blood-aqueous barrier, is so fast as to mask the secretory activity.

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[1] Nixon, D. A., *J. Physiol.*, **131**, 11–12P (1955).
[2] Campling, J. D., and Nixon, D. A., *J. Physiol.*, **126**, 71 (1954).
[3] Nixon, D. A., *J. Physiol.*, **132**, 4–5P (1956).
[4] Krause, A. C., and Weekers, R., *Arch. Ophthal.*, **20**, 299 (1938).
[5] Van Heyningen, R., *Biochem. J.*, **65**, 24 (1957).
[6] Flexner, L. B., *Amer. J. Physiol.*, **124**, 131 (1938).
[7] Davson, H., *J. Physiol.*, **129**, 111 (1955).

Influence of Dietary Protein Percentage on Growth of Wool

As with other forms of animal production, it is a common experience that growth of wool is affected by nutrition and the quantitative relation between such growth and intake of food has been studied experimentally[1,2].

Early investigators stressed the high cystine content of wool, and suggested that the nutritive value of pastures for growth of wool depended on their ability to supply this amino-acid[3,4]. Marston[5] elaborated the theory that the rate of growth of wool is determined principally by the dietary supply of essential amino-acids, subject to competing demands on this supply. This view of the mechanism by which nutrition influences the rate of growth of wool has been widely accepted despite some earlier evidence to the contrary[6,7].

Results of recent experiments at this Laboratory indicate that growth of wool is independent of the dietary protein percentage over a wide range for diets fed both at maintenance and *ad libitum* levels of intake. Pelleted diets ranging from 7·5 to 29 per cent crude protein were prepared by varying the proportions of peanut meal and maize in the concentrate and the proportions of lucerne and wheaten chaff in the roughage. An additional diet was used in which the concentrate comprised a mixture of wheat, oats, linseed meal and coconut meal. The diets all contained 50 per cent roughage and 50 per cent concentrate and were approximately equal in net energy content as judged by published starch equivalent values for the constituent feed stuffs.

Growth of wool was measured at 4 weekly intervals by clipping 10 × 10 cm. midside sample areas defined by tattoo lines. The relation between the sample and total growth was determined for each sheep over a 12-week period during the experiment (period 2). It has been found that the ratio of total to midside growth is not affected by the level of feeding[2]. The wool samples were extracted successively with ether and water to remove wool wax and suint and the oven dry weights obtained. The crude protein content (N × 6·25) of the diets was determined by Kjeldahl's method on aliquot samples of feed.

Thirty-six 2-year old medium-wool Merino ewes housed in individual pens were fed 500 gm. daily of one diet prior to being divided at random into 4 groups, and fed *ad libitum* diets of different protein percentage. Intakes of the same diets were reduced again to 500 gm. per day for a further period. Afterwards the sheep were all again fed one diet prior to being divided into four different groups and fed another series of diets. The sequence of experimental treatments and results are shown in Table 1. The intake and growth data for periods 2 and 3 are for the latter 8 weeks of these periods to allow some adjustment to occur to the changes in feed intake at the beginning of these periods. Intakes of 500 gm. per day were sufficient to maintain the sheep in average body condition. No differences in body-weight change were observed between the groups on diets of different protein content at this feed intake. On *ad libitum* intakes only slight differences were observed in the rates of body-weight increase between the different diets. This suggests that diets were in fact approximately isocaloric in net energy.

Table 1. Wool Growth, Feed Intake, Crude Protein (per cent) of Diet and Efficiency of Protein Conversion into Wool

Period	Duration (weeks)	Group	Ration	Feed intake (gm./day)	Crude protein (per cent	Wool growth (gm./day)	Wool growth Efficiency* (per cent)
1	8	I	*F*6	509	16·9	4·90	5·7
		II	*F*6	517	16·9	4·40	5·0
		III	*F*6	507	16·9	4·81	5·6
		IV	*F*6	508	16·9	4·58	5·3
2	12	I	*F*6	1,553	18·6	12·46	4·4
		II	*F*11	1,389	18·5	11·54	4·9
		III	*F*12	1,382	24·0	12·54	3·8
		IV	*F*13	1,389	29·3	12·27	3·2
3	12	I	*F*6	499	18·4	6·38	6·9
		II	*F*11	500	18·3	6·43	7·0
		III	*F*12	500	24·5	6·89	5·7
		IV	*F*13	500	29·5	7·33	5·0
4	8	I	*F*11	500	18·1	5·79	6·4
		II	*F*11	500	18·1	5·53	6·1
		III	*F*11	500	18·1	5·89	6·5
		IV	*F*11	500	18·1	6·03	6·7
5	12	V	*F*16	447	7·5	5·19	15·8
		VI	*F*15	491	11·2	4·65	8·4
		VII	*F*14	500	13·6	4·88	7·7
		VIII	*F*11	495	17·2	4·93	5·7

* Efficiency is expressed as (gm. clean dry wool)/(gm. crude protein intake) × 100.

The effect of increasing the intake of food of the sheep is shown by a comparison of the growth of wool in period 2 with that for the other periods. Comparison between periods also shows the existence of a seasonal trend in growth of wool[2]. The experiment commenced on August 2, 1957, and finished a year later, midsummer occurring in period 2.

Within any period there were no statistically significant differences in growth of wool between the groups fed diets of different protein content. The commonly observed growth response to increasing intake of food cannot therefore be attributed to an increasing dietary supply of amino-acids and must be wholly due to an increased energy supply when diets containing more than 8 per cent crude protein (on a dry matter basis) are fed. It must be expected that with diets of lower protein content a point must be reached when the supply of amino-acids is insufficient for wool synthesis. However it is not known whether this point is reached before protein deficiency interferes with the digestive function of the rumen and thereby with the availability of energy from the diet.

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[1] Marston, H. R., *Aust. J. Sci. Res.*, B, **1**, 362 (1948).
[2] Ferguson, K. A., Carter, H. B., and Hardy, M. H., *Aust. J. Sci. Res.*, B, **2**, 42 (1949).
[3] Marston, H. R., and Brailsford Robertson, T., Coun. Sci. Indust. Res. Aust. Bull. No. 39 (1928).
[4] Marston, H. R., Rep. Fourth Internat. Grassl. Congr., Aberystwyth, 21 (1937).
[5] Marston, H. R., 'Progress in the Physiology of Farm Animals', edit. by Hammond, J., Chapter 11 (Butterworths, London, 1955).
[6] Fraser, A. H. H., and Fraser Roberts, J. A., *J. Agric. Sci.*, **23**, 97 (1933).
[7] Slen, S. B., and Whiting, F., *J. Anim. Sci.*, **11**, 156 (1952).