Summary of experiments involving the creation of fistulas (cannula) in experimental animals in New Zealand

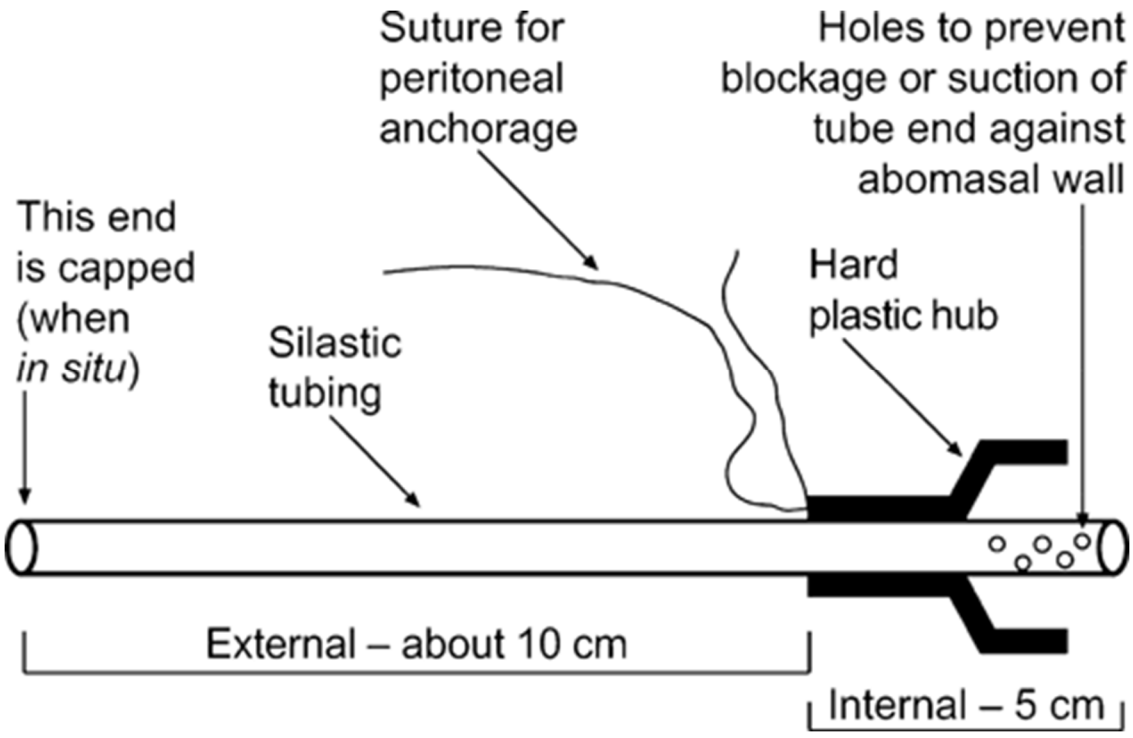
Contents

What is a fistula, and how does introducing a fistula cause suffering?

For decades, New Zealand scientists have artificially created fistulas (also known as cannulas) in ruminant animals such as cows and sheep. Fistulas are tubes that are created surgically to connect a cow or sheep's stomach to her skin. The outside of the fistula is covered with a plastic cap that can be opened by scientists to remove stomach contents for analysis, or introduce foreign substances such as tracer gases or chemicals such as urea.

An Australian paper published in 2015 includes a detailed description of the process of creating fistula in sheep. Scientists make the fistula by clamping a fold of the rumen with a metal clamp. One sheep suffered rumen perforation, and when another sheep was operated on, the metal clamp slipped the day after surgery. Just over half the sheep had a mild fever over 4 weeks after the initial operation.[1]

During a similar experiment at Ruakura, Hamilton, 12 sheep were deprived of food and water overnight prior to being operated on. A fistula was created surgically (Fig. 1) inside the main body of each sheep's fourth stomach, a process that involved inserting a hard plastic hub. The internal end of the fistula was sutured to the stomach wall. The external end of the fistula was capped. [2]



In an experiment published in 2017, a fistulated cow died in the Waikato, for reasons that are unclear. [3]

After fistulation, animals are used in experiments which cause further suffering. In the case of experiments exploring greenhouse gas emissions, cows and sheep are often confined in 'metabolism chambers' and/or 'respiration chambers'. The latter are small plastic chambers which measure the gases produced by the animal. [4]

A New Zealand manual published by the Ministry of Agriculture and Forestry in 2014 includes detailed descriptions of the respiration chambers used to confine fistulated cows and sheep.

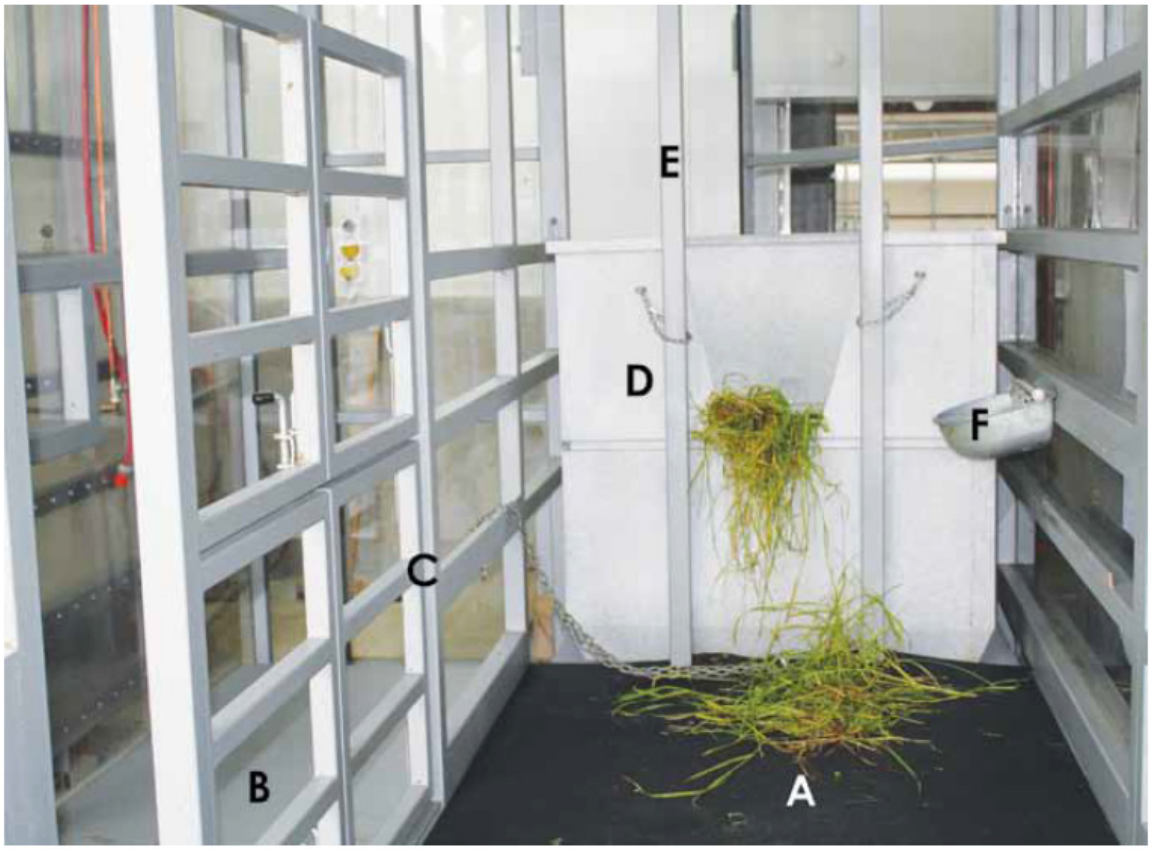
At the AgResearch cattle respiration facility, cows are confined in four chambers, constructed from steel tube, and covered in clear 6 mm thick polycarbonate. Each chamber is 4.0 m long, 2.0 m wide and 2.2 m high. A head bail prevents the cows from turning around.

The following illustration shows fistulated Danish cows. The techniques used are similar to those in New Zealand. [5]

Plate 1: Sketch of the building containing the respiration chambers. The building is connected with the other cattle facilities with a central lane. The cattle facilities include barns for both loose and tied up cattle as well as barns for milking and feed mixing. The respiration chambers are placed in room K33-1 together with fistulated dairy cows. Sensors are placed in laboratory 1.

An image of the interior of a cow respiration chamber at the Grasslands Research Centre, Tennent Drive, Palmerston North.[6]

Plate 15: Internal view of the chamber showing the cattle area covered in a rubber mat **(A)**, the operator area **(B)**, the protection frame **(C)**, feed bin **(D)**, the bars to avoid cattle passing throughout the front door (E) and the water trough **(F)**.



Here are images of the sheep respiration chamber at the New Zealand Ruminant Methane Measurement Centre (NZRMMC), Palmerston North, Massey University. [7] [8]

Plate 1: The sheep respiration facility comprises 24 chambers housed in a dedicated building.

Plate 4: A modified metabolic crate used to hold the sheep in the respiration chamber.

This illustration shows sheep in respiration chambers at AgResearch Grasslands Research Centre, Tennent Drive, Palmerston North. [9]

Plate 7: The sheep are maintained in the metabolism area in sets of 24 animals, ready to be wheeled into the respiration chambers every second day.

What kinds of animals are fistulated in New Zealand?

- dairy cows (including the Holstein Friesian breed and a Friesian-Jersey cross)[10] [11] [12] [13] [14] [15] [16]
- sheep (various breeds including Romney) [17] [18] [19] [20]
- red deer[21]

AgResearch has also partnered with Yangzhou University in China to carry out experiments involving fistulated goats.[22]

How many animals are fistulated?

The numbers of fistulated animals experimented on varies, but are usually fairly small. The smallest experiments I found were based around 4-5 fistulated cows.[23] [24] Larger experiments involved 16 fistulated cows.[25] The AgResearch cattle respiration facility appears to have just four individual chambers, so a maximum of 4 cows can be experimented on at a time in respiration experiments.

Where are the animals who are fistulated?

The experimental animals appear to mostly be located in:

- the Waikato (cows) [26]

- Scott Farm, Dairy NZ, Vaile Road, Hamilton, New Zealand (cows) [27] [28]
- AgResearch, Grasslands Research Centre, Palmerston North [29] [30]
- Lye Farm, Dairy NZ, Hamilton (cows) [31] [32] [33]
- Agri-Quality Animal Health Laboratory, Ruakura, Hamilton, New Zealand[34]
- Ballantrae Research Farm, AgResearch, Palmerston North (cows)[35]

Which companies/researchers carry out the fistulation experiments?

Companies and institutions involved in fistulation research include:

- AgResearch Limited, Grasslands Research Centre, Palmerston North, New Zealand[36] [37] [38] [39] [40] [41] [42]
- New Zealand Agricultural Greenhouse Gas Research Centre, Tennent Drive, Palmerston North[43]
- Institute of Fundamental Sciences, Massey University, Palmerston North, New Zealand[44]
- Institute of Veterinary, Animal, and Biomedical Sciences, Massey University, Palmerston North, New Zealand [45] [46] [47]
- School of Science, University of Waikato, Hamilton, New Zealand, [48]
- DairyNZ, Newstead, Hamilton, New Zealand[49] [50] [51] [52] [53]
- AgResearch Ruakura, Hamilton, New Zealand [54] [55]

Some of the individual scientists who carry out fistulation research include:

Garry Waghorn (DairyNZ)

Kirsty J. Hammond (AgResearch)

Gemma Henderson (AgResearch)

Funders of fistulation research

New Zealand Ministry of Business, Innovation and Employment New Economy Research Fund (contract C10X0803) [56]

Pastoral Greenhouse Gas Research Consortium.[57] [58]

New Zealand Ministry of Business, Innovation, and Employment. [59]

AgResearch Research and Capability Fund[60]

DairyNZ[61] [62]

Foundation for Research, Science and Technology[63]

National Institute of Water and Atmospheric Research manufactures the tubes used to pump tracer gases into the stomachs of fistulated cows. [64]

Why are animals fistulated?

1. To investigate how productivity can be increased (i.e., how an animal's feed can be converted more efficiently into meat or milk).

   An experiment published in 2014, and another one in 2017 tried to identify strains of stomach bacteria that would break down the fibre in cow feed more efficiently - so that dairy cows would produce more milk from the same amount of feed. [65] [66]
   An experiment published in 2013 explored the DNA of microbes taken from cow stomachs.[67] Another experiment published in 2013 explored the impact of fungus-infected feed on cows in relation to milk production. [68] A 2017 experiment explored how different mixtures of pasture grasses affected milk production. [69] Similarly, a 2016 Master's thesis explored how the protein levels in the cows' diet influenced milk yield. [70]

2. To explore how greenhouse gases can be reduced (in practice this is similar to (1)). Scientists try to manipulate the stomach microbes of cows and sheep so that they produce more milk or meat without an increase in methane or CO2 emissions. This involves confining animals in small respiration chambers for up to 2 days at a time.

   In a joint AgResearch/Massey University/DairyNZ experiment in 2014, 8 fistulated sheep were confined in pens indoors for 7 days, following which they were confined to individual metabolism crates for 7 days. The sheep were then moved to individual respiration chambers for two days. [71]

   In a 2016 AgResearch experiment, 9 fistulated cows were confined in respiration chambers for 2 days at a time to measure their methane emissions. There was an overall 13-day measurement period. The respiration chambers were 2.0 m wide, 2.2 m high and 4.0 m long. Each 13-day measurement period was preceded by a 7 day 'adaptation' period. The 'adaptation' period was obviously stressful as after 3 days in covered yards the researchers transferred the cows for a further four days to individual pens to avoid "disturbing behavioural interactions between the heifers and cows." At the end of this period, tubes were inserted into the cows' rumens and a tracer gas (sulphur hexafluoride) was pumped in. The cows were also fitted with PVC head yokes that fitted closely to their noses to collect the air they breathed out.[72]

3. To improve water quality – specifically to investigate how the diet of cows influences the amount of nitrogen in their urine, which in turn impacts on water quality.

   A 2016 Master's thesis investigated the effect of dietary protein on both the milk yield and urine composition of fistulated cows. The cows were confined in small metabolism chambers for 9 days[73], and urea was pumped into their stomachs through the fistula 6 times a day (up to 690 g urea per day).[74] Stomach contents

were removed daily through the rumen for analysis. Urea is toxic, and the cows showed signs of lethargy. [75]

4. To modify the gut microorganisms of the animal to reduce the risk of food poisoning when humans eat animal flesh that may have become contaminated with gut bacteria during the slaughter process. [76]

5. Exploring the condition of bloat in cows

   In an undated experiment, Massey scientist Garry Waghorn described inflating a cow with CO2 through the fistula. Waghorn reported that 'We needed 70 L to 'bloat' a small cow; those that had never bloated kicked up a fuss, but 'bloaty' cows just chilled out. One was going 'click, click, click'; I asked Dave Shelton, "what's that noise Dave?" "She can't breathe" – i.e., death imminent! We unplugged the hose pretty quick!'[77] *As far as I can tell, these are historical experiments, and are no longer performed.*

Arguments against research involving fistulated cows

1. Many of the experiments carried out were inconclusive, or the results obtained were not useful. For example, an experiment comparing the greenhouse gas emissions of heifers and mature cows concluded that there were no significant differences. [78] Another experiment found that methane measurements of fistulated cows using the 'GreenFeed' technique were inaccurate, as up to 40% of the methane escaped via the fistula.[79] Similarly, an experiment on fistulated sheep did not find any links between the kind of feed given to the sheep and greenhouse gas emissions.[80]

2. There are alternatives to fistulation such as buccal swabs.[81]

3. There is no need for humans to consume meat or dairy, and avoiding animal products is a much simpler and more effective way to reduce greenhouse gas emissions and improve water quality than carrying out complicated and expensive experiments that cause animal suffering.

4. In the case of respiration chamber experiments, experimental results are influenced by the fact that animals are of different sizes, behave differently, and poo and pee at different times. Consequently 'environmental conditions inside the chambers are not only different between chambers, but conditions change within a day.' [82]

5. Experiments to try and make cows produce more milk and meat are unlikely to benefit farm workers, the environment or the community in general – they are designed to increase the profits of companies such as Fonterra, research institutions,

and industry organisations such as Dairy NZ. Animal experimentation, agriculture and capitalism are deeply interconnected.

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