



**Figure 15.27** Protein metabolism in the forestomachs. The amino acid supply stems mainly from two sources, microbial protein and undegraded protein (bypass protein). Small amounts of free amino acids are also transferred from the reticulorumen to the small intestine (not shown).

when they graze on vegetation with low protein content.

#### Protein degradation versus protein bypass.

Amino acids absorbed in the small intestine are derived from two sources:

- feed proteins that have passed undigested through the forestomachs (UDP)
- microbial proteins that have been synthesized in the rumen

Because there is continual transport of forestomach content to the abomasum and the small intestine, some protein, *bypass protein*, necessarily evades bacterial degradation. Generally, proteins dissolved in the rumen fluid, such as cytoplasmic plant proteins, are most easily degraded by bacterial enzymes, whereas less soluble pro-

teins, such as the corn protein zein and heat-treated proteins, are more likely to pass through the rumen without being broken down.

When feed intake increases, the retention time of ingesta in the rumen is reduced and a larger proportion of the proteins pass through the reticulorumen without being degraded. Nevertheless, the supply of protein to the small intestine often limits milk production. Therefore, the feed industry has developed methods by which the extent of degradation of proteins in the reticulorumen is reduced, thus maximizing the nutritional value of commercial feed mixtures.

**Flow of amino acids to the intestine.** The feeding strategies employed today have been designed to enable ruminants to utilize fully the

Amino acids absorbed in the small intestine are derived from bypass proteins and microbial protein

The sum of bypass protein and microbial protein must satisfy a ruminant's amino acid requirements