Scotland (excluding certain outlying areas) during 1926. The investigation was instituted by the Scottish National Milk and Health Association and assisted financially by the Empire Marketing Board.

For the purposes of the enquiry *surplus milk* is defined as "the portion of the milk offered for domestic use not so absorbed" and the term *milk residues* indicates the fluid remaining after any process has removed part of the solids from whole milk.

Information as to the amount, distribution and utilisation of surplus milk and milk residues was collected from the cities and large towns, country milk depots, creameries, factories and other sources, and is dealt with in Part I of the report. The first conclusion arrived at is that there is no appreciable amount of surplus milk at the consuming centres. There is, however, an appreciable surplus on the farms and at the country depots. On the farms this surplus is mainly made into cheese and the resulting residues are utilised locally, *e.g.* whey is used for the feeding of pigs. Statistics are quoted to show that there are sufficient pigs in the farm cheese making counties to absorb all the whey, but local estimates suggest that a considerable proportion of this whey is not fed economically.

The county depots, creameries and factories are mainly concerned with liquid milk sales, and have equipment for manufacturing surplus milk into cheese and butter. The residues produced, however, are found to be poorly utilised and the report states that of 5·7 million gallons of whey produced, 75 per cent. or 4·3 million gallons are run to waste; of 6·5 million gallons of separated milk produced, 20 per cent. or 1·3 million gallons are run to waste.

The above amount of whey was produced at 23 depots and in view of the importance of having unused whey readily available for manufacture with the minimum transport costs, it is suggested that, without disturbing the flow of milk to the depots, but by rearranging the flow of milk from the depots, it would be possible to secure a similar output of whey from only six depots.

The unused separated milk was produced at 18 depots, but centralisation of output, although desirable, is not considered feasible at present.

Part II of the report discusses the possible methods of utilising surplus milk and milk residues, and the relative values of the different methods of utilising whey and separated milk are summarised. The difficulty of having regular supplies of milk residue products in relation to marketing is noted and it is calculated that the quantity of separated milk wasted annually in Scotland would, if centralised condensing were feasible, provide an amount equal to the total annual Scottish imports of condensed separated milk.

Part III describes concisely the processes of milk condensing and drying, casein-making and the recovery of milk sugar, and discusses average manufacturing costs and returns. From the average costs and returns the gross return per gallon of milk

treated is estimated, *e.g.* condensed separated milk (sweetened), 5½*d.* per gallon; separated milk powder, 2¾*d.* to 3½*d.* per gallon; casein 1¼*d.* to 1¾*d.* per gallon; and whey powder 2*d.* per gallon.

J. MACKINTOSH

J. B. ORR, A. CRICHTON, E. SHEARER and M. SPEEDY. Milk substitutes in the rearing of calves. *Scot. J. Agric.* **12**, ii, 168–74, April 1929.

Experiments are reported in which a milk substitute food of suitable composition was added to a diet of oat meal and linseed meal with hay *ad lib.*

The milk substitute food consisted of the following:

Blood meal	10·18 parts
Chalk	2·40 ,,
Potassium chloride	1·15 ,,
Steamed bone flour	0·66 ,,
Sodium chloride	0·50 ,,
Ferric oxide	0·10 ,,
Potassium iodide	0·01 ,,
	25·00

This mixture was added to the meals in the proportion of 7·5 parts of the mixture to 100 parts of the meal. Cod-liver oil was fed at the rate of ⅛ oz. rising after 8 weeks to ¼ oz. per head daily.

Calves reared on 50 gallons whole milk during the first seven weeks and then given oat meal and linseed meal and hay made very poor progress, whereas others receiving the same allowance of whole milk and meals with the above supplement added made satisfactory growth.

J. MACKINTOSH

DAIRY LEGISLATION

W. A. DAVIDSON. Summary of the first year's veterinary work under the Milk and Dairies (Scotland) Act 1914. *Scot. J. Agric.* **11**, iv, 397, October 1928.

Dutch Legislation. *Le Lait*, **8**, lxxx, 958, December 1928.

Trade Boards Acts 1909 and 1918. Milk Distributive Trade Board (England, Wales and Scotland). *Dairyman*, **51**, 216, December 1928.

PRACTICAL DAIRYING

O. F. HUNZIKER, W. A. CORDES and B. H. NISSEN. Metals in dairy equipment. Metallic corrosion in milk products and its effect on flavour. *J. Dairy Sci.* **12**, ii, 140–81, March 1929.

This paper deals with an important problem, namely, the suitability of different metals for use in dairy equipment. The authors pointed out that the utility of different metals should be measured by three different standards.

1. Their liability to corrosion.
2. Their liability to produce flavours in milk and dairy products and affect their keeping qualities.
3. The toxic properties which they may possess.

The experimental work which the authors publish is concerned with the liability to corrosion of different metals which are used in dairy equipment and the conclusions they reach are contained in the following summary.

1. Allegeny metal, tin, and heavily tinned copper.

These metals have no effect on flavour and show maximum resistance to corrosion and tarnishing. The tin coating on copper must be heavy and intact.

2. Nickel, aluminium, and manganese aluminium alloy.

These metals are not entirely satisfactory in high-acid milk products. Furthermore, the nickel tarnishes readily and the aluminium is sensitive to alkali washing powders.

3. Monel metal, enduro, ascoloy, and nickel silver.

Monel metal tarnishes appreciably in milk products. In these tests it had only slight effect on flavour. Enduro and ascoloy are sensitive to high-acid products and their performance in dairy equipment is uncertain. Nickel silver tarnishes severely and was injurious to flavour in the majority of milk products.

4. Tinned iron, copper, galvanised iron, iron, and zinc.

With the exception of properly tinned iron, this group is unfit for use in contact with milk products. Tinned iron is equally so whenever iron is exposed.

R. Stenhouse Williams

G. T. Pyne and J. Lyons. Studies in cream viscosity. *J. Dept. Lands. Agr. Ireland*, **27**, ii, 121–8, 1928.

The prohibition of the use of preservative and thickening substances in cream raises marketing difficulties.

Experiments have been made to investigate the possibility of increasing the viscosity of pasteurised cream by treatment which could be carried out in a creamery. From these it appears that:

1. Cream prepared by the separation at about 90° F. of milk which had been previously pasteurised and chilled overnight is rather more viscous than pasteurised cream, but the viscosity of the former is greatly increased by allowing it to stand at 34° F.

2. Cream prepared by the re-separation at 90° F. of cream (34 per cent. fat) which had been previously pasteurised and chilled showed a satisfactory viscosity, but still far below that obtainable by the first method.

3. Addition of lactic acid (beyond certain amounts) improved the viscosity in all cases, and the action appeared to be almost instantaneous. Lactic acid is only likely to prove of value when added to cream which has been so heated as to possess already a fairly high viscosity.

4. The viscosities were compared by means of a pipette viscometer attached to a capillary tube, and without accurate temperature control. The figures obtained in this way are more or less approximate, but they are sufficiently accurate for the purpose.

G. M. Moir

J. Hawesson. Influence of rennet ferment on the ripening of cheese. Experiments with Russian Backstein. *Le Lait*, **9**, lxxxi, 2–12; lxxxii, 148–61, January and February 1929.

R. Meurer. Is the modern momentary heating (biorisation) equal to the Holder method? *Molk. Ztg.* **42**, 1159–60, 1928. (*Centralbl. f. Bakt.* i, Ref., 91, xv–xvi, p. 382.)

As a result of previous experiments the author concludes that the process of biorisation is worthy of attention.

In both methods bacteria are destroyed but the biological condition of milk after biorisation is less altered than when the Holder process is employed.

A. T. R. MATTICK

E. H. DEYSHER, B. H. WEBB and G. E. HOLM. Relations of milk temperature and time of forewarming of milk to the heat stability of its evaporated product. *J. Dairy Sci.* **12**, i, 80–9, January 1929.

Variations in the heat treatment of a milk affect greatly the heat stability of the evaporated product. Temperatures up to 70° C. applied for 10 min. decrease the stability, while higher temperatures markedly increase it. Higher temperatures and a longer heating period than those generally used further stabilise the product to heat. This treatment is objectionable, however, in that the body of the resulting product is affected adversely.

J. GOLDING

A. W. FARRALL. The application of steam for heating and sterilising dairy utensils. *J. Dairy Sci.* **12**, ii, 95–113, March 1929.

This is a record of experiments conducted at the University of California to determine the best methods of applying heat for the sterilising of dairy utensils. After discussing the thermal properties of steam and the fundamentals of heat transfer from steam to metal surfaces and from metal surfaces to air, the writer refers to various practical applications, such as steaming cans over jets, steaming in tank type containers, and steaming by blowing a steam jet against the outside of the metal surface. The presence of moisture left on the utensil after steaming is also considered. The author is of opinion that steam heats the cans more efficiently than superheated steam, but that the latter leaves much less moisture in the can than when either saturated or wet steam is used. If superheated steam is used in the last steam jet of a continuous can washer drying is materially aided. In the closed type of steriliser heating with steam is stated to be more rapid than with hot air.

E. B. BLACK

N. S. GOLDING and K. C. THORNELOE. The use of a steam steriliser for dairy utensils on the farm. *Scientific Agric.* **9**, 6, February 1929.

The installation of steam sterilising plants on the farms of 11 milk producers in Fraser Valley, British Columbia, resulted in an improvement in the quality of the milk produced.

The experiment was carried out through a period of 4 weeks, 2 weeks before the introduction of the steam sterilisers and 2 weeks while the sterilisers were in use. During the experiment 8 milk samples were tested.

J. MCCLEMONT

M. A. F. BARNETT. The utilisation of whey. *New Zealand J. Agric.* **38**, i, 36–39, January 1929.

The author refers to Harding's method for condensing whey (*Research Monograph*, No. 5, Ministry of Agriculture and Fisheries, England), and then proceeds to describe a similar method which is being tested in New Zealand.

This method differs from that of Harding in that the evaporator is of a very simple type, in which the heating steam passes through a series of pipes immersed in the whey. This type of machine is much easier to keep clean than that used by Harding, in which the whey boils inside the tubes, which constantly require cleaning.

Tests have been made working the evaporator at 15 in. vacuum in the first effect and 25 in. in the second. There is slight trouble due to frothing, but this can

be overcome by the addition of a small quantity of cotton-seed oil (or other cheap vegetable oil). The temperature in the first effect (80° C. for 15 in. vacuum) is probably sufficient to coagulate the albumen, although no trouble from that source was apparent.

R. STENHOUSE WILLIAMS

F. J. DOAN. The homogenising process. *Pennsylvania Bull.* **230**, 23–5, 1928.

STATISTICS

Butter and Cheese Exports and Imports 1927 and 1928. *Int. Rev. of Agr.* **19**, 11, ST-389, November 1928.

Grading of export butter and cheese. Leading dairy factory averages of year 1927–8. Dairy Division. *New Zealand J. Agric.* **37**, iii, 196, September 1928.

Imports of butter into the United Kingdom for the ten years ended 30. vi. 28. *World's Butter Review*, p. 17, November 1928.

REVIEWS

Empire Marketing Board.

The Weekly Dairy Produce Notes published by the Statistics and Intelligence Branch of the Empire Marketing Board every Friday contain a brief review of the position of dairy produce supplies, with arrivals and shipments afloat during the week, followed by a statement of prices issued by the London Provision Exchange. Statistics of imports and exports of dairy produce are also given for various countries. This publication is obtainable only by application to His Majesty's Stationery Office, Shepherdess Walk, London, N. 1.

Commonwealth of Australia.

Report of the Council for Scientific and Industrial Research for the period from July 1, 1927 *to June* 30, 1928 (Melbourne 1929).

This is a brief but valuable report of the activities of the Council over a period of 12 months, and includes amongst other things short accounts of progress in Agricultural Research, and mention is made of the Council's decision to initiate a scheme of dairy research.