

# ABSTRACTS AND REVIEWS

## BACTERIOLOGY

### GENERAL

S. E. OWEN. **The relation of media pH to the bacteriostatic action of dyes.** *Amer. J. Pharm.* **102**, 154-8, 1930. (*Chem. Abst.* **24**, x, 2488, May 20, 1930.)

The pH value of media is an insignificant factor in the selective action of gentian violet, basic fuchsin and perhaps also methylene blue. Eight of the certified food dyes tested show no bacteriostatic action at pH values ranging from 5.4 to 10.4. Guinea green inhibits the growth of *B. anthracis* in the acid range and at pH 7.4 but not in other alkaline pH values greater than this. Erythrosine inhibits the growth of *B. anthracis* at all pH values studied. A brief bibliography and also a comprehensive reference list on the bacteriological importance of stains, dyes and chemicals are appended.

A. GUILLIERMOND. **Sur la toxicité des colorants vitaux.** (Toxicity of vital stains.) *C. R. Soc. Biol.* **104**, xix, 468-72, June 6, 1930.

The toxicity of various vital stains for *Oidium lactis* and other fungi (Mucoraceae, *Spermophthora gossypii*, *Penicillium glaucum* and various yeasts) has been determined and compared with their toxicity for *Saprolegnia*. It was found that for each one there was a limiting dose which varied with the fungus and the culture medium, and was much lower for *Saprolegnia* than for the other fungi. The latter are not coloured during their growth in media containing the stains, neutral red included, but *Saprolegnia* accumulates neutral red within its cells.

E. R. HISCOX

C. H. WERKMAN. **An improved technic for the Voges-Proskauer test.** *J. Bact.* **20**, ii, 121-6, August 1930.

After discussing the chemical mechanism of the test and the use of oxidising agents such as  $H_2O_2$  to hasten the appearance of colour, the author describes the method of using  $Fe_2Cl_6$  as a catalyst.

Two drops of 2 per cent. solution of  $Fe_2Cl_6$  are added to 5 c.c. of the culture followed by shaking with 5 c.c. of 10 per cent. solution of NaOH. In positive tests a bright copper colour, which is stable, is formed at once.

A. T. R. MATTICK

F. C. HAPPOLD. **The correlation of the oxidation of certain phenols and of dimethyl-*p*-phenylenediamine by bacterial suspensions.** *Biochem. J.* **24**, vi, 1737-1743, 1930.

Strict aerobes oxidise dimethyl-*p*-phenylenediamine, but this oxidation may be masked by reducing systems present. It has been shown that tyrosinase in the presence of atmospheric oxygen and certain phenols which form *o*-quinones, causes the deamination and decarboxylation of amino acids thus forming an aldehyde, ammonia and carbon dioxide.

The author has investigated the relationships between these reactions in the case of a number of bacteria.

All organisms giving the dimethyl-*p*-phenylenediamine reaction catalyse the oxidation of catechol to *o*-benzoquinone. The enzyme responsible is heat labile. None of the organisms tested (except a tyrosinase-containing *Vibrio*) could deaminate an

amino acid in the presence of a monohydric phenol, although those producing a colour change with catechol could deaminate in the presence of this phenol.

Only the aerobic spore-formers catalysed the oxidation of guaiacol to a red brown substance. J. G. DAVIS

O. BIER and J. REIS. **La réaction oxydante directe chez les streptocoques.** (Direct oxidising reaction of the streptococci.) *C. R. Soc. Biol.* **104**, xxi, 707–8, June 20, 1930.

The authors have examined cultures of 110 streptococci of very varied origin, and have observed that, contrary to previous statements, these organisms did not invariably give negative results, but that 23.6 per cent. gave a typical oxidising reaction. From this it follows that the reaction cannot be used as a means of distinguishing gonococcus and meningococcus from other cocci. E. R. HISCOX

G. FISCHER. **La croissance de *B. coli* et des bacilles paratyphiques dans des milieux demisolides.** (Growth of *B. coli* and paratyphoid bacilli in semi-solid media.) *C. R. Soc. Biol.* **104**, xix, 528–30, June 6, 1930.

When a culture of *B. coli* is inoculated into a medium containing 2 per cent. peptone and 0.2 per cent. agar (pH 7.5), there is normal development at the surface to a depth of 1 cm. Below this there is a series of horizontal rings, 0.2–2 mm. thick, with clear areas between. A similar effect is obtained in Petri dishes, but the rings are concentric. The growth in the horizontal and concentric ring consists of long, thin, mobile bacilli, whilst the organisms in the surface growth are short, thick, non-mobile rods, similar to the normal forms of *B. coli*.

If the medium is heated and re-inoculated it will not support growth. If a layer of fresh medium is poured on the surface, growth will not occur at the bottom of this layer. It would appear that the exhaustion of the medium is due to the development of toxins and not to impoverishment. E. R. HISCOX

H. HOEK. **Bacterial filtration by the Berkefeld filter and the size of the pores.** *Chem. Fabr.* pp. 249–50, 1930. (*Brit. Chem. Abst.*, p. 743, August 15, 1930.)

For the purpose of bacterial filtration by cylinders the size of the largest pores is the most important factor to be considered. This can be measured by noting that pressure at which air bubbles begin to be forced through the cylinder when the latter is held under water.

An efficient bacterial filter should not pass air bubbles under a pressure of 0.55 atmospheres. J. G. DAVIS

H. PLOTZ and J. GELOSO. **Relations entre la croissance des microorganismes anaérobies et le potentiel du milieu de culture.** (Relation between growth of anaerobic micro-organisms and the potential of the culture medium.) *Ann. Inst. Pasteur*, **45**, v, 613–40, May 1930.

Previous workers have reported that anaerobes can only grow over an rH range of 0 to 14. The authors have employed an ingenious method of measuring potentials *in vacuo*, employing an H-tube one arm of which contains a saturated calomel electrode and the other the culture medium. Contact is made between the solutions through the minute layer of adsorbed electrolyte on the glass.  $E_h$  values obtained with different cultures of anaerobes in this apparatus are shown graphically, anaerobiosis being obtained either by evacuating or by the addition of the usual reducing substances (alkaline-heated glucose, cysteine, sodium hydrosulphite, titanium citrate, glucose and platinum black). *Cl. tetani*, *E. coli* and *Cl. botulinum*, *bifermentans*, *putrificum*, *sporogenes*, *oedematis-maligni* and *histolyticum* were studied in this way. All tended finally to give an  $E_h$  of  $-0.265$  (rH = 5.5). Determinations on uninoculated

culated broths showed that, in the presence of the reductants listed above, the potentials verged towards this value ( $rH$  7.5). Thus the organism has on the medium an effect similar to that of platinum black, *i.e.* that of catalysing the dehydrogenation of the sugars. *Cl. tetani* was found to grow only at an  $rH$  range of 0 to 14.

J. G. DAVIS

G. TANMAN. **The poisonous action of some metals and alloys on bacteria.** *Forschungen u. Fortschritte*, 5, 257, 1929. (*Chem. Abst.* 24, xiv, 3529, July 20, 1930.)

Copper, nickel, silver and cobalt in a culture of bacteria exert a toxic action in extremely low concentrations (oligodynamic action).

Manganese, aluminium and iron do not appear to be poisonous under similar conditions. Results obtained with alloys are also given. (Cf. Richet, *Comp. Rend.* 114, 1494.)

J. G. DAVIS

J. P. SCOTT. **A simple mineral mixture agar for the cultivation of *Pasteurella bovisepitica*.** *J. Bact.* 20, i, 9–14, July 1930.

Ions essential for the growth of anaerobes in protein media are potassium, ammonium, dihydrogen phosphate, bicarbonate and pyruvate.

The effect of different concentrations of salts on the growth of *P. bovisepitica* is described and a salt mixture evolved, which when added to a protein medium increases the growth, viability and pathogenicity of this organism. Viability is better at room temperature than at 50° C. or less. Gas formation by *Pasteurella* organisms is increased by adding certain salts to the medium.

J. G. DAVIS

O. KLINGMÜLLER. **Untersuchungen über Unterschiede des *Streptococcus cremoris* und *Streptococcus mastitidis*.** (The differences between *Streptococcus cremoris* and *Streptococcus mastitidis*.) *Milchw. Forsch.* 10, v–vi, 431–54, October 1930.

The investigation of the morphological and physiological characters of a number of strains of *Str. cremoris* and *Str. mastitidis* confirmed the view that the two species were very much alike. A close relationship was indicated by their morphology and by the facts that they produced equal quantities of acid in milk, brought about a similar degradation of casein, were both able to produce gas from lactose and dextrose and gave negative tests for bacteriophage, whilst *Str. mastitidis* rapidly lost its pathogenicity. On the other hand, the difference in their resistance to high temperatures and the longer life of *Str. mastitidis* argued against such a relationship. If the view be taken that *Str. cremoris* is a race of *Str. mastitidis* it is easy to understand that it will be more sensitive to external influences.

E. R. HIRSCOX

C. A. MAGOON and B. C. BRUNSTETTER. **A new vessel for the efficient aeration of bacterial cultures in liquid media.** *J. Bact.* 19, vi, 415–22, June 1930.

This paper gives a description of an ingenious culture vessel designed to secure uniform conditions of food supply and aeration for studying the physiology of micro-organisms.

A. T. R. MATTICK

F. KRASNOW and M. REINER. **Biochemical studies of streptococci. VI. Relation of osmotic pressure to availability of synthetic media.** *J. Dental Res.* 9, 733–40, 1929. (*Chem. Abst.* 24, xi, 2773, June 10, 1930.)

The 46 media used exhibited a wide range in osmotic pressure; the lowest pressure was less than 50 mm. Hg, the highest 915 mm. The number of media showing growth increased as the osmotic pressure decreased.

- P. MAZÉ and P.-J. MAZÉ. **L'action de l'oxygène libre sur les ferments lactiques se développant en anaérobiose.** (The action of free oxygen on the lactic ferments developing under anaerobic conditions.) *C. R. Soc. Biol.* **105**, xxxii, 519-20, November 28, 1930.

The presence of a sterile zone at the limit of the regions of aerobic and anaerobic life of a culture of a lactic ferment allows of the demonstration of the method by which free oxygen inhibits the evolution of anaerobic micro-organisms. The products of the anaerobic fermentation are transformed by the oxygen which diffuses through the medium into antiseptics which destroy the organisms in that zone where these compounds are abundant. It has been demonstrated that acetaldehyde is produced in this region though probably this is not the only reaction which occurs.

E. R. HISCOX

- G. S. GRAHAM-SMITH. **The longevity of dry spores of *B. anthracis*.** *J. Hygiene*, **30**, ii, 213-5, June 1930.

Material containing numerous young spores of *B. anthracis* was inoculated on small pieces of dry sterile canvas, contained in Petri dishes which were stored in a cupboard with glass doors. The spores were thus kept dry at room temperature and exposed to diffuse daylight. At intervals pieces of cloth were removed and examined for the presence of living spores. Within a few months about 50 per cent. of the spores appeared to have lost their power of germinating, but of the remainder, a considerable proportion were still capable of germination after 10 years. The proportion of living spores steadily decreased until they all apparently disappeared in about 23 years.

E. R. HISCOX

- E. W. TODD. **Virulence of haemolytic streptococci. I. The influence of oxygen on the production of glossy variants.** *J. Exp. Path.* **11**, v, October 1930.

By long subcultivation on aerobic agar, glossy (smooth) colonies of avirulent strains may be obtained. These are more resistant to peroxide than the virulent (rough) strains; the latter also produce more peroxide than the avirulent strains and so suffer auto-sterilisation earlier. The addition of hydrogen peroxide accelerates the selection of smooth types, while catalase prevents the appearance of virulent types.

J. G. DAVIS

- G. A. HUNT and L. F. RETTGER. **A comparative study of members of the lactobacillus genus, with special emphasis on lactobacilli of soil and grain.** *J. Bact.* **20**, i, 61-81, July 1930.

A brief review of previous work on the specification of the lactobacilli is followed by a description of the morphological and cultural characteristics of 36 strains either isolated from soil, grains and faeces, or from stock cultures. Growth was increased by the addition of yeast or tomato extract. The sugar fermentations and serological relationships are described in detail; these do not always confirm each other. Cell morphology and colony formation serve only as preliminary means of identification. Soil organisms do not usually ferment lactose, *L. bulgaricus*, *acidophilus* and *odontolyticus* do. Gas-producing strains rapidly lose this property when cultured in the laboratory. It is interesting to note that although grains protected from animal (mice) contamination rapidly ceased to yield lactobacilli, all attempts to isolate lactobacilli from the intestinal contents of mice failed.

J. G. DAVIS

- W. LOELE. **Relation of the oxidising substances in bacteria and yeasts to cellular oxidases.** *Arch. path. Anat. (Virchows)*, **267**, 733–45. (*Chem. Abst.* **24**, x, 2488, May 20, 1930.)

Naphthol and benzidine-oxidases are found in yeasts; the appearance of the reaction is dependent on the nutrient medium and on the age of the culture. Certain groups of bacteria give the oxidase reaction.

- E. W. and A. E. STEARN. **Differential action of oxidising agents on certain Gram-positive and Gram-negative organisms.** *J. Inf. Dis.* **46**, vi, 500–13, June 1930.

Gram-negative organisms are more susceptible to oxidising agents than Gram-positive organisms. A few Gram-negative organisms, however, approach the Gram-positive in their resistance to such reagents. The mechanism of this inhibition differs from that of ordinary dyes. These results are discussed in relation to modern ideas on oxidation-reduction environment.

J. G. DAVIS

- E. LEPPER and C. J. MARTIN. **The oxidation-reduction potential of cooked-meat media.** *J. Exp. Path.* **11**, iii, 137–39, June 1930.

The oxidation-reduction potential of meat media under conditions in which these are used for the cultivation of anaerobes is of the order of  $-0.2$  volt. Discrepancies between gold and iridium electrodes did not exceed 30 millivolts. This value is consistent with the estimated values of the system parahaematin-haemochromogen which is alleged to be responsible for the equilibrium attained in sterile cooked-meat media.

J. G. DAVIS

- E. LEPPER and C. J. MARTIN. **The oxidation-reduction potential of cooked-meat media following the inoculation of bacteria.** *J. Exp. Path.* **11**, iii, 140–45, June 1930.

$E_h$  curves of some facultative and strict anaerobes are given. The effect of the hydrogen evolved in the solution upon the electrode readings, and the chemical mechanisms involved in the poisoning of the oxidation-reduction potential are discussed.

J. G. DAVIS

- L. F. HEWITT. **Oxidation-reduction potentials of cultures of haemolytic streptococci.** *Biochem. J.* **24**, ii, 512–24, 1930.

This paper gives the oxidation-reduction potential curves of cultures of haemolytic streptococci in various media and under various conditions of oxygen tension. The author claims that "streptococci" are not favoured by low reducing potentials although his evidence is based on the behaviour of only one strain. Serum proteins inhibit the fall of potential in aerobic cultures. This effect is ascribed to the oxygen carrying capacity of sulphur groups in the molecule. Peroxide is frequently formed in aerated cultures ( $E_h + 0.5$  and  $rH$  30). Low concentrations (0.007 per cent.) were not toxic. Aerated cultures gave an  $rH$  of 17–21 and freshly boiled media cultures an  $rH$  of 9–13.

J. G. DAVIS

- L. F. HEWITT. **Oxidation-reduction potentials of staphylococci cultures.** *Biochem. J.* **24**, iii, 676–81, 1930.

$E_h$  curves for cultures of *Staphylococcus aureus* under various conditions of oxygen tension and media are given. This organism resembles *C. diphtheriae* in maintaining intense reducing conditions in the presence of oxygen, and also in maintaining this level for a long period. Glucose broth does not give the low values obtained with ordinary broth. [This author does not give values for uninoculated media or proof of viability during the experiments. It is possible, therefore, that some of the values given are due to the medium rather than to the organisms.] J. G. DAVIS

L. F. HEWITT. **Oxidation-reduction potentials of cultures of *C. diphtheriae*. I.** *Biochem. J.* **24**, iii, 669–75, 1930.

*C. diphtheriae* produces a higher reducing intensity than the haemolytic streptococci. Both types, however, show a more rapid fall in potential under aerobic conditions than when sealed. The rise in potential subsequent to the logarithmic growth rate period obtained with the streptococci does not occur with *C. diphtheriae*. Serum possesses the same oxygen-carrying effect that was observed with the streptococci.

J. G. DAVIS

J. A. CRANSTON and B. LLOYD. **Studies in gas production by bacteria. I. Apparatus for the measurement of the rate of gas production. II. Denitrification and bacterial growth phases.** *Biochem. J.* **24**, ii, 525–8, 529–48, 1930.

I. The author describes three simple methods which have been devised for the measurement of gas evolution by bacteria: (1) a pycnometer method for use where compactness is required; (2) a capillary tube method for making simultaneous readings of a large number of cultures; and (3) a large-scale apparatus in which the gases can be analysed and samples of the medium withdrawn.

II. Experiments are described which show the relationship of the rate of gas production to the growth rate. From the study of the effect of lag in cultures of nitrate and nitrite broth the authors suggest the following scheme for denitrification:



G. S. WILSON. **The growth of *Br. abortus* in sealed tubes.** *J. Exp. Path.* **11**, iii, 157–63, June 1930.

The efficacy of the well-known method of growing *Br. abortus* is due to the production of CO<sub>2</sub> by the sealing of the tubes (flaming the cotton-wool, melting the sealing wax, etc.). A tube which has been sealed in this way may contain 1 to 3 per cent. CO<sub>2</sub>.

J. G. DAVIS

L. H. LAMPITT. **Research work in the yeast field.** *J. Inst. Brewing*, **3**, vi, 250–60, June 1930.

A review of the researches on yeasts from the time of Pasteur until the present day.

E. R. HISCOX

F. MARBOE. **Ueber den Einfluss blanker Metalle auf Hefe.** (Effect of bright metals on yeast.) *Zbl. f. Bakt.* **II**, **81**, i–vii, 67–73, May 1930.

The action of a metal depends on its specific activity in conjunction with its solubility. The boiling of a medium containing metal reduces its action. The influence of the metals appears to depend on the toxic action of metal salts and on their reducing and oxidising properties.

E. R. HISCOX

H. TAMIYA and T. HIDA. **Vergleichende Studien über die Säurebildung, die Atmung, die Oxydasereaktion und das Dehydrierungsvermögen von Aspergillusarten.** (Acid formation, respiration, oxidase reaction and dehydrogenating power of species of *Aspergillus*.) *Acta Phytochimica*, **4**, 343–61, 1929. (*Zbl. f. Bakt.* **II**, **80**, xxiii–xxvi, 499, May 1930.)

G. BEHR. **Über Autolyse bei *Aspergillus niger*.** (The autolysis of *Aspergillus niger*.) *Arch. f. Mikrobiol.* **1**, iii, 418–9, September 1930.

The author distinguishes two forms of autolysis by *A. niger*. The first occurs at about pH 1 (“acid” autolysis) and liberates organic-nitrogen containing compounds. In addition a yellow pigment is formed, the chitin content increases progressively

and the decrease in mycelial growth is relatively small. The second or "neutral" autolysis occurs at a *pH* of about 6.5. The absence of organic-nitrogen containing compounds, the formation of ammonia, a violet pigment and a humin-like substance, the relatively great mycelial atrophy and the complete disappearance of chitin are characteristic of this mode of autolysis.

The investigation gave no evidence that organic acids originated by deamination. Some properties of the chitin are described. J. G. DAVIS

#### DAIRY BACTERIOLOGY

L. VOGELER. **Über sporenbildende Bakterien im Darmkot des gesunden Rindes unter der Berücksichtigung ihrer Bedeutung für die Milchwirtschaft.** (Spore-forming bacteria in the faeces of healthy cattle with reference to their importance for the dairy industry.) *Milchw. Forsch.* **10**, iii-iv, 180-230, July 1930.

The author has made a qualitative and quantitative study of the spore-forming bacteria in the faeces of healthy cows during different periods of feeding. During summer feeding in the field, the total number of bacteria and the percentage of spore-formers are much lower than during the period of stall feeding. During the former the *mesentericus* group is present in much larger numbers than the *mycoides*, although these two groups form the bulk of the spore-bearing bacteria. The *subtilis* group is rarely present. In the latter period the *mycoides* group is more abundant than the *mesentericus* and the *subtilis* group is frequently found though not in large numbers.

The various spore-forming bacteria are described and identified and their resistance to heat, their temperatures of growth, their reaction to salt, and acid-tolerance are determined, and correlated with their influence on products made from milk containing them. E. R. HISCOX

P. MAZÉ and P.-J. MAZÉ. **Les substances réductrices du lait assurent le développement prédominant de la fermentation lactique dans le lait.** (The reducing substances in milk assure the predominance of lactic fermentation in milk.) *C. R. Soc. Biol.* **105**, xxxii, 518-9, November 28, 1930.

The predominance of lactic ferments in milk which has soured naturally is due to the presence in the milk of reducing substances capable of fixing atomic hydrogen in an acid medium. When an agar stab is heavily inoculated with a young culture of a lactic ferment, colonies develop at the top and bottom of the tube, but between these two areas there is frequently a sterile zone of variable thickness, the formation of which depends on the species of ferment and the nature of the medium. If small quantities of methylene blue are added to the medium the sterile zone increases in thickness and tends to approach the surface. The methylene blue favours the anaerobiosis of the lactic ferment since it acts as an acceptor of nascent hydrogen and furnishes indirectly oxygen for anaerobic respiration. The richer the medium is in hydrogen acceptors in the presence of free acid the more will it favour the anaerobic development of lactic ferments. E. R. HISCOX

G. KOESTLER. **Euterbakterien und Milchsekretion.** (Udder bacteria and milk secretion.) *Schweiz. Milchztg.* No. 29, 197, 1930. (*Milchw. Zbl.* **59**, ix, 140, May 15, 1930.)

Udder bacteria can exert by their metabolic products a stimulus in certain parts of the milk gland. The disturbance so caused in milk production gives a secretion whose physico-chemical properties always show the same type of variation from the usual secretion. Such a milk possesses all the characteristics of so-called salty

(rässsalzige) milk. The author concludes that the strength of the reaction, *i.e.* the degree to which the salty characters are expressed, depends upon three factors: (1) the kind of micro-organism, (2) the number of bacteria present in the udder, and (3) the individuality of the milk gland.

M. I. CHRISTIAN

H. BARKWORTH. **Some factors affecting the keeping quality of milk.** *Milk Industry*, 10, xii, 65-9, June 1930.

The paper is a resumé of the results of 3167 keeping-quality tests carried out on morning's milk. Under similar conditions after arrival at the laboratory the keeping quality of a sample of milk is related to the bacterial count rather than the temperature on arrival. Coliform organisms depress the keeping quality of milk. The fat content of milk has little if any influence on its subsequent keeping quality.

A table is set out giving the variations in keeping quality on a basis of total count. The range of variations is approximately a total of 24 hours, 12 hours above or below the average for samples of any particular bacterial count. Two-thirds of the samples fall within these limits of variation.

L. J. MEANWELL

S. B. THOMAS. **A preliminary report on the bacteriological examination of fresh cream and artificial (reconstituted) cream.** *Welsh J. Agric.* 6, 284-9, 1930.

Sixty-two samples of fresh cream and reconstituted cream have been examined. The plate count of the former was found to be about 40 times that of the latter. Aerobic spore-formers were found in the artificial cream. The average keeping quality of the artificial cream was 56 hours, of the fresh cream 38 hours. While the fresh cream developed a "sour" taint, a butyric or putrefactive odour was noticed in the artificial cream. The average reduction time of methylene blue for the fresh cream was 2 hours, for the reconstituted material 8.2 hours. Anaerobic spore-formers were found in half the artificial cream, while 75 per cent. of the milk powders used in their manufacture contained these organisms.

(The importance of this last finding from the point of view of infection of other dairy produce, *e.g.* starter and cheese, must be considered.)

J. G. DAVIS

B. W. HAMMER and V. H. PATIL. **Proteolysis by *Streptococcus lactis*, with special reference to butter cultures and butter.** *Iowa Res. Bull.* 123, March 1930.

The first part of this bulletin is devoted to a review of the literature upon proteolysis by *S. lactis*.

The original work reported was carried out upon about 120 strains of *S. lactis* isolated from milk, sweet and sour cream and from butter cultures by plating on whey agar and fishing colonies. Proteolysis was measured by determination in milk cultures of the soluble and amino nitrogen. In butter protein decomposition was followed by similar determinations upon the filtrate from the non-fatty material of the butter. Incubation was carried out at room temperature (presumably about 23° C.).

A description of the chemical methods employed is given. In one series it was found that appreciable proteolysis in milk occurred in as short a time as 7 days without the addition of CaCO<sub>3</sub>. The more rapid acid producers gave the largest amount of proteolysis. In a further series proteolysis was appreciable in 36 hours. Tests with butter cultures showed them to be actively proteolytic in sterile and in pasteurised milk. Proteolysis was evident shortly after coagulation had taken place.

The organisms associated with *S. lactis* (*S. citrovorus* and *S. paracitrovorus*) in starter appeared to be practically non-proteolytic.

The lactic acid produced in butter cultures was not responsible for proteolysis. Cultures of *S. lactis* fell into two groups one of which coagulated milk quickly and

caused proteolysis, the other being variable in its rate of coagulation and non-proteolytic. Experiments to determine the influence of temperature in proteolysis showed it to be unaffected but coagulation was more rapid at higher temperatures (30° to 37° C.) than at room temperature.

When butter was examined for proteolysis it was found that *S. lactis* had no influence. On storage slight proteolysis took place which could not be referred to *S. lactis*.

A. T. R. MATTICK

K. VAS. **Mykologische Untersuchung der Butter mittels Mikroskop in erwärmten und Oelpräparaten.** (Mycological examination of butter by means of the microscope in heated and oil preparations.) *Kisérl. Közlemények*, **32**, 23, 1929. (*Milchw. Forsch.* **10**, i-ii, Ref. p. 39, May 1930.)

Quick methods for the microscopic examination of butter are suggested. These methods effect transparency of the butter samples either by melting or solution in oil while stains are applied in alcoholic or ethereal solution.

W. L. DAVIES

C. A. MITCHELL and R. C. DUTHIE. **Note on tubercle bacilli of avian origin harboured in the udder of a cow.** *Canad. J. Res.* **2**, vi, 406, June 1930.

Two hundred and ten days after injecting intravenously a previously tubercle-free cow with tubercle bacilli from a tubercular cow, the udder was removed and fragments injected into a guinea-pig and chicken. The chicken was positive to avian and bovine tuberculin 95 days after. The guinea-pig was negative, killed after 45 days. The chicken, killed 106 days after, showed progressive tuberculosis. Material from the chicken was inoculated into a guinea-pig, chicken and rabbit. The chicken died 120 days after and material from it was injected into another chicken, rabbit and guinea-pig. This rabbit was negative 109 days after. The chicken and guinea-pig reacted to avian and bovine tuberculin 52 and 46 days after respectively.

C. MADDOCK

## CHEMISTRY (ORGANIC, INORGANIC AND PHYSICAL)

### DAIRY CHEMISTRY

A. F. LERRIGO. **The routine detection of nitrates in milk.** *Analyst*, **55**, 652, 433-5, July 1930.

A modified technique for the diphenylamine test for nitrates in milk is described which is capable of detecting nitric nitrogen in the proportion of 0.1 part nitric nitrogen per 100,000. Special precautions are necessary to ensure absence of nitrates from the reagents used. In practice the addition of 5 per cent. water to milk can be detected if the water added contains 0.5 part nitric nitrogen per 100,000 and this without concentrating the milk serum.

Of 102 samples which contained less than 8.5 per cent. solids-not-fat, 50 gave a positive reaction for nitrate. Nitrates have also been detected in cream and the test might, it is suggested, afford additional evidence as to the artificial nature of cream.

J. GOLDING

K. VAS. **Die Löslichkeit von Kupfer und Zink in Milch und Molke.** (Solubility of copper and zinc in milk and whey.) *Kisérl. Közlemények*, **26**, 1, 1923. (*Milchw. Forsch.* **10**, i-ii, Ref. p. 17, May 1930.)

The rates of solubility of zinc and copper in fresh and increasingly acid samples of milk and whey have been studied. In fresh milk 0.75-2.25 mg. of zinc per square decimetre are dissolved in 48 hours, 1.25 mg. of copper per square decimetre being the amount of copper dissolved in the same time. Soured milk and whey are

much more active on zinc plates (dissolving 20.75 mg. per dm.<sup>2</sup>). The nature of the surface was found to be important, old and rough surfaces being found to be more easily acted on. Polished surfaces of copper resisted corrosion more than rusted (verdigris) copper surfaces. Thirty times more copper was found to dissolve in both fresh and sour milk and whey by not polishing the metallic surface. The importance of these findings to the dairy industry is stressed.

W. L. DAVIES

**W. LIEBSCHER.** The influence of the addition of a mineral salt mixture to feed on the quantity and some constituents of milk. *Landw. Vers. Sta.* **109**, 347–62, 1929. (*Chem. Abst.* **24**, x, 2509, May 20, 1930.)

The addition of 38 g. of CaO, 16 g. of P<sub>2</sub>O<sub>5</sub> and 4.75 mg. of I (as NaI) in the form of a mineral salt mixture "Ancora (F)" to the control feed gave the following results: The milk yield from 7 cows was not influenced; with one cow there was an influence. Neither in the percentage nor in the weight of the fat or dry matter of the milk were there any changes which could be correlated with certainty with the mineral salt addition. The specific gravity and the fat-free dry matter were somewhat increased. The mineral salt accordingly seems to exert a slight influence in a positive sense on the milk constituents which determine the specific gravity and the fat-free dry matter. No influence on the live weight could be established. The increase of individual ash constituents in the feed was therefore without special effect in the present case, and would, in all probability, have no effect or only a slight influence when green feed or pasture in summer, or good clover and meadow hay in winter, with average milk production, are the basis of nutrition.

**A. DÜRING.** Comparative sucrose determinations in sweetened condensed milk. *Pharm. Zentr.* **71**, 49–51, 1930. (*Brit. Chem. Abst.* B, p. 437, May 16, 1930.)

Comparison of the official method (Röttger, 1926, 1, 5th ed. 407) with the modified method described below showed the latter to be the more rapid, convenient, and accurate. The condensed milk (10 g.) is mixed with 60 c.c. of hot water and treated with a suspension of 1 g. of calcium oxide in a little water. The mixture is shaken, heated on the water bath at 80° C. for 1 hour, cooled, and treated successively with 10 c.c. of dilute sulphuric acid (1:4), 5 c.c. of lead acetate, and 5 c.c. of saturated sodium phosphate solution. After the precipitate has settled, the liquid is filtered by suction through a porcelain funnel covered with cloth and a thin layer of asbestos, and the residue on the filter is washed until free from acid. The filtrate is made up to 200 c.c., treated with 0.5 g. of ignited charcoal powder, and again filtered. The rotation of the solution in a 200 mm. tube at 20° C. (measured in the Laurent polarimeter) multiplied by 15 gives the weight of sucrose in 100 g. of sample.

**C. W. TURNER and A. C. HASKELL.** A statistical study of the size of fat globules in cow's milk. *Missouri Res. Bull.* **130**, November 1929.

Fresh milk was obtained for these studies from the dairy herd of the Missouri Experiment Station. The milk was treated with a glycerin-cochineal solution before mounting on a slide for examination. Micro-photographs with a magnification of 1000 were taken; from these the size of the globules was measured. J. GOLDING

**M. B. MACDONALD, E. C. ANDES and F. A. BRIGGS.** The effect of mineral oil treatment on the composition of milk. *J. Home Econ.* **22**, 213–8, 1930. (*Chem. Abst.* **24**, x, 2508, May 20, 1930.)

Addition of mineral oil to milk to remove the "onion flavour" does not affect its butter-making properties. The butter fat absorbs less than 1 per cent. mineral oil, and less than 0.5 per cent. butter fat is lost. The SbCl<sub>3</sub> test showed no detectable loss of vitamin A.

H. R. WHITEHEAD. **The reduction of methylene blue in milk. The influence of light.** *Biochem. J.* **24**, 579–84, 1930.

Methylene blue added to fresh milk of good quality is reduced in a short time in the presence of sunlight at 37° C. No bleaching occurs in darkness at the same temperature. An enzyme cause is ruled out by the occurrence of bleaching under the same conditions in milk heated at 100° C. for half-an-hour. Fat-free milk does not give the reaction, but sodium oleate added to such milk restores the property to bleach methylene blue, whereas the addition of sodium palmitate does not. It is suggested that sunlight catalyses an oxidation-reduction reaction in which unsaturated fats are oxidised and methylene blue is reduced.

(No reference is made to the previous work of Greenbank and Holm (*Ind. Eng. Chem.* (anal. ed.), **2**, ix, 1930) which embodies the same principle.) W. L. DAVIES

M. B. MACDONALD and A. GLASER. **The removal of bitter flavour from "bitterweed" cream.** *Tennessee Circ.* **26**, 1929. (*Chem. Abst.* **24**, x, 2508, May 20, 1930.)

If cows eat the bitterweed (*Helenium tenuifolium*) or common yellow dog fennel, a bitter taste is imparted to milk. The bitter substance was found in both fresh and cured bitterweed. It is a crystalline, non-volatile, nearly colourless, odourless, and very bitter substance. It is insoluble in fat and mineral oil but soluble in H<sub>2</sub>O, and for this reason is in solution in the milk serum. The bitter substance could only be removed from milk by several washings and separations in a separator; thus cream could be rendered practically free from flavour.

P. SANNYAL. **Recherche de la falsification du beurre par les graisses animales et végétales.** (Adulteration of butter with animal and vegetable fats.) *Mem. Dept. Agric. India*, **10**, 153–5, 1929. (*Le Lait*, **10**, xcv, 562, May 1930.)

One gram of melted butter is dissolved in 3 ml. of dry ethyl acetate at 30° C. 4 ml. of 93 per cent. alcohol are added and the mixture kept at 30° C. for half-an-hour. If foreign fats are absent, no precipitate appears. A precipitate forms with the minimum of 5 per cent. added animal fat or 12 per cent. added vegetable fat. Butter from cows fed on cottonseed cake gives a positive result and the test is therefore modified by dissolving the butter (1 g.) in 4 ml. of ethylacetate. The test is thus rendered less sensitive for the detection of added vegetable fat. W. L. DAVIES

S. B. THOMAS. **Laboratory work in connection with butter competitions.** *Welsh J. Agric.* **6**, 279–84, 1930.

Laboratory work in connection with farm-butter competitions consisted of a keeping-quality test, estimations of bacterial and mould and yeast counts, a bottle incubation test and a colorimetric estimation of hydrogen-ion concentration. In the keeping-quality test, unsalted butter was kept at 60° F., the number of days taken to develop a taint sufficient for it to be condemned for consumption being the index of the keeping quality. The keeping quality varied from 5 to 21 days, the averages for the various competitions varying from 8 to 13 days. W. L. DAVIES

N. KING. **Zur Kenntnis der kontinuierlichen Phase der Butter.** (The continuous phase of butter.) *Milchw. Forsch.* **10**, i-ii, 68–71, May 1930.

Microscopic examination of the structure of butter by the "continuous phase dilution method" revealed the continuous phase in butter to be the butterfat. The method consisted in diluting the "droplet concentration" by a centrifugal method, the form and physical properties of the water droplets and protected fat globules being observed under conditions which virtually amounted to dilution of the continuous phase with pure butterfat. W. L. DAVIES

N. KING. **Kolloidchemie der Butter. Ein Beitrag zur Histologie der technischen Stoffe.** (The colloid chemistry of butter. A contribution to the series "structure of technical materials.") *Koll.-Zeit.* **52**, 319-32, 1930.

The relation between the physical structure of butter and its properties with special reference to chemical and bacteriological changes is described.

The three theories of the structure of butter (*a*) emulsion of water in fat (Fischer), (*b*) fat in water emulsion (Rahn), and (*c*) water droplets and fat globules in fat (King) are discussed. Fat exists in two forms in butter, namely, as fat globules surrounded by a protein coating, and a continuous phase of fat. The significance of the continuous phase as a water-holding medium is referred to. The composition and distribution of the constituents in the aqueous phase are discussed. The functions of the water-fat and the air-fat interfaces during the chemical and bacteriological changes occurring in butter are explained.

W. L. DAVIES

H. RUEBENBAUER. **Analysis of sheep's milk cheese produced in the Tatra mountains.** *Przemysl Chem.* **14**, 169, 1930. (*Brit. Chem. Abst. B*, p. 528, June 13, 1930.)

The fat content of milk of sheep bred in the Tatra mountains varies from 6.86 per cent. in May to 9.12 per cent. in August, whilst the content of solids-not-fat remains constant (10.99-11.33 per cent.). An analysis of cheese made from the milk gives (per cent.): water content 36.81, fat 33.5, ash 4.54 (including 2.47 per cent. NaCl), casein 15.17, albumin 1.32, amino compounds 6.69, diamino compounds 0.72, ammonia 0.08, and lactose 1.17 per cent. The fat has m.p. 28.2°; F.P. 18.9°; critical dissolution temperature (alcohol) 53°; refractivity 44.1°; acidity corresponding with a free oleic acid content of 0.7191 per cent.; saponification value 229.1, soluble and insoluble volatile acid value, respectively, 28.2, 3.8; non-volatile acid content 86.4 per cent.; iodine value 35.2; thiocyanogen value 35.2; octoic acid value 2.4; lauric, stearic and oleic acid contents respectively 6.95, 4.7, 38.2 per cent.; palmitic and myristic acid content 33 per cent.; unsaponifiable residue 1.8 per cent. The fat gave a positive aldehyde reaction and a blue luminescence on exposure to the mercury-vapour lamp. Sheep's cheese thus differs from that of the cow chiefly in its albumin content and in the properties of the fat, which is distinguished by its low refractive index, high ratio of soluble to insoluble volatile fatty acids, and by the high saponification value. The microscopical flora of sheep's cheese consists chiefly of *Oidium lactis*, together with *Penicillium glaucum*, *B. lact. acid.* Leichm., and *B. casei*.

B. PLATON, E. HAGLUND and E. SÖDERBERG. **Influence of the dilution of whey on the consistency and acidity of cheese.** Sweden, *Centr. Exp. Sta. Medd.* **358**, 1929. (*Chem. Abst.* **24**, x, 2509, May 20, 1930.)

Experiments were made on the effect of dilution on the whey for cheese which were salted either directly or in brine. Curdling was brought about by the addition of 0.1 to 1 per cent. pure culture. Controls were also run so that four series in all were compared in which the dilution varied from 10 to 50 per cent. pH and the water content of the cheese were determined after 24 hours, 45 days and 120 days. For the last two periods of time the consistencies were determined, and for the 45-day period the salt content of the water. The cheese made with diluted milk were softer, more pliable and more elastic than those made from undiluted milk and the difference became more noticeable the greater the dilution. The pH values were greater for the diluted milks, and increased with the degree of dilution. The pH is low 24 hours after curdling, but it increases with age. The higher the value of the pH the softer did the cheese become. The optimum of added water is determined by the content of lactic acid bacteria and the manner of salting, and may vary from time to time, but since these factors primarily influence the pH, a determination of the

pH serves as a valuable means of control. A method of determining pH by means of a Hellige comparator was worked out. Bromcresol green gives values identical with those obtained by electrometric measurements. For fresh cheese the pH should be increased by a correction of 0.2 pH and for ripe cheese by 0.1 pH, when methyl red is used as the indicator.

## BIOCHEMISTRY

**I. MATSUO. Milk. IV. The effect of heating on the constituents of milk.** *Osaka J. Med.* **28**, 555–62, 1929. (*Brit. Chem. Abst.* B, p. 528, June 13, 1930.)

Raw and sterilised milk contained respectively: total nitrogen 0.47, 0.449; albumin 0.410, trace; globulin 0.022, 0.014; caseinogen 0.370, 0.398 per cent. Human milk (4–5 days after parturition) contained 1.41–1.66 mg. of ferric oxide per litre, in 13–44 days 1.12–1.57 mg., in 201–218 days 1.05–1.43 mg.; raw and boiled cow's milk contained 2.02 mg. (0.33 mg. only in a glass receiver); goat's milk contained 1.17 mg.

**A. F. COCA. On the dialysability of proteins.** *J. Immunol.* **19**, iv, 405–10, October 1930.

The author claims to have shown that egg pseudoglobulin, ovoalbumin and ovomucoid are dialysable through collodion sacs, parchment diffusion shells and a fish air bladder. Less than 1 per cent. dialyses through the membrane in 5 days; the value of 70 per cent. reported by L. F. Loeb was probably due to errors in technique.

J. G. DAVIS

**M. M. CLAYTON. The comparative value of different food proteins for reproduction and lactation in the rat. II. Milk, eggs, and meat.** *J. Nutrition*, **3**, 23–38, July 1930.

The rations were planned to contain 15–20 per cent. protein and 20 per cent. fat. Milk was fed only in dried form. A destructive effect on vitamin E was noticed on feeding with lard, or with large quantities of cod-liver oil. This was prevented by feeding the oil daily in small quantities. Other difficulties in the investigation included the ruling out of such factors as quality and assimilability of protein and amount and composition of mineral matter. Dried milk was found inferior to egg in vitamin E content but superior to beef, liver, and kidney. The amount of vitamin B present was of more importance for lactation and an alcoholic extract of wheat germ (ether extracted) improved lactation on the milk and meat diets.

W. L. DAVIES

**B. SURE. Dietary requirements for fertility and lactation. XXII. Further Studies of the rôle of milk fat in fertility and lactation.** *J. Nutrition*, **2**, 485–9, May 1930.

The effect on fertility and lactation of the increase of small amounts of butter fat to a ration satisfactory for growth in the rat was studied by estimating the percentage of young weaned in the fifth generation. A minimum of 9 per cent. butterfat added to a ration of two parts whole wheat and one part skim milk powder produced optimum results in both fertility and lactation. One of the limiting factors in all the milk diets studied from the lactation standpoint was vitamin B.

W. L. DAVIES

**G. C. SUPPLEE, O. D. DOW, G. E. FLANIGAN and O. J. KAHLBERG. A comparative study of liquid and dry milk as anaemia-producing diets.** *J. Nutrition*, **2**, 451–69, May 1930.

The production of nutritional anaemia in rats by feeding with raw milk and reconstituted dried milk of normal copper and iron content has been confirmed. Reconstituted dried milk containing increased iron content resulting from contact

with the drying plant prevented the development of anaemia and cured anaemia in rats. Complete recovery from anaemia occurred when the dried milk contained four times as much iron as normal milk, but the recovery was only partial when only twice the amount of iron was present. Supplementing the milk by inorganic addition of iron and copper did not furnish an appreciable degree of protection against anaemia. The results are not conclusive in showing that the copper content of milk is an important factor concerned in the development of anaemia in the rat. W. L. DAVIES

M. E. F. CRAWFORD, J. GOLDING *et al.* **The fat soluble vitamins of milk.** *Biochem. J.* **24**, iii, 682-91, 1930.

The results obtained in these experiments suggest definitely that the entire vitamin A and vitamin D content of milk is associated with the milk-fat. There are no indications that these vitamins are more concentrated in one fraction of the milk fat than in another, nor that there is a significant loss in either vitamin due to separating or churning, and consequently by testing the butter it is possible to obtain the approximate relative potency of milk. These experiments further suggest the utility of the Soames and Leigh-Clare method for the determination of vitamin D.

AUTHORS' SUMMARY

H. STEENBOCK *et al.* **Fat soluble vitamins. XXVIII. The antirachitic value of cow's milk as modified by exposure of the cow to sunlight and to radiation from a quartz mercury vapour lamp.** *J. Biol. Chem.* **87**, 103-26, May 1930.

Daily exposure of cows to sunlight or artificially generated ultra-violet radiations has little if any effect on the antirachitic potency of milk. The results stand in marked contrast to earlier observations with goats. There was no improvement in milk yield or butterfat secretion. The superior quality of summer milk and butterfat therefore depends on factors other than insolation of the cow. W. L. DAVIES

H. STEENBOCK *et al.* **Fat soluble vitamins. XXIX. Is antirachitic activation induced by ultra-violet radiations a panacea for negative calcium balances?** *J. Biol. Chem.* **87**, 127-37, May 1930.

Direct exposure of a goat to radiations from a mercury vapour lamp increased the antirachitic value of its milk. This was in direct contrast to the effect on cow's milk. It was observed that the goat ultimately showed a decided negative calcium balance although a slight improvement in calcium retention was observed when the period of irradiation commenced. A pronounced negative calcium balance was accompanied by restlessness of the animal. It is therefore possible that the excretory elimination of calcium may be controlled neurologically as well as by the antirachitic factor. Antirachitic activation cannot be considered a panacea for a disturbed calcium balance. W. L. DAVIES

H. STEENBOCK, E. B. HART, F. HANNING and G. B. HUMPHREY. **Fat soluble vitamins. XXX. The antirachitic value of cow's milk as modified by the feeding of irradiated yeast.** *J. Biol. Chem.* **88**, 197-214, August 1930.

50 g. of irradiated yeast fed to cows increased the antirachitic potency of milk. 10 g. of such yeast fed daily caused a slight increase in the antirachitic potency of the butterfat, an effect not clearly demonstrable in the milk. The effect of 10 g. was equivalent to that of 180 g. of cod-liver oil. The feeding of irradiated yeast may be considered as a practical measure for the production of milk of standard antirachitic potency. Feeding 200 g. of yeast did not lower milk yield nor fat content. W. L. DAVIES

W. L. DAVIES

- A. D. PRATT. Does the nickel dissolved from the container during pasteurisation catalyse the destruction of the vitamins of milk? *J. Nutrition*, **3**, 141-56, September 1930.

Milk pasteurised in a nickel container was found to have a nickel content of 15 parts per million. By comparing milk pasteurised in glass vessels with that pasteurised in nickel vessels it was found that vitamin A was not appreciably destroyed in either case. Partial destruction of vitamin B and C occurred during pasteurisation, but nickel did not increase the destruction. The results are statistically interpreted.

W. L. DAVIES

- C. BARTHEL. Ripening process of cheese. *Svensk. Kem. Tids.* **42**, 28-39, 1930. (*Chem. Abst.* **24**, xi, 2809, June 10, 1930.)

An address on the chemistry and mycology of cheese ripening, including tables of N partition.

- H. ZELLER, W. WEDEMANN, L. LANGE and E. GILDEMEISTER. So-called low pasteurisation of milk. *Arb. Reichsgesundh. Amt.* **61**, 1-72, 1929. (*Brit. Chem. Abst.* **B**, p. 528, June 13, 1930.)

Chemical and bacterial changes are recorded; the acidity is diminished, albumin and globulin are partly coagulated, the casein is altered, the catalase diminished, and the diastase destroyed.

- A. C. FAY. The normal limits of variation of the methylene blue reduction test. *J. Agric. Res.* **40**, ix, 855-62, May 1, 1930.

From the results of a relatively large number (75-100) of comparative tests carried out on each of 19 samples of milk the author concludes that the normal variations are so small that the possible error in the reduction time for any one sample is not large enough to have any significant influence on the grading of that sample, even though the coefficient of variability becomes greater as the reduction time increases. The simplified methods of making the test (*i.e.* the use of apparatus that has merely been boiled, the use of different types of vessels for the measurement of the milk, the use of tablets for the preparation of the methylene blue solution, slight variations in the measurements of the amount of solution used) have increased its practicability, but have not seriously impaired its value for the grading of milk.

E. R. HISCOX

## PHYSIOLOGY

- C. PORCHER and L. MAYNARD. La graisse du sang et la graisse du lait pendant la lactation. (Blood fat and milk fat during lactation.) *Le Lait*, **10**, xcvi, 601-13, June-July 1930.

In this paper the authors describe the determination of the fat per cent. in blood. They find that the fat per cent. in blood is constant in each case but varies with the individual and that it increases and remains constant during lactation, and is not due to the fat fed. The ratio fatty acid to unsaponifiable fat in blood is approximately a constant, varying from 1.25 and 1.40 to 1. They suggest that the fatty acid per cent. in blood is an index of the milk fat producing qualities of the cow.

Alongside their tabulated results they give the milk and fat yields and per cent. fat, both unsaponifiable and fatty acid.

J. D. GARRARD

W. O. NELSON and J. J. PFIFFNER. **An experimental study of the factors concerned in mammary growth and in milk secretion.** *Proc. Soc. Exp. Biol. Med.* **28**, i, 1-2, October 1930.

The initiation of milk flow is caused by two separate factors (*a*) development of the mammary glands to a proper state, and (*b*) initiation of secretion. The former is brought about by an ovarian factor (*e.g.* lipid extract of corpora lutea) and the latter by the pituitary principle (anterior pituitary lobe extract). W. L. DAVIES

D. RAPPORT. **The interconversion of the major foodstuffs.** *Physiol. Rev.* **10**, iii, 349-473, July 1930.

L. S. PALMER, W. S. CUNNINGHAM and C. H. ECKLES. **Normal variations in the inorganic phosphorus of the blood of dairy cattle.** *J. Dairy Sci.* **13**, iii, 174-95, May 1930.

The inorganic blood phosphate of 25 cows of all ages was determined by Brigg's modification of the Bell-Doisy method. The tests were made in periods of three consecutive days, and although the conditions were presumably identical, very considerable day to day variations in the P of the plasma were observed (up to  $\pm 123$  per cent., the maximum analytical error being  $\pm 10.37$  per cent. and the usual error less than  $\pm 3$  per cent.). Some evidence of hour-to-hour variation was obtained so that the following factors were studied: *Feeding* caused a slight rise (5.7 per cent.) in 6 out of 10 cows, at end of  $\frac{3}{4}$  hour. *Drinking* caused a very slight fall (3.6 per cent.) in every case, at end of  $\frac{1}{2}$  hour. *Exercise* caused a marked rise (6.34 per cent. just after) followed by a still more marked fall (22 per cent.) at end of  $\frac{1}{2}$  hour, and usually a further fall (4.9 per cent.) in next  $\frac{1}{2}$  hour.

The figures given above refer to the mean significant change in blood phosphate over and above the maximum analytical error, expressed as percentage of mean blood phosphate. *Parturition.* There was a fall on the day before parturition (may be as much as 3.2 mg. P per 100 c.c.) which usually persisted for several days. In all cases examined, the calf's blood contained more inorganic P than that of its dam. *Age.* The values were lower in first week, increasing up to 2 months with a gradual tendency to rise up to 6 months. Average from 0 to 185 days old was 7.26 mg. per 100 c.c. There was a slow decline after 6 months to the average value for mature cattle (5.91 mg. per 100 c.c. which was reached at about 18 months). G. L. PESKETT

M. G. BERTRAND and Y. BEAUZEMONT. **Sur les variations de la teneur en zinc des animaux avec l'âge: influence du régime lacté.** (Variations of the zinc content of animals with age: influence of milk diet.) *Ann. Inst. Pasteur*, **45**, ii, 247-50, August 1930.

The zinc content of a mammal is high at birth and falls continuously during suckling; it continues approximately constant during adult life and finally in old age rises, ultimately exceeding that at birth.

Values of 37 mg. per 100 g. dry matter at birth and 11 mg. per 100 g. dry matter for adult rats are given.

Milk is very poor in zinc, hence young animals whose suckling is continued for a long period may suffer from a zinc deficiency. J. G. DAVIS

H. MAI and A. KELLER. **Zur Unterscheidung von Frauenmilch und Kuhmilch.** (Method for distinguishing human from cow's milk.) *Klin. Wchnschr.* **9**, 535-6, 1930. (*Physiol. Abst.* **15**, iv, 234, July 1930.)

The method consists in determining the chloride-lactose quotient. In cow's milk the average chloride concentration is 114 mg. per cent. and lactose 5.13 gm. per cent. The authors' chloride-sugar quotient is  $2.23 \pm 0.05$ . For human milk the figures are: chloride 34.5 mg. per cent., lactose 7.48 g. per cent., quotient  $0.44 \pm 0.015$ . From

these figures it is easy to detect in a mixture of the two milks the relative amounts of each.

L. K. ACHRAP and N. A. POKDOPAEV. **Material zur Frage über die Sekretion der Speicheldrüsen beim Trinken von Milch.** (The secretion of the salivary glands caused by drinking of milk.) *Pflügers Arch.* **224**, 539–44, 1930. (*Physiol. Abst.* **15**, v, 296, August 1930.)

Apart from the salivary secretion of the large salivary glands due to the chemical properties of the food given, there is a salivary secretion which is due to the actual administration of food and is independent of the physical and chemical properties of the food given. The salivary secretion on taking milk is due (a) to the act of taking the milk, and (b) to the necessity of digesting the milk.

G. MASSIA and J. ROUSSET. **La structure du mamelon chez la femme.** (Structure of the nipple in woman.) *Bull. hist. à la physiol. et à la path.* **7**, 118–28, 1930. (*Physiol. Abst.* **15**, iv, 205, July 1930.)

A description is given of the minute structure of all the parts of the nipple. The authors regard the appearance and distribution of a certain type of cell in "dyskeratosis" as of great importance. In old women these cells are found in the epidermis, and in the walls of the sebaceous canals and the galactophore canals; in young women they are very scanty. They are especially numerous in the sebaceous canals, and are found in fairly young women who have been pregnant and lactated; possibly the cells migrate at this time.

## DAIRY HUSBANDRY

J. B. LINDSAY and J. G. ARCHIBALD. **Mineral supplements for dairy cows.** *J. Dairy Sci.* **13**, ii, 102–16, March 1930.

This paper is a final report on 6½ years' investigation of this subject carried out at the Massachusetts Agricultural Experiment Station. During the earlier years tri-calcic phosphate in the form of steamed bone-meal as a source of lime and phosphorus showed little, if any, advantage in supplying these elements in that form. In the last 2 years a mixture of 80 per cent. di-calcic phosphate and 20 per cent. carbonate of lime was added to a ration supposedly deficient in lime, with the following results: With one exception all the cows in a herd of 13 to 16 maintained their general condition well. The mature cows receiving the mineral supplement made somewhat greater gains in live weight than the non-mineral group, but the added minerals had little, if any, effect on the growth of the young cows and heifers. Neither the milk yield nor the composition of the milk was significantly affected. Reproductive troubles were not serious in either group, but the cows receiving the mineral supplement were a little nearer normal, and produced slightly better calves.

The authors emphasise that none of the differences between the groups were sufficiently striking to warrant a general recommendation as to the use of this mineral mixture. For cows with a milk yield averaging 5000 to 8000 lb. annually the need of a mineral supplement is not indicated, but for heavy yielders (10,000 lb. and upwards annually) it is probably good insurance to supply additional lime and phosphorus.

They express the opinion that the problem of mineral deficiency in rations is largely a regional one, and that where the roughage carries a reasonably high percentage of calcium and liberal grain feeding is practised, mineral supplements will not be necessary for the average cow.

J. MACKINTOSH

W. B. ELLET, C. W. HOLDAWAY, J. F. EHEART and L. D. LASTING. **Feeding hevea rubber seed meal for milk production.** *Virginia Agric. Exp. Sta. Tech. Bull.* No. 41, April 1930.

Hevea rubber seed meal is a new high protein concentrate in the United States. It is the by-product from the kernels of the seed of the Para rubber tree (*Hevea brasiliensis*) after the extract of oil. The by-product comes as a cake from the pulp presses, and when ground forms a dry, friable and rather fine meal, having a pleasant odour. Experiments with this meal have been conducted with dairy cows to determine its value for milk production, and the digestibility of its constituents.

The results indicate that Hevea rubber seed meal may be used as a medium protein concentrate in rations for cows. It is palatable, neither laxative nor constipating in its physiological effect on the digestive system and is apparently equal to linseed meal (equivalent to English linseed cake or cake meal) for milk production. Up to 5 lb. per head daily may be given. The analysis and digestibility coefficients (in brackets) were as follows: moisture 9 per cent., crude protein 27.5 per cent. (71), ether extract 9.5 per cent. (92), crude fibre 15.0 per cent. (20), nitrogen free extract 33.5 per cent. (58), ash 5.4 per cent.

J. MACKINTOSH

O. E. REED and C. F. HUFFMAN. **The results of a five year mineral feeding investigation with dairy cattle.** *Michigan State College Agric. Exp. Sta. Tech. Bull.* No. 105, February 1930.

In this experiment the effects of a basal ration low in minerals (especially calcium), of mineral supplements in the form of bone flour, limestone rock (finely ground), raw rock phosphate (finely ground), and a complex mineral mixture and of alfalfa hay in place of timothy hay were studied. Seven lots of five heifers (all Holstein Friesians of similar age and breeding) were used and maintained under this experiment from the age of six months to five years. Data were obtained on the rate of growth, reproduction, health of cows and calves, milk and fat yields and the effect of the various supplements on appetite and on the bones and teeth. Numerous illustrations of the cows at various ages and of their calves are given, and interesting information is supplied on the rate of growth, breeding records, etc.

The results indicate that the general need for mineral supplements for dairy cattle under normal conditions may be greatly exaggerated. Mineral supplements supplying calcium are not greatly needed even when such feeds as timothy hay and other low calcium roughages are used. Raw rock phosphate to the extent of 1.5 per cent. of the grain mixture injured the health and teeth of the animals, perhaps by reason of its fluorine content; also the complex mineral mixture used caused harmful effects and injury to the teeth in the course of time.

J. MACKINTOSH

R. A. ROBERTS. **The utilisation of grassland for milk production.** *J. Brit. Dairy Farmers' Assoc.* 42, 29-40, 1930.

This article gives a description of the dairy pastures of England and indicates to what extent pasture can supply the dairy cow's requirements. It is pointed out that the temperate regions of the earth tend to provide foods—grass, cereal grains and root crops—higher in carbohydrates and poorer in proteins than are considered balanced for the needs of the dairy cow. The author shows how this protein shortage may be to a large extent overcome by management of grazing land, the early cutting of hay and the selection of suitable species of forage plants. The mineral content of pastures is also discussed.

J. MACKINTOSH

J. A. CRICHTON. **Economic calf rearing.** Series V, 2, Government of Palestine Agric. Leaflets.

K. W. D. CAMPBELL. **Milking at three eight-hour intervals as a means of investigating variations in the fat and solids-not-fat.** *J. Agric. Sci.* 20, ii, 213-32, April 1930.

The object of this investigation was to collect evidence on the effect of thrice-daily milking on the yield of individual cows, and on the effect of milking at three eight-hour intervals on the percentage and weight of butterfat. Twelve cows in the herd at the University of Reading farm were milked thrice daily, at the hours of 6 a.m., 2 p.m. and 10 p.m. throughout a complete lactation; at each milking the milk yielded by each cow was weighed, sampled and the percentages of fat and solids-not-fat determined. The cows were all home bred Dairy Shorthorns, which calved between November 29th, 1927 and May 3rd, 1928, and of different ages; namely, 1st calf, 3, 2nd calf, 3, 3rd calf, 2, 4th calf, 2, and 5th calf, 2. The management was on uniform lines throughout the period.

It was found that the nine cows increased in milk yield when milked thrice daily by an average of 19·3 per cent., the individual yields showing a range from a decrease of 21·1 per cent. to an increase of 41·8 per cent. The calculated increase obtained from the three first-calf heifers was 5·6 per cent. These comparisons are made on the milk yields after standardisation by the methods suggested by Sanders. The effects of intervals of varying length between the milkings on the yield and percentage of fat is discussed, and tables are given showing the variation in milk yield and fat percentage from day to day. The author suggests that some factor operates at night tending to lower the rate of fat secretion and that this factor operates whether the night interval be long or short.

(No reference is made in the test to the solids-not-fat content of the milk, nor to the possible influence of the milkers on the yield and fat content of the milk.)

J. MACKINTOSH

H. T. CRANFIELD. **Effect of abnormal weather conditions on the quality of milk.** *J. Min. Agric.* 37, iv, 347-50, July 1930.

During the 12 months ending September 1929 only 16·8 inches of rain fell in South Notts. This resulted in the diminution of growth of grass with consequent depression of milk yields. At the same time bulk milk was frequently low in non-fatty solids, the total number of samples containing less than 8·5 per cent., being 75 or 16 per cent. of the total in July and 49 or 45 per cent. of the total in September. July is most frequently the month in which non-fatty solids fall below 8·5 per cent.

It has been observed by other workers that the effect of drought is to depress yields, raise fat percentages and depress non-fatty solids.

(In 1928 more than 10,000 samples of milk from individual cows were tested by lactometer at Reading for specific gravity and non-fatty solids. The maximum number of samples below 8·5 per cent. occurred in July 1928, being 33 per cent. of the total for that month. The rainfall for 1928 was one inch lower than the average for the preceding ten years.)

K. W. D. CAMPBELL

R. C. GAUT and C. L. WALTON. **The ox warble flies and their control.** *J. Brit. Dairy Farmers' Assoc.* 42, 16-28, 1930.

The authors give a concise description of the life-history of the ox warble flies, and of the methods of treatment formerly recommended, then describe more fully the experiments carried out by the Worcestershire County Council in 1928 and 1929. Various kinds of dressings were applied to the backs of the affected animals and the effects on the animal itself and on the larvae noted. The best results were obtained with a preparation known as Derris-soap wash, consisting of 1 lb. derris powder,  $\frac{1}{4}$  lb. soft soap and 10 lb. water. Applications were made four times during the "warble season," i.e. March to June inclusive. The systematic and thorough use of

this wash will result in killing practically all the warbles and very greatly lessen number of flies. In areas where there is no importation of affected cattle the flies can be exterminated in a few years.

J. MACKINTOSH

## DAIRY INDUSTRY

A. BURR. **The water content of cheese.** *Landw. Jahrb.* **68**, 172-3, 1928. (*Chem. Abst.* **24**, xii, 3063, June 20, 1930.)

The H<sub>2</sub>O content of fresh and cured cheese is given. Seven varieties have been studied.

S. ORLA-JENSEN and E. W. SIVERSTEN. **Om Vandsterilisering.** (Sterilisation of water.) *Maelkeritidende*, **43**, xxxviii, 799-801, September 19, 1930.

Cheap and effective methods of sterilisation of water are of interest to the dairy industry, since bad water is a source of trouble. The author has found that the addition of HCl or NaOH, and subsequent neutralisation is not effective for naturally infected water. If only small quantities are needed in the dairy, heating the water is the easiest method. Chlorination gives good results if it has no influence on the flavour of the butter, etc.

E. R. HISCOX

O. LAXA. **Undersøgelser af Jonas Niensens Sterilisator.** (The Jonas Nielsen steriliser.) *Maelkeritidende*, **43**, xxxvi, 765-9, September 5, 1930.

An account, with diagrams, is given of the recent modifications of the Jonas Nielsen steriliser. The milk is allowed to flow through tubes in cylinders I-IV where it is gradually warmed to a temperature of 70°-80° C. by means of the outflowing milk. In cylinder V it is heated to a temperature of 108°-110° C. or 128°-130° C. by means of steam after which it returns through cylinders IV-I losing heat to the inflowing milk, and is finally cooled to a temperature of 80° C. by means of water and cooling mixtures in cylinders VI-VIII.

Bacteriological investigations of the milk at different stages show that when the milk is heated to 128°-130° C. in cylinder V it is very rapidly sterilised. When it is heated to 108°-110° C. the sterilisation is not complete in this cylinder, but may be assumed to be complete by the time the milk has returned to cylinder III. The pipes in the cooling cylinders VI-VIII must be very carefully cleaned and sterilised, otherwise heavy contamination with *B. coli* and other organisms may occur at this stage. The advantages of this method of sterilisation are discussed.

E. R. HISCOX

C. E. SLAUGHTER. **Disposal of creamery wastes.** *Michigan Eng. Exp. Sta. Bull.* **18**, July 1928.

The author reviews the special features of creamery wastes and the legal position as to their disposal in Michigan. In order to determine the lines on which large-scale experiments should be based, he conducted a series of controlled laboratory tests with a 2 per cent. milk solution embodying the principles of tank storage, septic tanks, contact beds, controlled acidity tanks and chemical precipitation, with further treatment of the effluent in secondary tanks or sand filters.

The most successful processes appear to be either the use of lime in septic tanks or treatment with ferrous sulphate and lime with subsequent precipitation. Definite recommendations, based on laboratory evidence, are given for the disposal of wastes from isolated creameries, together with the estimated cost of operation.

J. HOLMES

E. F. ELDRIDGE. **Studies on the treatment of milk products waste.** *Michigan Eng. Exp. Sta. Bull.* 24, July 1929.

This is a progress report of investigations conducted with an experimental plant at the Michigan State College. The methods of disposal were (1) chemical precipitation, (2) biological filtration of effluent from chemical precipitation, (3) biological treatment of raw waste on sand filter, (4) biological treatment of raw waste on gravel filter. Detailed procedure and analytical results are given in each case. It is suggested that whilst no single system can be universally applied, properly controlled chemical precipitation with ferrous sulphate and lime gives a clarified effluent suitable for secondary treatment on a biological filter.

Results obtained with sand and gravel filtration of the raw waste were encouraging, but further investigations appeared advisable. J. HOLMES

E. F. ELDRIDGE. **The treatment of milk products waste.** *Michigan Eng. Exp. Sta. Bull.* 28, March 1930.

This paper describes a further study of creamery waste disposal by means of biological filtration through sand, gravel, brush and cinder mediums, together with a general review of the subject, and the main features to be considered before deciding on the most efficient method in the case of any particular creamery. Further investigations are in progress dealing mainly with the economical aspects of the subject. J. HOLMES

## REVIEW

A. G. HOUSE. **The Bacteriological Control of Milk. A practical guide for media preparation and milk testing.** Cambridge University Press, 1931. (3s. 10d. post free from the National Institute for Research in Dairying.)

In a foreword Dr R. Stenhouse Williams refers to Mr House's long experience in media-room management and routine bacteriological analysis. The fruits of this long experience are offered in a concise manner, each chapter containing an excellent summary of the methods described. Many labour- and time-saving hints are given, these in themselves making the book a valuable addition to the laboratory shelf.

There are three main sections: (1) The preparation of glassware, (2) The preparation of media, and (3) Methods of milk testing—the official plate-count method being dealt with in full detail.

An excellent appendix contains a complete list of laboratory furnishings and apparatus required to carry out from 10 to 100 routine tests weekly. Attached to the appendix are two very practical ground plans for milk-testing laboratories, both of which can be adapted to existing buildings.

The monograph is eminently suitable as a book of reference for workers who have previously undergone a course of training in bacteriological technique, and is invaluable to anyone who contemplates the installation of a control laboratory.

(In naming this monograph the main title might well have been omitted, as no attempt is made to suggest methods by which any actual control can be practised over milk supplies.) L. J. MEANWELL

## STATISTICS

### NUMBER OF DAIRY AND OTHER CATTLE

THE following table shows comparative figures of the dairy herd, and of other cattle, in the principal countries within the British Empire in which dairying is of major importance. The figures are in each case the latest available, and are generally of a preliminary nature, but it should be noted that the estimates of livestock relate to different dates in the various countries. It should also be noted that classification of cattle into the dairy herd and other cattle is not a matter of uniform practice throughout the Empire, but the figures give a fairly accurate indication of the extent of the dairy herd and of any change in comparison with the preceding census.

| Countries             | Year*   | Cows and<br>heifers in<br>milk or<br>in calf<br>000 head | Other<br>cattle<br>000 head | Total<br>cattle<br>000 head |
|-----------------------|---------|----------------------------------------------------------|-----------------------------|-----------------------------|
| England and Wales...  | 1930    | 2670                                                     | 3176                        | 5,846                       |
|                       | 1929    | 2713                                                     | 3245                        | 5,958                       |
| Scotland ... ..       | 1930    | 452                                                      | 781                         | 1,233                       |
|                       | 1929    | 454                                                      | 779                         | 1,233                       |
| Northern Ireland ...  | 1930    | 256                                                      | 417                         | 673                         |
|                       | 1929    | 264                                                      | 436                         | 700                         |
| Irish Free State ...  | 1930    | 1311                                                     | 2727                        | 4,038                       |
|                       | 1929    | 1307                                                     | 2830                        | 4,137                       |
| Canada ... ..         | 1930    | 3683                                                     | 5254                        | 8,937                       |
|                       | 1929    | 3685                                                     | 5140                        | 8,825                       |
| Australia ... ..      | 1928-29 | 2467                                                     | 8834                        | 11,301                      |
|                       | 1927-28 | 2422                                                     | 9195                        | 11,617                      |
| New Zealand ...       | 1930    | 1424                                                     | 2297                        | 3,721                       |
|                       | 1929    | 1371                                                     | 2075                        | 3,446                       |
| Union of South Africa | 1929    | Not available                                            |                             | 10,518†                     |
|                       | 1928    | Not available                                            |                             | 10,478                      |
| Kenya ... ..          | 1930    | 68                                                       | 159                         | 227‡                        |
|                       | 1929    | 61                                                       | 157                         | 218                         |

\* Estimates relate to June 1 except New Zealand (January 1), South Africa (August 31), Kenya (July 31); for Australian States estimates refer to December 31 except New South Wales (June 30 following).

† Including 6,773,000 cattle on farms owned by Europeans.

‡ Relates solely to European-owned cattle; the estimated total number of native-owned cattle in Kenya in 1930 was 4,966,000.

## TRADE IN DAIRY PRODUCE

The following tables give details of the trade in butter and cheese of the principal countries handling these products during 1930, with comparative figures for 1929. The particulars are based on information published by the International Institute of Agriculture, Rome, brought up to date, where necessary, from official sources.

*Imports and exports of butter*

| Countries                  | Exports         |                 | Imports         |                 |
|----------------------------|-----------------|-----------------|-----------------|-----------------|
|                            | 1930<br>000 lb. | 1929<br>000 lb. | 1930<br>000 lb. | 1929<br>000 lb. |
| <i>Exporting countries</i> |                 |                 |                 |                 |
| Austria ... ..             | 4,112           | 2,211           | 545             | 1,098           |
| Denmark ... ..             | 372,558         | 350,620         | 1,389           | 1,424           |
| Estonia ... ..             | 31,010          | 27,247          | —               | —               |
| Irish Free State...        | 58,815          | 62,836          | 3,391           | 4,621           |
| Finland ... ..             | 37,726          | 36,610          | 7               | 2               |
| France ... ..              | 12,095          | 16,722          | 12,924          | 9,753           |
| Hungary... ..              | 3,430           | 1,191           | 40              | 143             |
| Latvia ... ..              | 40,630          | 32,624          | 49              | 49              |
| Lithuania ... ..           | 16,219          | 9,004           | —               | —               |
| Netherlands ... ..         | 92,394          | 104,325         | 4,396           | 4,469           |
| Poland ... ..              | 26,714          | 33,248          | 29              | 112             |
| Sweden ... ..              | 58,857          | 54,977          | 18              | 24              |
| U.S.S.R.... ..             | 17,229*         | 56,009          | —               | —               |
| Argentina ... ..           | 48,866          | 37,547          | —               | —               |
| India ... ..               | 551             | 522             | 282             | 229             |
| Syria and Lebanon          | 1,916†          | 2,116           | 170†            | 238             |
| Australia ... ..           | 126,411         | 102,919         | 2               | 4               |
| New Zealand ... ..         | 209,771         | 183,639         | —               | —               |
| <i>Importing countries</i> |                 |                 |                 |                 |
| Belgium ... ..             | 2,648           | 2,877           | 22,412          | 9,559           |
| Czecho-Slovakia            | 694             | 717             | 714             | 836             |
| Germany ... ..             | 578             | 337             | 293,560         | 296,230         |
| Greece ... ..              | —               | —               | 1,420           | 1,537           |
| Italy ... ..               | 1,843           | 1,651           | 3,115           | 1,909           |
| Norway ... ..              | 236             | 1,191           | 1,530           | 1,351           |
| Switzerland ... ..         | 42              | 159             | 18,786          | 16,649          |
| United Kingdom             | 21,028          | 14,839          | 764,782         | 717,539         |
| Canada ... ..              | 1,179           | 1,400           | 38,605          | 35,929          |
| U.S. America ... ..        | 2,967           | 3,913           | 2,471           | 2,773           |
| Ceylon ... ..              | —               | —               | 723             | 736             |
| Java and Madura            | —               | —               | 7,557           | 7,712           |
| Japan ... ..               | —               | —               | 611             | 503             |
| Algeria ... ..             | 82              | 64              | 3,232           | 2,207           |
| Egypt ... ..               | 42              | 29              | 2,417           | 1,649           |
| Tunis ... ..               | 13              | 18              | 829             | 717             |

\* Data to September 30.

† Data to November 30.

Imports and exports of cheese

| Countries                  | Exports         |                 | Imports         |                 |
|----------------------------|-----------------|-----------------|-----------------|-----------------|
|                            | 1930<br>000 lb. | 1929<br>000 lb. | 1930<br>000 lb. | 1929<br>000 lb. |
| <i>Exporting countries</i> |                 |                 |                 |                 |
| Czecho-Slovakia            | 8,274           | 7,050           | 2,963           | 3,349           |
| Denmark                    | 12,626          | 14,513          | 809             | 648             |
| Finland                    | 4,683           | 4,837           | 35              | 44              |
| Italy                      | 80,974          | 71,803          | 12,562          | 13,975          |
| Lithuania                  | 1,960           | 1,299           | 11              | 11              |
| Netherlands                | 206,739         | 211,237         | 1,510           | 1,446           |
| Norway                     | 1,380           | 1,347           | 750             | 840             |
| Poland                     | 3,267           | 3,907           | 1,074           | 1,351           |
| Switzerland                | 65,925          | 69,737          | 4,251           | 3,437           |
| Yugo-Slavia                | 4,583           | 4,890           | 300             | 370             |
| Canada                     | 66,955          | 92,945          | 1,779           | 2,103           |
| Australia                  | 7,273           | 5,135           | 150             | 597             |
| New Zealand                | 201,863         | 197,552         | 4               | 7               |
| <i>Importing countries</i> |                 |                 |                 |                 |
| Austria                    | 4,482           | 2,923           | 5,637           | 5,717           |
| Belgium                    | 875             | 899             | 51,106          | 46,456          |
| France                     | 38,921          | 40,609          | 65,524          | 52,173          |
| Germany                    | 5,410           | 4,919           | 137,459         | 146,570         |
| Greece                     | 262             | 355             | 2,302           | 3,314           |
| Hungary                    | 93              | 40              | 386             | 547             |
| Irish Free State           | 194             | 154             | 2,350           | 2,410           |
| Sweden                     | —               | —               | 1,470           | 1,420           |
| United Kingdom             | 8,927           | 9,976           | 348,592         | 335,331         |
| U.S. America               | 2,130           | 3,020           | 68,313          | 76,382          |
| India                      | 7               | 7               | 1,133           | 1,237           |
| Java and Madura            | —               | —               | 1,671           | 1,821           |
| Syria and Lebanon          | 128*            | 196             | 582*            | 703             |
| Algeria                    | 212             | 194             | 10,397          | 8,468           |
| Egypt                      | 60              | 123             | 7,553           | 6,563           |
| Tunis                      | 29              | 13              | 1,746           | 1,695           |

\* Data to November 30.