Gas culprits identified in rumen

Richard Rennie
richard.rennie@globalhq.co.nz

A JOINT effort by New Zealand, Australian, American and Japanese scientists has discovered another way to cut livestock gas emissions.

Researchers have, for the first time, been able to identify the main rumen microbes that produce and consume hydrogen, a vital gas for rumen methanogens that feed on it in the process generating the greenhouse gas methane.

The work by AgResearch and Otago, Illinois, Hokkaido and Monash Universities. The findings have just been published online by the International Society for Microbial Ecology.

The scientists' work contrasts to other recent discoveries around methane inhibitors that focus on reducing the methane microbes produce.

"So this work is not so much focusing on the methanogens. It is more about the organisms that produce the hydrogen that the methanogens love to live on and grow on in the rumen," research head Dr Graeme Attwood of AgResearch said.

The microbes are an important part of the rumen ecosystem with their hydrogen providing fuel for methanogens that form 70% of its methane-forming microbial population.

"From here the trick is to find ways to control the process of hydrogen production.

> *"Low methane emissions animals are something you can select for but we would like to identify pathways that encourage lower levels in the general animal population."*
>
> **Dr Graeme Attwood AgResearch**

"The hydrogen is produced when fibre is digested in the rumen so we will need technologies that do not compromise the animal's ability to digest that fibre," Attwood said.

"Our best scenario is to redirect the hydrogen to organisms that do not make methane as a result of consuming it."

He said the team was fortunate to have access to data generated from trials studying low and high gas emitting sheep.

That world-leading research was also done in NZ and found there was as much as a 38% difference in gas emissions between high and low emitting sheep.

"We were lucky enough to also get some rumen samples from those animals and we did a whole lot of DNA sequencing on them.

"We found the low emitting animals had a whole different set of organisms consuming hydrogen, effectively competing with methanogens for that hydrogen.

"Low methane emitting animals are something you can select for but we would like to identify pathways that encourage lower levels in the general animal population.

"We are looking at molecules that will reduce the hydrogen levels without compromising fibre consumption."

While much of the industry would love to see an easy, one-shot fix to methane, Attwood cautions it is a difficult path to develop one.

"You can see quite rapid changes when you introduce inhibitors to the rumen but the trick is to make sure you get inhibitors quite specific to the target bacteria and that their effects last long enough to be useful.

GASSED: Identifying gas-producing microbes might help cut emissions off at the pass, scientist Dr Graeme Attwood says.

"There is also the opportunity for resistance to develop in microbes, just as it does with antibiotics.

"So we require a suite of molecules on hand to choose from and possibly rotate over time to reduce the likelihood of that happening."

The ideal outcome would be if an animal could be vaccinated and produce the required response itself.

But that is tough given the range of microbes, compared to the usual one target-one needle approach for vaccinations in humans, for example.

With the microbes identified now the researchers are sifting through compound libraries, seeking out those compounds that deliver the greatest gas-reducing response from the microbes.

Massive Dutch chemical company DSM has claimed its methane inhibitor 3-NOP is due for commercial release this year on ration-fed livestock.

Attwood said he and his colleagues do not see it making their work redundant.

"Far from it. It is quite complementary to our work, given we are looking at the supply of hydrogen while it focuses on the methanogens directly. The two can work together."

The work was funded by the Government in support of the activities of the Global Research Alliance on Agricultural Greenhouse Gases, a NZ initiated alliance of 57 countries working together to reduce greenhouse gas emissions from agriculture.