

Notes from a forum on the assessment of nitrogen requirements

Strathspey Hotel, Aviemore (3 October 1979)

The *Chairman*, Professor Greenhalgh, opened the meeting by pointing out that a forum in ancient Rome was a place for all to take part in open discussion, and could be contrasted with that other Roman institution, the circus, in which many spectators watched a small number of gladiators who were often foreigners. He compared circuses to modern international congresses which many of those in the current forum had recently attended. He mentioned that he had come prepared with names of people he would not hesitate to call upon should the discussion flag. In the event there was no necessity for such stimulation.

Dr. Braude opened the discussion, stating his view that the factorial method, although instructive, provided insufficient information for it to be relied upon in practice. He drew attention to individual pig differences in enzyme secretion. *Dr E. L. Miller* supported this view up to a point. He said that addition of factors in arriving at an estimate involved the addition of errors, though some may cancel out. For example, the nitrogen required by the ruminant for maintenance and also that provided in the form of microbial yield were both in his opinion underestimated and therefore the errors cancel. The factors recommended by the Agricultural Research Council will change with time, and the alteration of one will upset the balance. However, he agreed that some form of factorial approach was required initially to give a first estimate. The *Chairman* asked how one could take account of the inter-animal variations mentioned by *Dr Braude* who replied that he found the exercise of seeking protein requirements of "pigs" to be futile, and no longer bothered. *Professor Fleck* interposed that assessment was necessary in medicine. *Dr Topps* said that farmers must have a guide. *Dr Corbett* thought that for the ruminant, protein nutrition had been studied in more depth than had energy requirements and felt more effort was needed in respect of energy. *Dr Ørskov* approved of the principle of factorial estimates but maintained that these must never be rigidly adhered to; he cited his own observations of the interconversion of endogenous urinary- and metabolic faecal-N. Returning to requirements *Dr Suttle* warned against measuring amino acid requirements with techniques involving the use of N-free diets. *Dr Smith* felt it was dangerous to lump together metabolic faecal-N and endogenous urinary-N, because of losses due amongst other things to enzymes and *Professor Lloyd-Davies* suggested that endogenous losses per unit body-weight were affected by the fatness of the animal. Against the use of factors, *Sir Kenneth Blaxter* referred to the misplaced effort which had resulted from the Food and Agriculture Organization protein estimates for man. The FAO had claimed, on the basis of the calculated factors, that protein malnutrition had been eliminated. He felt that there was nothing wrong with calculating average requirements so long as the fact was understood. The

Chairman asked if an imprecise estimate was worse than no estimate. *Dr Braude* considered that by using factors we gave the impression we knew more than we did, but *Dr Buttery's* request for an example of a wildly incorrect result obtained by using factors produced no reply.

The *Chairman* asked for a definition of maintenance in relation to amino acid turnover. *Dr Millward* stated that amino acids are reutilized efficiently and their turnover did not impose a large maintenance charge. *Dr Reeds* felt that 'allowance' and 'requirement' were frequently confused, and said that estimation of amino acid 'requirement' was possible but was expensive. He thought we could debate the physiological basis of maintenance requirement for ever, but pointed out that some similar concept had to be adopted in order to explain results. *Sir Kenneth Blaxter* agreed, and suggested that the greater the flux through the cell wall the greater was the oxidative loss of amino acids. *Dr Millward* disagreed, saying that branched-chain amino acids were oxidized in skeletal muscle where the flux is low, while other amino acids were oxidized in the liver where flux is high. *Dr Mathers* considered that there was a minimum rate of amino acid oxidation. *Dr Reeds* thought that protein intake and energy intake affected amino acid catabolism but in different ways. *Dr Fuller* stressed the importance of the loss of intact protein. He felt that there must be an element of empiricism in the factorial approach, and it is unlikely that we shall be able to quantify and obtain a figure for each amino acid. The amino acid requirement is meaningful only for a particular specified product, and there is a need to go back to the dose-response information. *Dr Braude* remarked upon the importance of the genetic background and referred to quoted figures of, say, 60 g N/d absorption against 120 g N/d. *Dr MacRae* pointed out that many individual observations are combined to give a requirement value. He reiterated that the physiological state of the animal determines its own nutrient utilization. *Dr Smith* said that the figure for microbial-N yield in the ARC recommendations had been obtained by consideration of published values, but another speaker, *Professor Taminga*, thought the figure was too high.

Dr Thomas said that we must remember not to ignore the non-essential amino acids. They, too, must be synthesized in the rumen. *Dr Ørskov* felt we should not regard the ARC figures as final. The situation was dynamic and we must be prepared for changes. *Dr MacRae* questioned the ARC claim that degraded N is converted in the rumen into microbial-N with 100% efficiency. *Dr E. L. Miller* defended the statement but said the efficiency was only apparently 100%. *Dr MacRae* said that calculations based on experiments using ¹⁵N indicated that the efficiency was probably only 60% if N all came from food protein. *Dr Ørskov* said recycling had not been taken into account, and it was probable that insufficient information was available at the present time for a more accurate estimate. *Dr Ulyatt* castigated some participants for nit-picking. The ARC has provided a conceptual framework, he said, but does it provide a better basis for calculation? *Dr MacRae* advocated that with the limitation in finances, research must be based on 'experiments' and not description of static situations. Results are not yet available on the dynamic condition; should we continue to measure degradability

etc. at, say, Rowett and NIRD? Or should we set up a new approach to this type of experiment? The *Chairman* pointed out the difficulty of testing the ARC on a small scale. *Dr Suttle* supported the idea of an ARC coordinated experiment, but *Sir Kenneth Blaxter* pointed out that in fact much validation had already been carried out with independent results from the literature, and the results incorporated in the ARC report. *Dr Robinson* introduced a breath of fresh Irish air by stating that if research should be cut on the grounds of insufficient funds, we should get down to basic principles. Let the farmers do the testing themselves, he said, using their own genotypes. He said that runners rather than commentators were needed.

Dr Fisher pointed out that factorial methods had been useful for the laying hen. If you have good empirical information only simple models are required. He admitted that this approach begs all the questions raised in the earlier part of the discussion. There were many outstanding questions remaining, but he thought that further work is unlikely to affect seriously the way we feed the hen. *Dr Corbett* introduced the question of environmental effects. In hot climates dietary amino acid concentration must be increased to maintain egg production. *Sir Kenneth Blaxter* pointed out that in man endogenous N excretion falls in hot climates. *Dr Fuller* agreed that climate is a factor which should be taken into account in a factorial system, and he felt that there was a case for accepting such a system to provide information for farmers (*pace Dr Robinson!*) *Dr Braude* returned to the pig and questioned whether it was rational to have a single requirement value for any particular class of pig. *Dr Fisher* again put his view that though requirements were irrational it was still rational to aim at a simple model. *Dr Oldham* compared requirement and response relationships, and asked what degree of tolerance was acceptable in practice? *Dr Ørskov* referred to the importance of previous nutrition and genetic background. What is the requirement desired to achieve? In answer *Dr Thomas* said that the farmer must choose the best option.

In conclusion, *Mr Palmer* of ADAS put the farmer's point of view. He thought the research worker should choose an 80% precise model rather than attempting the impossible, but at the same time standards must not be reduced too far. Industry should be encouraged to aim higher and the research worker should not lower standards to meet the existing situation. He concluded that research work must aim high.