The In-Vitro Gas Laboratory. Rumen and Cecum Carbohydrate Digestibility and Fractionation

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The *In-Vitro* Gas Laboratory –
Rumen and Cecum Carbohydrate Digestibility and Fractionation

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What?
The purpose of the laboratory is to provide facilities for research on carbohydrate fractionation, rumen or cecum digestibility and methane production.

Why?
- **Feed costs contribute 50-70% of variable costs of equine and bovine production**
  - **Feed digestibility = Money**
- **Rumen acidosis/laminitis associated with feed digestibility / fiber content of diets**
- **The use of feed additives to manipulate digestibility in horses or cattle has become more common, but documented effects are scarce**
- **The use of feed additives to decrease methane production in cattle is not well documented**
- **Mitigating methane (CH_4) production from ruminants is desired**
  - **Because CH_4 is an approx. 25 times more destructive greenhouse gas than carbon dioxide (CO_2)**
  - **Because CH_4 production represents an energy loss**
- **Animal production, fiber digestion and CH_4 emissions should be considered together**

How?
- **Carbohydrate fractionation by sequential determination of neutral detergent fiber (NDF), acid detergent fiber (ADF) and acid detergent lignin (ADL)**
- **Digestibility:**
  - **of dry matter or organic matter using a batch digestibility system**
  - **of dry matter or organic matter using the wireless in-vitro gas technique system**
- **Gas production kinetics minute by minute for 24, 36, 48 or 72 hours**
- **Methane quantification by gas chromatography**

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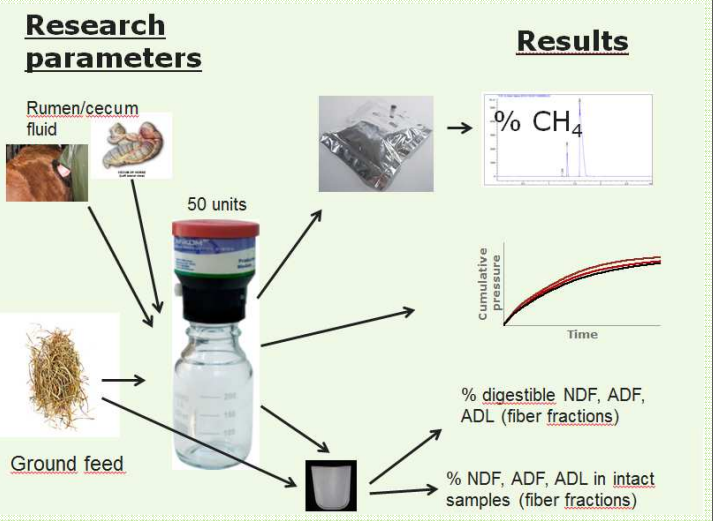
How?
A schematic view of the processes:



Outputs:
- **NDF, ADF and/or ADL contents of feed/rations**
- **ml total gas**
- **ml CH_4**
- **Dry matter digestibility**
- **Organic matter digestibility**
- **Fiber fractions digestibility**
- **ml CH_4/g DM**
- **ml CH_4/g dDM**
- **ml CH_4/g NDF**
- **ml CH_4/g dNDF**
- **Fermentation kinetics variables (rate of degradation, maximum rate, ”half-time” of degradation)**

Outcomes:

- Ansah T, Osafo E L K and Hansen H H 2013: Variety, harvest date after planting and plant fraction of Napier grass influence *in vitro* gas production. *Livestock Research for Rural Development. Volume 25, Article #78.* www.lrrd.org/lrrd25/5/ansa25078.htm
- Cornou, C., Storm, I. M. L. D., Hindrichsen, I. K., Worgan, H., Bakewell, E., Ruiz, D. R. Y., Abecia, L., Tagliapietra, F., Cattani, M., Ritz, C. & Hansen, H. H. A ring test of a wireless in vitro gas production system 2013: *Animal Production Science* 53(6):585-592
- Hansen HH, Storm, IMLD, Sell AM, 2013: Effect of biochar on in vitro rumen methane production. *Acta Agriculturae Scand Section A* 62(4)305-309
- Tagliapietra F, Cattani M, Hansen HH, Bittante G, Schiavon S 2013: High doses of vitamin E and vitamin C influence *in vitro* rumen microbial activity. *Animal Feed Science and Technology*
- Tagliapietra F, Cattani M, Hindrichsen IK , Hansen HH , Colombini S, Bailoni L et al. 2012: True dry matter digestibility of feeds evaluated *in situ* with different bags and *in vitro* using rumen fluid collected from intact donor cows. *Animal Production Science 52(5):338-346*.

•MSc project about Icelandic vs DV horses (feces)
•MSc student about Icelandic vs DV horses (cecum fluid)
•Visiting scientist from France, NorFeed cattle feed additives
•Internship student from France, about carbohydrate source and buffer pH
•Veterinary final project from Italy about carbohydrate source and buffer pH
•PhD student from Italy about carbohydrate source and rumen methane
•MSc project on extreme diets in sheep
•MSc project on biochar additives for methane reduction

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