Investigating potential interactions between methane emission and rumen microbial profiles in Danish Holsteins

J. Lassen[*], B. St-Pierre[†], R. Smith[†], A. D. G. Wright[†] & P. Løvendahl[*]

[*] Department of Molecular Biology and Genetics, Aarhus University, Denmark
[†] Department of Animal Sciences, University of Vermont, USA

Methane – two stories

› Green house gas emission

› Indicator of feed efficiency

The host controls some of the variation

› Changing rumen content between two cows (Weiner et al 2010: JDS)

› Rumen pH reestablished over 24 hour period

› Bacterial community reestablish somewhat slower but gets close to original community within 60 days

› Animal control and variation – genetics?

Quantitative genetics

› Precise measurements in large numbers (+10000)

› Respiration chambers and fistulated cows is hardly the solution

› A number of new approaches are being tested

Objective

› Set up protocol and pipeline for large study on host methane x rumen microbial community interaction

› Investigate the interaction on relatively small scale data

Equipment for measuring methane in AMS
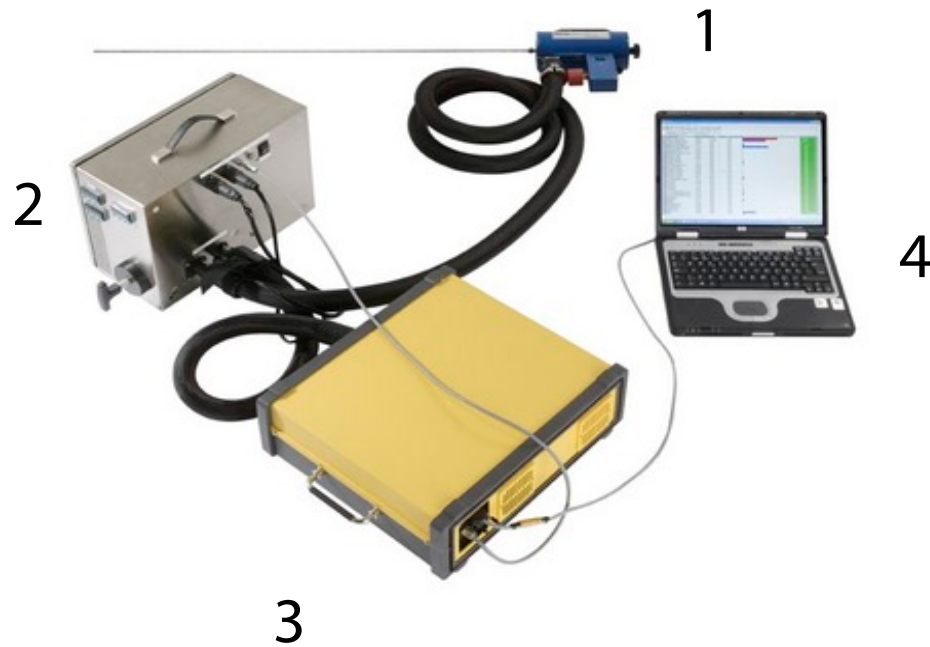
1. Sampling unit

2. Pump unit

3. Analyser FTIR – (GASMET DX-4000, www.gasmet.fi)

4. computer + software

Good and bad

› High capacity, non invasive approach

› Potential for other gasses

› Spot samples of biology

› No control of breath

› Ongoing validation

Sampling rumen fluid for genetic analysis

› High capacity

› Invasive procedure

› No surgery or slaughter

› Samples not taken the same place in rumen from cow to cow

› Limited saliva contamination

Data

› 1 herd (~600 cows)

› 50 Holstein

› 1. lactation cows

› Same TMR diet

› Feed 8 times daily

› Same 2 robots

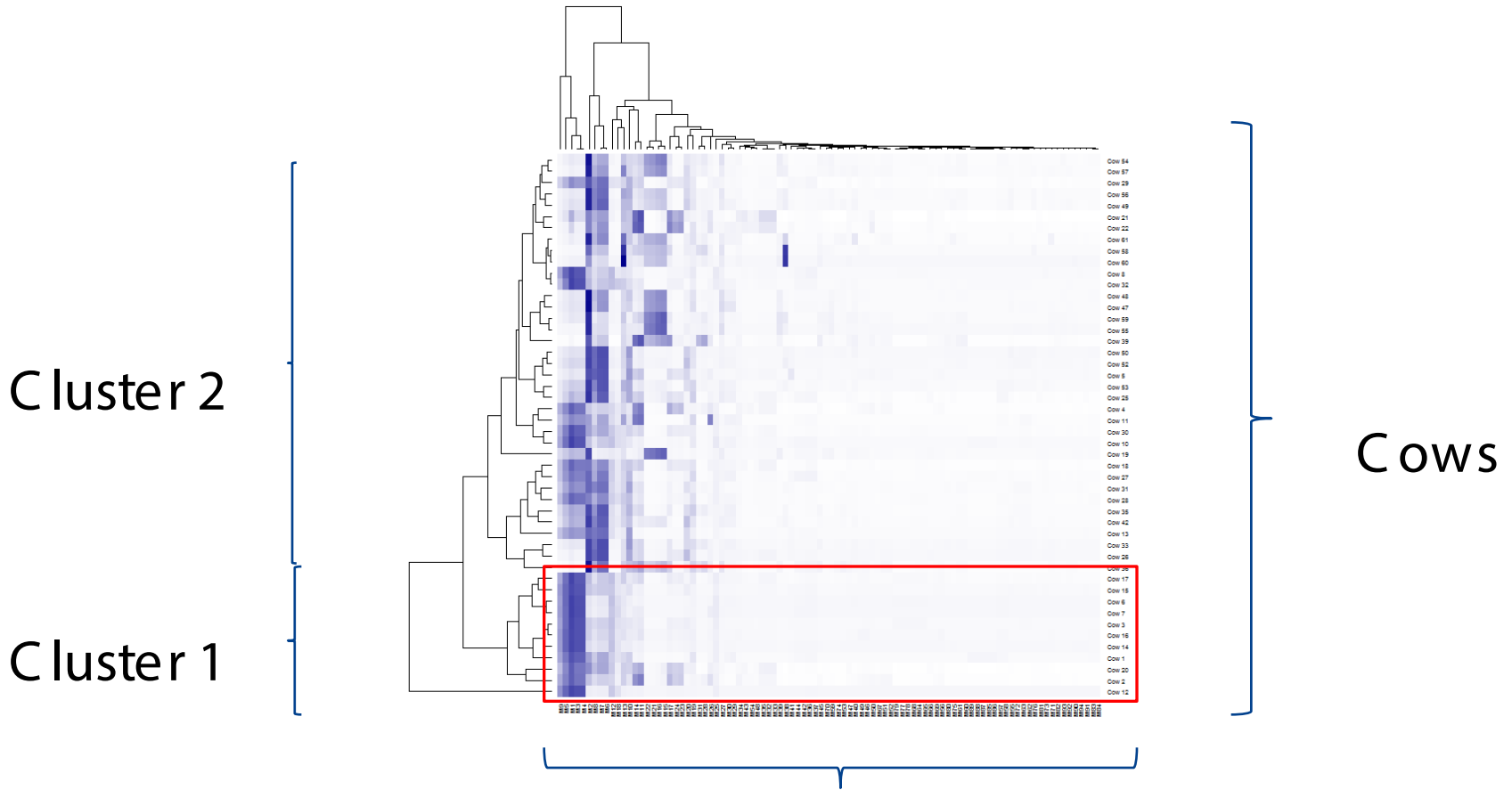# Statistics pr day

Variable	Mean	SD	Min	Max
ECM	28,6	5,1	11,7	38,5
Weight	583	61	479	718
Methane l	498	43	412	543
CH4/l Milk	16,1	1,6	12,7	23,3

Handling rumen samples

› On ice in farm
› 5 x 1,5 ml samples in lab
› Stored in -80 C

› DNA extraction
› 454 Sequencing of 16s RNA
› MOTHUR bioinformatics tool
› RDP Classifier

Cluster 2

Cluster 1

Cows

Bacterias

Means within cluster

	Cluster 1	Cluster 2
CH_4 / l milk	15,1[a]	17,9[b]
LCH_4	472[a]	512[a]
ECM	29,3[a]	27,1[a]
Weight	573[a]	616[a]
Days in milk	114[a]	116[a]

Next step

› Protozoa and archea will be analysed

Larger project

› 2000 cows will be phenotyped and genotyped (1000 before new year)

Take home message

› An area for collaboration between scientific communities: genetics, microbiology, physiology, nutrition, bioinformatics

› Indication of host control of rumen microbial community

› Indication of relation between clustering and methane emission

› Ongoing work