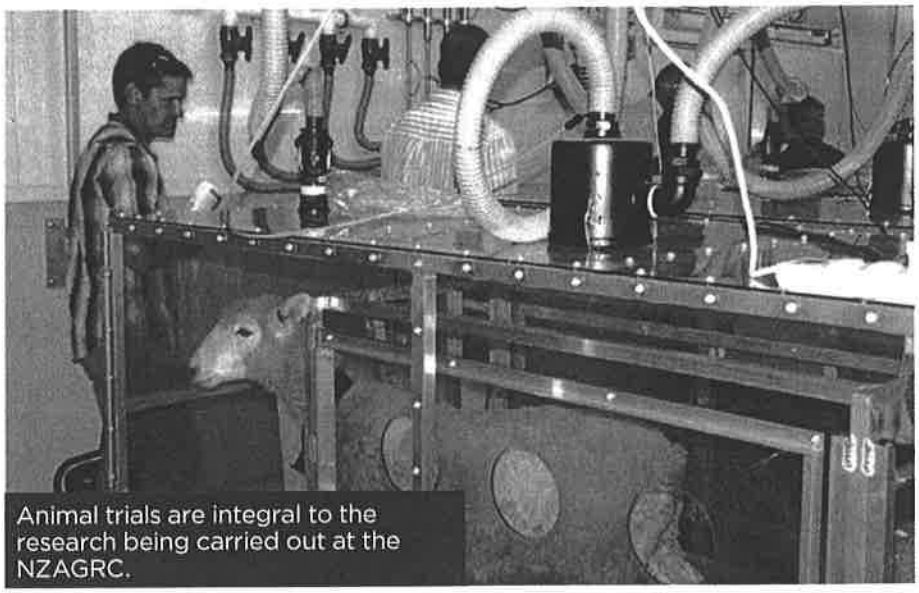
Tiny organism a big challenge to methane researchers

Much effort and intellectual grunt is going into solving the livestock methane emissions problem. **Peter Burke** reports on this science challenge facing New Zealand.



Animal trials are integral to the research being carried out at the NZAGRC.

A TINY MICRO-ORGANISM one thousandth of a millimetre long is proving a huge challenge for scientists in New Zealand and overseas.

It's called a methanogen and it produces methane in the rumen of farm animals which they emit when they belch. That methane in the atmosphere contributes to the global warming now causing massive problems.

The agricultural sector accounts for 46% of New Zealand's emissions, a serious challenge given our large ruminant population.

New Zealand scientists hope within five years to develop on-farm technologies to help reduce methane gas emissions from cattle , sheep and deer.

The Pastoral Greenhouse Gas Research Consortium (PGgRc) and the New Zealand Agricultural Greenhouse Gas Research Centre (NZAGRC) are working together to solve this problem, by funding research to develop ways of reducing methane production.

One scientist working on methanogens is Dr Peter Janssen at AgResearch, Palmerston North.

Janssen says the rumen of animals is where feed is held and fermented by a complex community of different micro-organisms including methanogens. These live on the hydrogen gas that is a by-product of the rumination process; the methane they produce is no use to the animal so is expelled during belching.

"These methane producing micro-organisms are evolutionarily distinct from the other parts of this complex system including the ruminant animal. They are biologically different – promising if you are trying to develop a strategy to eliminate those without harming any other part."

Trouble is it's difficult to develop a vaccine or any sort of inhibitor, Janssen says.

The science challenge is underpinned by continuous investment by the PGgRc and NZAGRC, funded by the government and the primary sector.

Janssen says it takes a long time to build up knowledge and expertise in this area – a clear understanding of methanogens, in part by growing them in a laboratory.

Various scientific strategies are being worked on and trialled. These including breeding animals that produce less methane and studying different feed types for their effects on the amount of methane an animal produces.

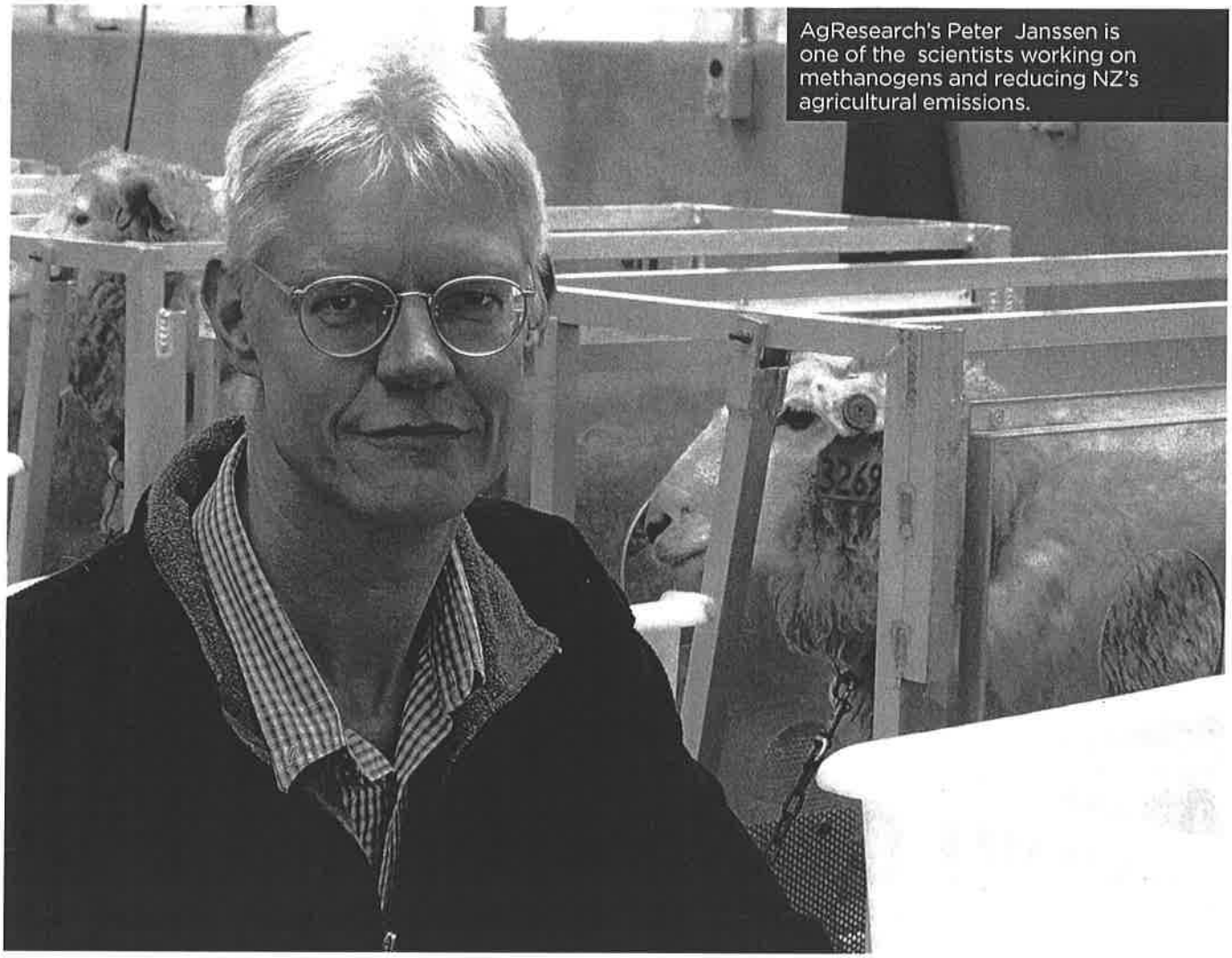
Our scientists have bred animals that produce less methane. Various brassicas are found to reduce methane emissions, to a limited degree. Scientists are working on a vaccine and an 'inhibitor' but a solution is still five years away.

Janssen says New Zealand researchers' contribution is significant and the quality of their work world class.

"Similar research is being done in Australia, Canada, to some extent in the US and some EU countries [but there is no] comprehensive programme. We have a programme of hedging our bets with low impact, low risk and high impact, high risk strategies.

"No one else has programmes applicable to our agricultural systems so we have to look after our own and make sure we develop things that work in our farming systems."

There is no guarantee a solution developed overseas would work in New Zealand given the unique nature of our farming systems.



AgResearch's Peter Janssen is one of the scientists working on methanogens and reducing NZ's agricultural emissions.

Breathe in, now breathe out...

ANIMAL TRIALS ARE integral to the research being done by the NZAGRC and the PGgRc.

At the research facility, based at Palmerston North, experiments on sheep and cattle measure the effects of mitigation strategies, Dr Peter Janssen says.

Before the animals undergo the methane tests they get time to acclimatise to the environment. Sheep selected for tests are fed for two to three weeks prior on the diet they will have during the two-day trial.

"The aim is get the rumen adapted to the food otherwise huge errors, or variance can occur. So they might be on cut pasture or lucerne pellets or a brassica; it depends on the type of experiment.

"We often use a lucerne pellet diet because you can produce a large amount of it and it's consistent from day to day and from experiment to experiment; whereas pasture changes a lot. You have to be careful it wasn't the change in pasture quality that's causing a slight difference in the methane emissions."

This helps ensure validity of data over a longer period, given that variations in feed quality are effectively taken care of.

After two to three weeks of the new diet, the animals are taken to the research facility, put in metabolism crates and tethered and fed for about three days acclimatise to their new environment. No welfare issues arise and they soon settle.

Once acclimatised to the laboratory environment they are moved to the next room and the methane chambers – respiratory chambers where for two days air is pumped in and everything coming out is measured every six minutes including the methane.

"We can give them a defined amount of feed and measure how much of that they can eat.... Later we measure how much methane they produce, so we know how much they ate and how much methane they produce.

"Then we can calculate 'methane yield', basing our measurements of methane on the amount of methane per unit of feed eaten." From this they can calculate whether some feeds produce more or less methane.

Vaccination trials can determine any impact on methane production or the animals can be dosed with an inhibitor to test its impact on methane production. The researchers can also identify animals which are low methane producers.

In a nearby computer room all data is collected and stored.