

## Goals for My Program in Rumen Microbiology

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Though hidden from view, the rumen and its microbes hold a central role in feeding of cattle. During fermentation, microbes break down fiber and other feed components and produce VFA. In this process, microbes harvest energy from feed, then harness part of this energy to produce microbial protein. Volatile fatty acids so produced meet up to 70% of the animal's energy needs, and microbial protein meets 60 to 85% or more of protein needs.

Microbes may be essential to cattle, but they charge a fee for their services. Microbial fermentation causes 4% of feed (gross) energy to be lost as heat, and methane production from methanogens causes an additional 2 to 12% loss. My goal is to make microbes spend those fees more efficiently, or at least better predict how wasteful they will be.

At present, microbes are not particularly efficient with the energy they harvest from fermentation; they may use as little as 1/3 for production of microbial protein (cellular growth). My lab tries to understand how the remaining energy is “wasted” on functions other than protein production. If we could re-route even part of this wasted energy, we could increase microbial protein and decrease need for expensive feed protein.

We have found when given large amounts of excess energy, rumen microbes can waste energy by simply burn off the excess energy as heat, in a process known as energy spilling. When given smaller amounts, microbes can store much of the energy, but storage itself requires an irreversible expenditure of energy. We are now trying to identify which microbes store energy by tagging their energy reserves with a fluorescent compound, and in the future, we may be able to identify microbes that spill energy. In the more distant future, we may be able to directly manipulate microbial populations—such as with vaccines—to eliminate the most wasteful microbes.

Even if we cannot reduce waste, we may be able to develop better diet formulation software to predict the magnitude of this waste. Such improved software would enable less protein to be fed safely. As mentioned, rumen microbes flowing from the rumen supply most protein digested by cattle. Diet formulation software predicts the size of that microbial protein supply, but it often does so inaccurately because it does not account for waste explicitly. With data we will generate, we can represent the waste more explicitly and improve predictions of diet formulation software, increasing confidence in predictions. It is my long-term goal to release this improved diet formulation software to dairy producers and allied industry in Florida and around the globe. This will help dairy producers feed better and more cost-effective rations.

## NOTES

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