

although subsequent work from the same institute (Engelhardt and Nickel 1965) did not show this limit; in the latter studies the rate of entry of urea into the alimentary tract was proportional to blood urea concentration.

The nitrogen transferred to the rumen is probably derived both from saliva and by direct passage through the rumen wall. The studies of Somers (1961*b*) indicate that secretion of nitrogen in saliva has an upper limit; this work showed that following a single intracarotid infusion of urea, the secretion of total nitrogen or urea in parotid saliva reached an upper limit when blood urea nitrogen level was approximately 30 mg/100 ml and did not increase with further increase in blood urea concentration. It is possible that a similar limitation to salivary nitrogen secretion existed in the present studies but at a lower blood urea concentration. The existence of an upper limit to urea transfer through the rumen wall was demonstrated by the use of an *in vitro* technique by Gartner (1962, 1963); in the earlier studies maximum transfer of urea was found when the concentration of urea nitrogen in the external solution was 10–20 mg/100 ml while in the latter urea transfer increased with increasing urea nitrogen concentration up to 10 mg/100 ml and then remained constant. In more recent studies with an *in vitro* system, Engelhardt and Nickel (1965) could not demonstrate a limitation to urea transfer through the rumen wall, the transfer being in accordance with concentration gradient over a wide range of urea concentrations. The foregoing discussion indicates the need for further work on mechanisms regulating urea transport into the rumen via both the salivary glands and the rumen wall.

In the present studies, the total amount of nitrogen transferred to the rumen, the sum of transfer on the basal diet and that accruing from the infused urea, cannot be accurately assessed because recycling on the basal diet has not been determined. In previous studies of the digestion of this diet (Hogan and Weston 1967) the quantity of nitrogen leaving the abomasum was 2.8 g/day greater than the quantity of nitrogen provided by 640 g of the diet. This gain is equal to the sum of nitrogen recycled to the rumen, and nitrogen entering the omasum and abomasum. The components of greatest quantitative significance are probably recycling of nitrogen to the rumen and the secretion of nitrogen into the abomasum in gastric juice. The other components are probably small and tend to counterbalance. Thus the quantity of urea entering the omasum and abomasum, except in gastric juice, was probably small as blood urea concentrations were low; similarly, little absorption of nitrogen from the forestomachs would be expected since the concentration of ammonia in digesta was low. Ash and Hogan (unpublished data) found the mean nitrogen content of 24 samples of gastric juice to be 20.8 (S.E. \pm 2.7) mg/100 ml and Masson and Phillipson (1952) calculated the rate of gastric juice secretion to be 5 litres/day. Applying these values to the present experiments, it may be calculated that approximately 1 g nitrogen/day is secreted in gastric juice and hence nitrogen transfer to the rumen on the basal diet was 1.8 g/day. Accordingly, the total transfer of nitrogen to the rumen during urea infusions resulting in blood urea nitrogen levels of 16–18 mg/100 ml or above may be estimated to be 4.3–5.3 g/day. At these blood urea levels the body urea nitrogen pool was in the range of 2.9–3.2 g, hence the total transfer of nitrogen per day was equal to 1.5–1.8 times the urea nitrogen pool.

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