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Invited Commentary

New products for rumen manipulation

In terms of improving animal productivity and profitability, the use of monensin and related ionophoric antibiotic growth promoters has unarguably been one of the major successes of rumen microbiology in contributing to ruminant nutrition (Russell & Strobel, 1989). Addition of ionophoric antibiotics to ruminant diets has been associated with beneficial changes in the ratio of volatile fatty acid produced in the rumen, reduced susceptibility to digestive upsets, a decrease in the loss of energy from the animal as methane and a reduction in the ruminal degradation of dietary protein, amongst other effects (Russell & Strobel, 1989). However, whilst the production benefits associated with these changes have created a considerable market for the sale of monensin and other ionophoric antibiotics for use in ruminant diets, and the study of these ionophores has greatly enhanced our understanding of rumen microbiology, it is perhaps salutary to remember that monensin was originally identified and developed as a coccidiostat for chickens and only later used in ruminants (Richardson *et al.* 1976).

Legislation has recently been introduced within the European Union to prohibit the use of growth-promoting antibiotics, including monensin and related compounds, in animal feeds (EC, 2003). The scientific basis for these restrictions, based around concerns that the use of antibiotics in animal agriculture can give rise to transmissible resistance factors that may compromise the therapeutic use of antibiotics in humans, may be questionable (Callaway *et al.* 2003; Russell & Houlihan, 2003). Nevertheless, the removal of antibiotic growth promoters in Europe has led to a perceived 'gap' in the animal feeds market and an increased interest in alternative means of manipulating rumen fermentation.

A paper by Selje *et al.* (2007) in this issue reports results from a substantive EU-funded project ('rumen-up'; http://www.rowet.ac.uk/rumen_up) which has systematically screened a large collection of plants and plant extracts to identify potential new rumen-manipulating agents. The use of extracts and oils from plants to control microbial populations both in the gut and in feeds is rooted in human history (Erdogru, 2002). Kamel (2001) suggested that use of plants and plant extracts to manipulate animal production dates back to the ancient Egyptians, Chinese, Indians and Greeks, whilst Leeny (1921) described the use of 'Youatt's Cordial' containing ginger, peppermint and opium to treat digestive upsets in cattle. There is a small, but fascinating, literature from the 1960s investigating the potential of plant essential oils as rumen manipulators (Nagy *et al.* 1964; Nagy & Tengerdy, 1968; Oh *et al.* 1967, 1968) although interest seems to have faded thereafter possibly reflecting the introduction of ionophoric antibiotics on to the market in the 1970s.

What is however new in the study of Selje *et al.* (2007) is the use of a highly targeted reductionist screening programme to investigate the activity of a wide range of materials in order to identify plants or plant extracts that inhibit ruminal protein degradation. Such an approach has much to recommend it; experiments can be precise and well controlled, and the resultant data are clear and unambiguous. However, as the authors acknowledge, plants identified as being able to control rumen proteolysis may also have wider effects on ruminal fermentation and indeed animal performance, and thus subsequent to identifying suitable candidate plants and extracts, additional experiments both *in vitro* and in animal models will be required. There is also the wider question of gaining regulatory approval. European regulations require new additives to be extensively assessed for efficacy, toxicology and environmental safety (EC, 2003), and as such bring considerable financial barriers to new additives entering the market. Given that the market for such additives may well be geographically limited (North America and much of the rest of world still allow the use of monensin and its competing ionophores) and that the target itself defines a maximum price point in terms of the value of the protein supplement fed to the animal that is saved from ruminal degradation and is thus available for intestinal absorption, there are obviously very real commercial as well as scientific challenges to be met in bringing a new additive to market.

In conclusion, recent changes in European regulations have created opportunities to develop new products as rumen manipulators to be used in ruminant diets. However, in addressing this opportunity, ruminant nutritionists will need to overcome regulatory and commercial challenges in addition to addressing the obvious scientific and technical issues.

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