GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

Feed and Nutrition Network
FNN

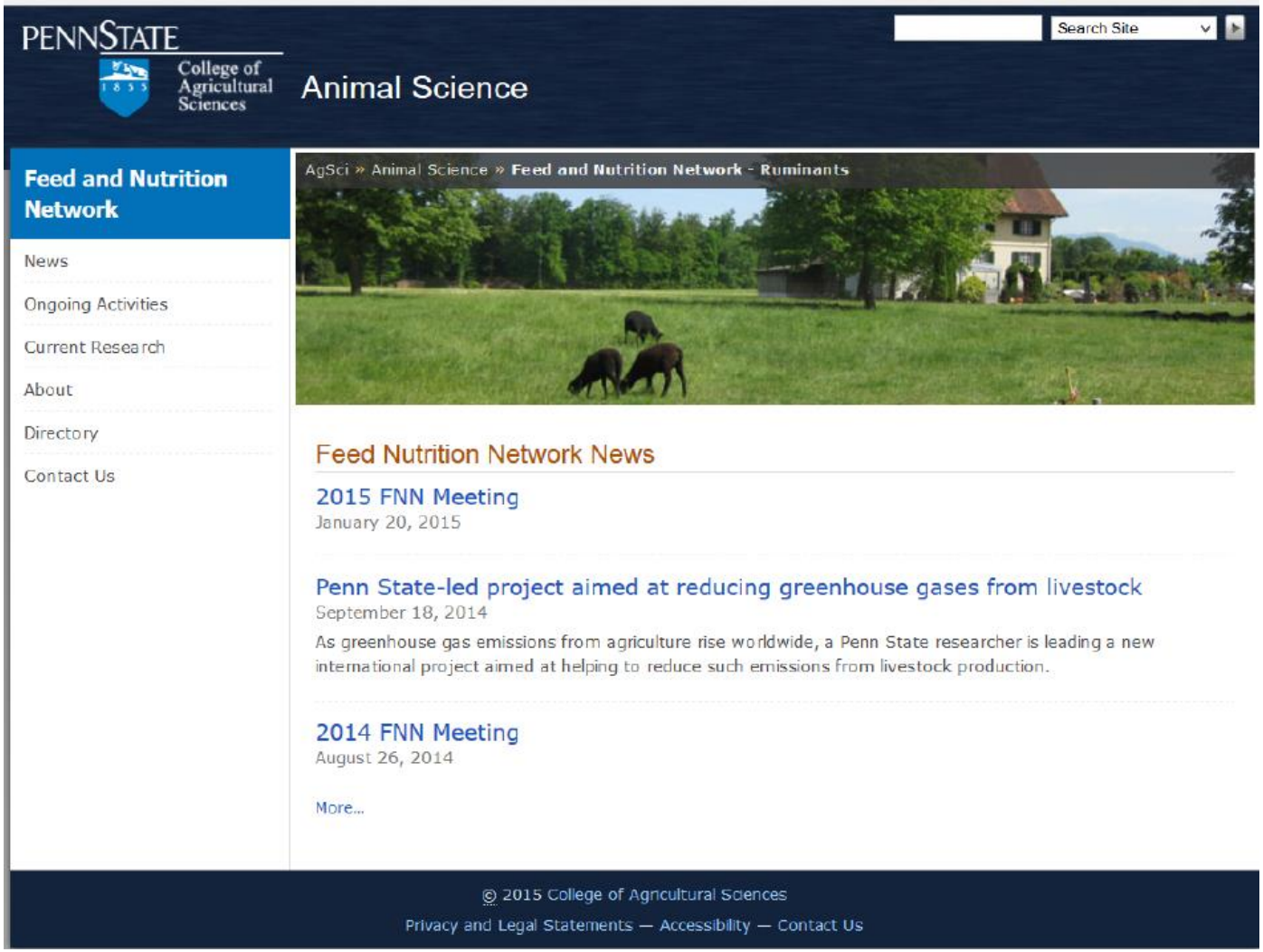
Livestock Research Group

Coordinator: Alex Hristov (USA)
Co-chairs: Jan Dijkstra & Andre Bannink (The Netherlands)

LRG meeting, Lodi, 2014

Currently hosted by Penn State

(http://animalscience.psu.edu/fnn)



Scope and goals

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- Build on, and utilize, the huge body of work available on mitigation of enteric methane (and nitrogen excretion) from ruminants by feed and nutrition to develop sound recommendations for stake-holders and identify future research priorities.

Goals of the Network

- Summarize and evaluate the available data on mitigating GHG emissions of ruminants by nutritional means (current focus: CH_4).
- Develop sound recommendations on CH_4 mitigation by nutritional means for stakeholders.
- Identify gaps in knowledge and focus research on priority issues.

Annual meetings

- Zurich, 2012
- Dublin, 2013
- Kansas City, 2014
- **Reading, 2015**
- Melbourne, 2016 (GGAA)

Countries represented at the FNN meeting in Reading, UK

Argentina, Belgium, Chile, Columbia, Denmark, Finland, France, Germany, India, The Netherlands, New Zealand, Norway, Poland, Spain, Sri Lanka, Sweden, Switzerland, UK, Uruguay, USA

Countries not attending: Australia, Canada, China, Indonesia, Ireland, Italy, Japan, Malaysia, Mexico

Current projects

- Various projects by member-countries participating in the GLOBAL NETWORK project.
- Two review papers being prepared by the Network:

Review: Suitability of current in vivo measurement techniques to meet specific objectives for accurately quantifying enteric methane emissions from ruminants

K. J. Hammond, L. A. Crompton, C. K. Reynolds, et al.

Review: Designing, conducting and interpreting in vitro batch culture experiments to assess methane production in ruminants

D. R. Yañez-Ruiz, et al.

GLOBAL NETWORK for the Development of Nutrition-Related Strategies for Mitigation of Methane and Nitrous Oxide Emissions from Ruminant Livestock

A. N. Hristov[1], E. Kebreab[2], Z. T. Yu[3], C. Martin[4], M. Eugène[4], D. R. Yáñez –Ruiz[5], K. J. Shingfield[6], S. Ahvenjärvi[6], P. O'Kiely[7], C. K. Reynolds[8], K. J. Hammond[8], J. Dijkstra[9], A. Bannink[10], A. Schwarm[11], and M. Kreuzer[11]

[1]Department of Animal Science, The Pennsylvania State University, University Park, U.S.A.; [2]Department of Animal Science, University of California, Davis, Davis, U.S.A.; [3]Department of Animal Sciences, The Ohio State University, Columbus, U.S.A.; [4]INRA, Clermont-Ferrand Research Centre, Saint-Genès Champanelle, France; [5]Estacion Experimental del Zaidin, CSIC, Granada, Spain; [6]MTT Agrifood Research, Animal Production Research, Jokioinen, Finland; [7]Animal and Grassland Research and Innovation Centre, Teagasc, Grange, Dunsany Co., Meath, Ireland; [8]School of Agriculture, Policy, & Development, University of Reading, Reading, U.K.; [9]Animal Nutrition Group, Wageningen University, Wageningen, the Netherlands; [10]Animal Nutrition, Wageningen UR Livestock Research, Lelystad, the Netherlands; [11]ETH Zurich, Institute of Agricultural Sciences, Zurich, Switzerland






The **GLOBAL NETWORK** consortium is a 4-yr project funded through The Joint Programming Initiative on Agriculture, Food Security and Climate Change (FACCE-JPI) and its objectives are integrated with those of the Network on "Feed and Nutrition in Relation to Greenhouse Gas Emissions" (FNN; http://animalscience.psu.edu/fnn), which is an activity of the Livestock Research Group (LRG) of the Global Research Alliance (GRA) on Agricultural Greenhouse Gases.

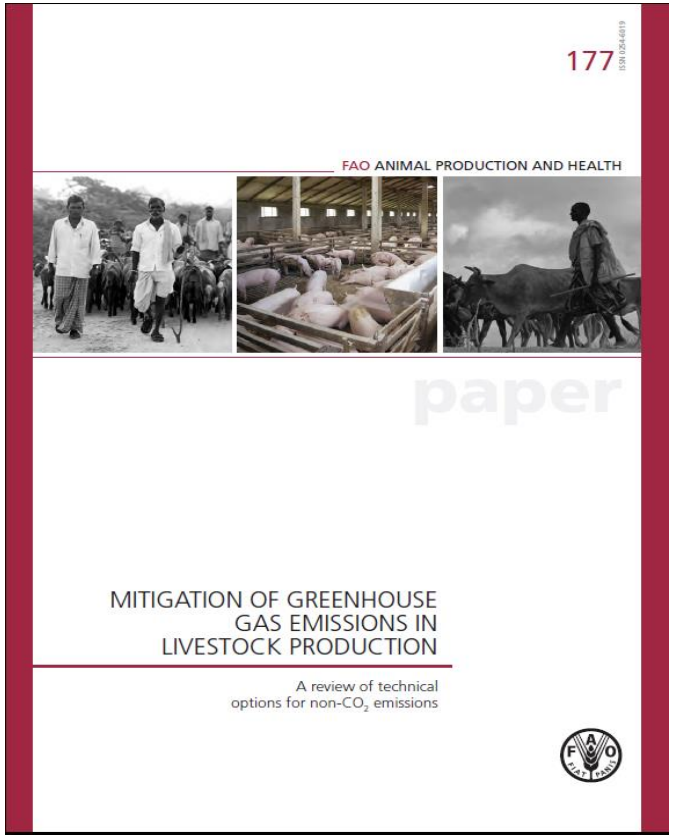
Objectives:

(1) Create, update, and expand animal and feed databases for the mitigation of enteric methane (CH_4);
(2) Gain understanding of the contribution of genetic and microbial factors to the variation in enteric CH_4 production, digestion, and nutrient utilization;
(3) Validate markers of enteric methanogenesis for the development and monitoring of CH_4 mitigation strategies in ruminants;
(4) Create, update, and expand a database of mitigation strategies aimed at improving dietary N utilization and decreasing NH_3 and nitrous oxide (N_2O) emissions from manure;
(5) Develop Standard Operating Procedures and guidelines for conducting and assessing data from in vitro and in vivo studies designed to evaluate nutritional strategies for mitigation of CH_4, NH_3, and N_2O;
(6) Develop new and evaluate existing models for predicting CH_4 emission and N excretions under various nutritional, animal, and farm management scenarios;
(7) Identify and recommend CH_4, NH_3, and N_2O mitigation technologies that are both practical and feasible for implementation in various ruminant livestock production systems.

Treatment means database

- 1,042 treatment means
- 224 publications
- Only in vivo experiments
- Data from 1965 to 2015

- **Goal: to provide effective, science-based enteric methane mitigation options**



Individual animals database

- Data from over 3,000 animals (cattle & sheep)
- About 30 contributors
- More data to come……
- Rules of use were laid out in a Consortium Agreement

- **Goal: to develop robust enteric methane prediction models**

Code	Description
Animal and diet-related data (provide as much as available)	
ID	Name and affiliation of contributor
Obs	Observation # or animal #
EXP	Experiment code (if contributing data from multiple exps.)
TRT	Treatment code (control; type of treatment - i.e., diet change, feed additive, microb
Status	Animal status - lactating, growing, etc.
Cannulation	Cannulated or non-cannulated animals
DIM	Days in milk (if lactating)
MeatAgeStart	For meat producing animals; age of the animal at the start of the exp
MeatAgeEnd	For meat producing animals; age of the animal at the end of the exp
MeatDuration	For meat producing animals; duration of the exp
MeatADG	For meat producing animals; average daily gain
MeatCarcDG	For meat producing animals; average carcass weight gain
YEAR	Year of publication (if not published, indicate 'unpublished')
Source	Journal/reference or unpublished
Location	E.g., Davis, CA; Reading, UK, etc.....
FEEDOF	Feed offered ad libitum or restricted
FORDM	Forage DM - if TMR there will be no concentrate (see below)
FORTYPE.1	Forage type 1 - grass silage, corn silage, hay etc & proportion in total forage DM
FORTYPE.2	Forage type 2 - grass silage, corn silage, hay etc & proportion in total forage DM
CONDM	Concentrate DM - if TMR there will be no concentrate
CONTYPE	Concentrate type
F:C	Forage to Concentrate ratio
DMI	Dry matter intake
GE	GE content of diet
CP	CP content
EE	Ether Extract intake
ASH	Ash intake
NDF	NDF intake
ADF	ADF intake
LIG	Lignin intake
STA	Starch intake
RumenpH	Rumen pH
RumenNH3	Rumen ammonia
RumenTotVFA	Rumen total VFA concentration
RumenAcet	Rumen acetate, molar % of total VFA
RumenProp	Rumen propionate, molar % of total VFA
RumenBut	Rumen butyrate, molar % of total VFA
RumenPRSol	Rumen passage rate of particulate phase
RumenPRLiq	Rumen passage rate of liquid phase
RumMethod	Method of rumen sampling (cannula, tube)
BUN	Blood (plasma) urea N
DMDP	DM digestibility percentage
DEDP	Digestible energy digestion percentage
NDP	Apparent N digestiblilty %
CDP	Carbon digestibility
EEDP	Ether extract digestibility
CFDP	Crude fibre digestibility
ASHDP	Ash digestibility
OMDP	OM digestibility
NDFDP	NDF digestibility
NDSADP	Nutrient detergent solubles digestibility
ADFDP	ADF digestibility
STADP	Starch digestibility
NFEDP	NFE digestibility
FECN	Fecal N
UN	Urine N
ManureNH3	Manure ammonia emission (if available)
ManureN2O	Manure nitrous oxide emission (if available)
SoilN2O	Soil nitrous oxide emission (if available)
MILKGE	Milk GE
MILKFat	Milk fat
MILKPrt	Milk protein (specify crude or true)
MILKLACT	Milk lactose
MILK_D	Milk production
MUN	Milk urea N
MFA4:0	Milk fatty acid, C4:0
MFA6:0	Milk fatty acid, C6:0
MFA8:0	Milk fatty acid, C8:0
MFA10:0	Milk fatty acid, C10:0
MFA12:0	Milk fatty acid, C12:0
MFA14:0	Milk fatty acid, C14:0
MFA16:0	Milk fatty acid, C16:0
MFA18:0	Milk fatty acid, C18:0
MFAtrans18:1	Milk fatty acid, trans C18:1
MFAcis9 18:1	Milk fatty acid, cis-9 18:1
MFA18:2n-6	Milk fatty acid, C18:2 n-6
MFA18:3n-3	Milk fatty acid, C18:3 n-3
CH4	Methane production
CH4Method	Methane measuring method chamber, SF6, version of SF6, GreenFe
SPECIES	Anima Species
CattleBREED	1 = Holestein; 2=Jersey; 3 = Ayrshire; 4 = Hereford; 5 = Angus; 6 = A
SheepBREED	(use your own coding)
SEX	1 = male; 2= female
AGE	Age in months
BW	Body weight - used to calc metabolic BW
Housing	Confinement or Pasture
Additives	Additives used such as ionophores
Design	Experimenta design (latin square - LSD, randomized - RD, etc)
DurationADAPT	Duration of treatment before data were collected
DurationEXP	Duration of data collection (i.e., methane or N excretion)
FeedComp	Feed composition analysis - indicate if measured traditional or NIR
Microbial data (if available)	
Methanogens	Total methanogens
	Methanobrevibacter
	Methanosphaera
	Methanomicrobium

Thank You!

(http://animalscience.psu.edu/fnn)

anh13@psu.edu; jan.dijkstra@wur.nl; andre.bannink@wur.nl