ABSTRACTS OF COMMUNICATIONS

The Sixty-eighth Meeting of The Nutrition Society was held at the London School of Hygience and Tropical Medicine, London, W.C. 1, on Saturday, 26 May 1951, at 10.30 a.m., when the following papers were read:

The Net Energy Value of Whole Milk as Determined by Respiration Calorimetry.

By K. L. BLAXTER, *Hannah Dairy Research Institute, Kirkhill, Ayr*

A series of 24 hr. balances of carbon and nitrogen were made with an Ayrshire bull calf which received cow's milk as its sole diet. An open-circuit respiration chamber was used to determine respiratory carbon dioxide. Oxygen consumption and respiratory quotient were also determined. Experiments were made when the calf was given both 4 and 8 l. milk each day. It was found that activity of the calf within the confines of its cage was an important variable. The metabolizability of the gross energy of the milk was 95 % and the net availability of the metabolizable energy was 85 %. Net energy values calculated by the application of Rubner's factors for simple-stomached animals to the nutrients digested by the calf agreed with the experimentally determined net energy values. Kellner's factors which were determined with mature cattle, however, grossly underestimated the net energy value of milk in the young calf. The high heat increment of the adult ruminant compared with the low heat increment of the young calf supports the contention that the products of rumen fermentation enter the cycles of intermediary metabolism with a considerable thermodynamic loss.

Gustatory Enzymes.

By A. F. BARADI and G. H. BOURNE, *Department of Histology, London Hospital Medical College, London, E. 1*

A number of enzymes have been shown by histochemical methods to be located in or around the taste buds in the papilla foliata of the rabbit. These include, alkaline and acid phosphatases, a simple esterase, lipase, muscle adenylase, and a nuclease. Alkaline phosphatase (and possibly other enzymes) is also associated with the gustatory organs in bat, monkey and man.

Various substances with pronounced taste (vanillin, quinine, peppermint, etc.) inhibited the activity of some gustatory enzymes and either had no effect on, or accelerated, the activity of others, e.g. vanillin inhibited phosphatase but not esterase or nuclease activity; quinine inhibited the esterase, did not affect the phosphatase, but accelerated the nuclease activity.

It is believed that the chemical mechanism of taste is associated with this process of differential enzyme inhibition or acceleration and that this mechanism is capable of distinguishing between an infinite number of tasting substances. It also explains why

substances of widely differing chemical structure can have a similar taste, since if they inhibit the same enzymes they will be responsible for identical impulses reaching the gustatory centre in the brain.

The same enzymes are present in the nasal mucosa, and it seems that the chemical mechanisms of both tasting and smelling are the same.

Antibiotics and Liver Extract for Suckling Pigs. By R. BRAUDE and K. G. MITCHELL, *National Institute for Research in Dairying, University of Reading*

Twenty-four blocks of six litter-mate pigs were dosed daily for 3 weeks during the 2nd to 5th week of life, with 10 mg. of either penicillin or streptomycin, with and without a liver extract. Control animals received liver extract only or no supplement. Twelve blocks were reared indoors and twelve on pasture. Both the meal mixture fed to the sows and the suckling-pig meal mixture fed in creeps contained fish meal.

At weaning, when 8 weeks old, the weights of the pigs indicated that there was no growth-promoting effect due to supplementations with penicillin or streptomycin. Previous findings (Braude, 1949) that pigs reared indoors benefit from an addition to their diet of a small quantity of liver extract, and that, irrespective of treatment, pigs reared out of doors grew better than those reared indoors have been confirmed.

We are most grateful to Miss P. M. Clarke for carrying out the statistical analysis on the data, and to Glaxo Laboratories Ltd. for the liver extract and the antibiotics.

REFERENCE

Braude, R. (1949). *Brit. J. Nutrit.* **3**, 293.

The Value of Antibiotics for Fattening Pigs. 1. As Supplements to Normal Fattening Rations. By R. BRAUDE, S. K. KON and K. G. MITCHELL, *National Institute for Research in Dairying, University of Reading*

The value of antibiotics and antibiotic residues as supplements to a basal *fattening* ration containing fish meal was tested in an individual feeding experiment involving nine replicates of five treatments, and five replicates of the sixth treatment. The experimental unit consisted of six litter-mates of similar initial weight. The experiment lasted 18 weeks starting when the pigs were 13–14 weeks old. The following six treatments were used: (1) control—basal meal only; (2) basal meal with 2 mg. aureomycin; (3) basal meal with 12 mg. penicillin; (4) basal meal with 62·5 mg. penicillin; (5) basal meal with 1814 mg. aureomycin mash (0·4 %); (6) basal meal with 1814 mg. streptomycin residue plus 12 mg. penicillin. All supplements are expressed per lb. of meal.

There were no significant differences between the treatments as far as rate of growth and efficiency of food utilization were concerned. There was, however, an indication that the pigs receiving aureomycin mash (treatment 5), aureomycin itself (treatment 2) and those on the higher level of penicillin (treatment 4) grew at a slightly greater rate than control pigs.

We are most grateful to Dr T. H. Jukes of Lederle Laboratories Inc. for the gift of the aureomycin preparations, and to Glaxo Laboratories Ltd. for the gift of the penicillin and streptomycin preparations.

The Importance to Sheep of Frequent Feeding. By J. G. GORDON (introduced by D. E. TRIBE), *Rowett Research Institute, Bucksburn, Aberdeenshire*

The Effects of Thyroxine and Deprival of Carotene on the Secretion of Carotene and the Alcoholic Form of Vitamin A in Cow's Milk. By R. CHANDA and E. C. OWEN, *Hannah Dairy Research Institute, Kirkhill, Ayr*

Depriving cows of carotene by replacing a diet containing carotene by a comparable one not containing carotene, did not affect the yield of milk. Nevertheless, the carotene and vitamin A contents of the milk were diminished. On reinstatement of the carotene diet the carotene and vitamin A contents of the milk increased. The rates of these increases were accelerated when the reinstatement was accompanied by thyroxine treatment.

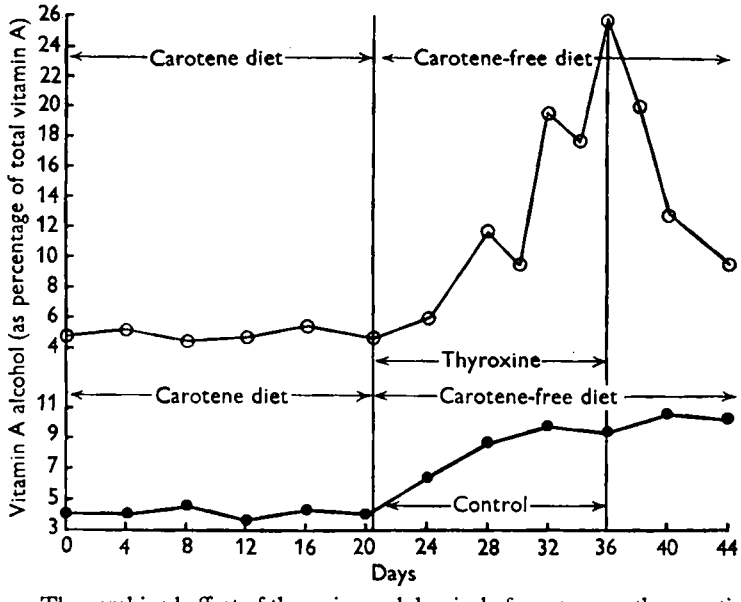

Fig. 1. The combined effect of thyroxine and deprival of carotene on the secretion of vitamin A alcohol in the cow's milk.

On the carotene-free diet the percentage of vitamin A present in the alcoholic form increased. When thyroxine treatment was superimposed on a carotene-free diet the percentage of vitamin A in the alcoholic form showed dramatic increases corresponding to increases of total vitamin A. This effect of thyroxine on the milk of a cow deprived of carotene is shown in Fig. 1.

The Partition of Carotenoids and of Vitamin A in the Milk of Cows and Goats. By R. CHANDA and E. C. OWEN, *Hannah Dairy Research Institute, Kirkhill, Ayr*

When ingesting the same amount of carotene per unit body-weight, goats secreted more vitamin A in their milk than did cows. In the light of earlier observations of Chanda, Clapham, McNaught & Owen (1951*a*, *b*) this superiority of the goat over the cow in respect of yield of vitamin A in the milk per unit body-weight is attributable to the greater activity of the thyroid gland of the goat. Neither carotene nor vitamin A alcohol was measurable in goat's milk though both were present in cow's milk. β-Carotene was, however, found in goat's colostrum. Variable amounts of β-carotene were demonstrated in goat's liver but none could be found in the kidneys. Goat's liver contained amounts of vitamin A comparable with those reported for sheep by Moore & Payne (1942).

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Moore, T. & Payne, J. E. (1942). *Biochem. J.* **36**, 34.

Pathological Changes in the Rat in Deficiency of Essential Fatty Acids. By V. RAMALINGASWAMI and H. M. SINCLAIR, *Laboratory of Human Nutrition, University of Oxford*

During studies of skin changes in essential fatty-acid deficiency in the rat, the changes in several organs and blood were investigated. The deficiency syndrome was characterized by failure of growth, lesions of the skin and muco-cutaneous junctions and increased water consumption. The urinary output was not increased and there was no haematuria. There was also no evidence of fluid retention since the moisture content of various organs and of carcasses of deficient animals did not differ from that of the controls.

Changes in the lips and angles of the mouth, together with the well-known changes in the paws, were the first to appear at about the 6th week of deficiency and were similar to those observed in pyridoxin deficiency (Ramalingaswami & Sinclair, 1950*a*). As in pyridoxin deficiency (Ramalingaswami & Sinclair, 1950*b*) elevation of the erythrocyte count and reduction of mean corpuscular volume were found in essential fatty-acid deficiency but were much less severe. The liver, spleen, pancreas, kidneys, heart, thymus, stomach, small and large intestines, salivary glands, base of the tongue, Harderian glands, eyes and testes showed no definite microscopic abnormalities. In the lungs of the deficient rats, however, collections of large foamy phagocytic cells, resembling 'heart-failure cells', were found in groups of alveoli.

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Ramalingaswami, V. & Sinclair, H. M. (1950*a*). *Brit. J. Nutrit.* **4**, xiii.
Ramalingaswami, V. & Sinclair, H. M. (1950*b*). *Int. Congr. int. Soc. Haematol.* III. Cambridge. Congr. Handb. p. 48.

The Relation of Deficiencies of Vitamin A and of Essential Fatty Acids to Follicular Hyperkeratosis in the Rat. By V. RAMALINGASWAMI and H. M. SINCLAIR, *Laboratory of Human Nutrition, University of Oxford*

In five experiments involving the use of 132 rats, the effects on cutaneous structure (anterior abdominal wall) of deficiencies of vitamin A and of essential fatty acids were studied. The criteria adopted for determining the identity of the experimental lesion with that in phrynoderma were plugging of the orifices of hair follicles with dense compact masses of keratin and acanthosis of the lining epithelium of these orifices, together with acanthosis and surface hyperkeratosis of the epidermis.

In deficiency of essential fatty acids, the changes were closely similar to those in phrynoderma, resulting in plugging of follicular openings with dense compact layers of keratin and acanthosis of their lining epithelium. In deficiency of vitamin A, however, they consisted of dilatation and loose hyperkeratosis of the upper third of hair follicles, with atrophy of their lining epithelium, and were similar to those described by Sullivan & Evans (1943) and Moult (1943). This change could not be modified appreciably either by prolonging the period of deficiency by intermittent vitamin A supplementation, or by inducing partial deficiency states of vitamin A, or by using adolescent rats.

On the basis of this experimental evidence, it is suggested that deficiency of essential fatty acids may be the cause of phrynoderma in man. The clinical literature on phrynoderma, which was reviewed, is not incompatible with this hypothesis.

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Sullivan, M. & Evans, V. J. (1943). *J. Nutrit.* **25**, 319.

The Content of Haemopoietic Factors in some Human Tissues. By R. H. GIRDWOOD, *Department of Medicine, University of Edinburgh*

In a patient with untreated pernicious anaemia who died of a coronary thrombosis, no vitamin B_{12} was detected by microbiological assay using *Lactobacillus leichmannii* as test organism in the liver, kidney, spleen, lung, brain, stomach wall, intestinal wall, or muscle. Growth factors for *Streptococcus faecalis* (presumably chiefly pteroylglutamic acid, folinic acid, or both, or their conjugates) were present in all these tissues, chiefly in the liver and kidney.

Skin-biopsy specimens from three pernicious-anaemia patients in relapse contained growth factors for *Lb. leichmannii*, destroyed by alkaline hydrolysis (presumably vitamin B_{12}) amounting to 2·5 μg./100 g., 2·4 μg./100 g., and negligible quantities respectively. The first two amounts were comparable to what was present in control patients. Growth factors for *Strep. faecalis* were present in amounts comparable to those in the controls.

In a patient who died of primary malnutrition without anaemia, and who in the 24 hr. before death had not eaten foods containing significant amounts of vitamin B_{12}, there was a high bacterial count in the jejunum and ileum after death, with 7·8 μg. vitamin B_{12}/100 ml. of jejunal contents in the jejunum and 6·4 μg./100 ml. in the

ileum. The liver contained 38·8 μg. vitamin B_{12}/100 g., 446 μg. *Leuconostoc citrovorum* factor/100 g. and, in addition, 134 μg. pteroylglutamic acid/100 g. The kidney contained about half these amounts of the various factors. It appears possible that synthesis of vitamin B_{12} by intestinal organisms was important in this patient.

The Effect of Dietary Lactose on the Response of the Rat to Vitamin B_{12}. By W. F. J. CUTHBERTSON and DOREEN M. THORNTON, *Research and Development Division, Glaxo Laboratories Ltd., Greenford, Middlesex*

An attempt has been made to develop a rat-assay method for vitamin B_{12} based on the observation that dietary lactose depresses the growth of rats (Ershoff, 1949) and that this effect may be overcome by vitamin B_{12} (Hartman, Dryden & Cary, 1949). A marked depression of growth was observed in weanling stock rats fed on a soya diet containing 20 % lactose. This effect was completely overcome by 30–40 μg. vitamin B_{12} (orally)/week. Rats from dams on soya-glucose (vitamin B_{12}-deficient) diet grew at still lower rates and 40 μg. vitamin B_{12}/week did not restore growth to normal.

The amounts of vitamin B_{12} required to produce significant growth increments were such as to make impracticable vitamin B_{12} assay based on its growth-promoting effects for these rats.

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Effect of Parental Nutrition on the Growth Response of the Rat to Vitamin B_{12}. By W. F. J. CUTHBERTSON and DOREEN M. THORNTON, *Research and Development Division, Glaxo Laboratories Ltd., Greenford, Middlesex*

Vitamin B_{12} improves the growth of rats on vegetable diets (Emerson, Wurtz & Zanetti, 1949) especially if the animals are from dams on such diets (Emerson *et al.* 1949; Dryden, Hartman & Cary, 1949; Bosshardt, Paul, O'Doherty, Huff & Barnes, 1949). This effect of parental nutrition has been studied during development of an assay procedure for vitamin B_{12} on rats.

Animals were fed on a soya-glucose diet—the 'deficient' diet—from weaning. The response to vitamin B_{12} supplements was studied over the following 28 days. Stock rats grew well on this diet, vitamin B_{12} supplements having only slight beneficial effects. Rats from the first litters of dams given the deficient diet since mating did not grow well, but with supplements of 1–2 μg. B_{12}/week showed normal growth. Animals from the second and third litters grew as well as the first-litter animals on the soya-glucose diet, but higher supplements of vitamin B_{12} were required for maximal growth. Mortality was greater in the second and third litters.

Animals from the first litters of dams on the deficient diet were most suitable for vitamin B_{12} assay.

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