This Week's Citation Classic

Hume I D, Moir R J & Somers M. Synthesis of microbial protein in the rumen. I. Influence of the level of nitrogen intake. *Aust. J. Agr. Res.* **21**:283-96, 1970. [Dept. Animal Science and Production, Univ. Western Australia, Perth, Western Australia]

Direct measurement was made of daily production of microbial protein in the rumen of sheep. Protein production in the rumen increased linearly over a range of (low) nitrogen intakes, and the maximum rate of production was sufficient to meet the animal's maintenance requirement for protein. [The *SCI*® indicates that this paper has been cited over 100 times since 1970.]

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"When we began our work at the University of Western Australia on measuring microbial protein production in the ovine rumen there was little quantitative information available on nitrogen metabolism in the rumen. Yet if we were to establish nitrogen and protein requirements for domestic ruminants, we needed to know just how much microbial protein was produced in the rumen each day.

"Our approach to the problem was simple; we would feed sheep on protein-free purified diets supplemented with urea and collect and subsample the digesta flowing out of the rumen. If our collections were quantitative, analysis of the digesta for protein would enable us to calculate the daily flow of (microbial) protein. But it took us almost a year to perfect the surgical and collection procedures. We wanted to collect the digesta from the omasum to avoid the addition of endogenous protein in the abomasum. Initial attempts to introduce a flexible funnel through an abomasal fistula to fit snugly over the orifice from the omasum failed, and I remember this phase of the work as being particularly frustrating. But it is always darkest just before dawn. Dawn in this case was a chance sighting of a paper by Willes and Mendel[1] on a technique for permanently fistulating the omasum, something I had dismissed as being impossible given the internal arrangement of the omasum with its tightly packed laminae.

"However, we tried the technique, and it worked. The other technique essential to our work was the use of inert digesta markers such as polyethylene glycol and ^{51}Cr-EDTA, since even with an omasal fistula we were not able to collect the digesta flowing out of the rumen quantitatively. But at least we could sample the digesta as it left the rumen.

"Now we were in a position to start work. The first experiment, and the one reported in this paper (the first of four papers in the series[2-4]), was important in that it established that microbial protein synthesized in the rumen could satisfy the animal's maintenance requirement for protein, even on a very simple diet.

"Nevertheless, microbial protein yields were far less than would be predicted from the classic work of Bauchop and Elsden[5] on growth yields of anaerobes *in vitro*. This led us to examine the effect on microbial protein production in the rumen of several dietary factors known to influence animal performance.

"Although I think that my report of the stimulatory effect of dietary protein on microbial protein synthesis[3] is probably more important, our cited paper was the first quantitative report on the production of microbial protein in the rumen. This is why it has been so frequently cited in the literature. A more recent review has been published."[6]

1. **Willes R F & Mendel V E.** A permanent omasal fistula for experimental studies in sheep. *Amer. J. Vet. Res.* **25**:1302-3, 1964.
2. **Hume I D.** Synthesis of microbial protein in the rumen. II. A response to higher volatile fatty acids. *Aust. J. Agr. Res.* **21**:297-304, 1970.
3. ----------. Synthesis of microbial protein in the rumen. III. The effect of dietary protein. *Aust. J. Agr. Res.* **21**:305-14, 1970. [The *SCI* indicates that this paper has been cited over 80 times since 1970.]
4. **Hume I D & Bird P R.** Synthesis of microbial protein in the rumen. IV. The influence of the level and form of dietary sulphur. *Aust. J. Agr. Res.* **21**:315-22, 1970.
5. **Bauchop T & Elsden S R.** The growth of micro-organisms in relation to their energy supply. *J. Gen. Microbiol.* **23**:457-69, 1960.
6. **Harrison D G & McAllan A B.** Factors affecting microbial growth yields in the reticulo-rumen. (Ruckebusch Y & Thivend P, eds.) *Digestive physiology and metabolism in ruminants.* Lancaster, England: MTP Press, 1980. p. 205-26.