

# SmartCow

An integrated infrastructure for increased research capability  
and innovation in the European cattle sector

## Catalogue of training courses and study tours



*Horizon 2020 Programme*  
INFRAIA-02-2017  
Integrating Activities for  
Starting Communities



## Introduction

This catalogue presents the training courses and study tours that will be organized within the framework of the SmartCow project. As the courses and tours will take place from 2019 through to 2021, their programs are subject to change. New training courses may also be added to this catalogue.

SmartCow offers:

- Face-to-face courses, taking place in various European countries
- Web conference courses, accessible from your office, via a PC + Internet connection and a phone
- One-day study tours

## What is SmartCow?

SmartCow aims to promote coordinated use and development of key European cattle research infrastructure. It combines strong scientific and technical skills in animal nutrition (in vivo methods for nutrient utilization and emissions measurements), genetics (genotyped animals, phenotyping capabilities), health and welfare (sensors and automatic recordings of physiological and behavioral traits) and ethics in animal experimentation.

SmartCow receives funding from the European Union Horizon 2020 Research and Innovation Programme.

## Partners

**INRA** (Institut National de la Recherche Agronomique), France

**SRUC** (Scotland's Rural College), UK

**Aarhus University**, Denmark

**FBN Leibniz** (Leibniz Institute for Farm Animal Biology), Germany

**Teagasc** (Agriculture and Food Development Authority), Ireland

**CRA-W** (Centre Wallon de Recherche Agronomique), Belgium

**IRTA** (Institut de Recerca i Tecnologia Agroalimentàries), Spain

### How can I participate in a course or study tour?

The training courses and study tours target scientists, technicians, stakeholders, students, etc.

Tuition fees are covered by the SmartCow project. Participants will have to organize and fund their own travel and accommodation expenses.

Please note that all these activities will take place in English.

## Contact

If you are interested in participating in a training course or a study tour, or if you need any further information about this training program, please contact:

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## Study tours

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## Gold standard methods to assess key phenotypes in ruminant nutrition

Intake, whole tract digestibility, N balance, CH<sub>4</sub> emission and feed efficiency

**Organizing center:** INRA (France)

**Type of training:** face-to face

**Target participants:**

Scientists, RI technicians, stakeholders  
Bachelor, Master or PhD students

### **Training objectives**

After the training session, the trainee will be able to:

- Understand the importance of targeted phenotype and its biological significance for both purposes : feed evaluation, and individual phenotyping
- Understand the technical, biological and ethical limits of gold standard methods for both purposes

### **Pre requisite skills**

Knowledge on ruminant digestion and nutrition

### **Program**

Assessing feed intake, whole tract digestibility, N balance, CH<sub>4</sub> emissions (considering open chambers as gold standard method but also other methods such as the SF<sub>6</sub> tracer technique and GreenFeed) and feed efficiency in cattle  
Biological significance of these phenotypes, and the advantages and limits (technical, biological and ethical) of each gold standard measurement method

**Pedagogical approach:** Lectures, study case and practical sessions in INRA facilities and laboratories

**Duration:** 3 days

**Location:** Theix (France), INRA Center

### **Trainers**

Cécile Martin, Gonzalo Cantalapiedra-Hijar, Pierre Nozière and René Baumont (Inra)

### **Date of course or estimated period of course**

2019

## Measurement techniques and proxies for ruminant methane emissions

**Organizing center:** SRUC (UK)

**Type of training:** Web conference

**Target participants**

Early career researchers and research technicians  
Master or PhD students

**Training objectives (capacity to be transferred)**

After the training session, the trainee will be able to:

- Describe the principles of operation of respiration chambers for measuring methane emissions
- Outline the available proxy or short-term measurement techniques for estimating methane emissions from ruminants.
- Understand the strengths and weaknesses of these techniques and proxies

**Pre requisite skills**

Graduate-level understanding of ruminant production systems and ruminant nutrition/rumen function

**Program**

- Theory and practice of operation of respiration chambers
- Short-term methane measurements (GreenFeed, 'sniffers' and laser methane detector) – theory, strengths and weaknesses
- Proxies based on rumen sampling (rumen microbiome; rumen genes) – theory, strengths and weaknesses
- Modelling rumen methane emissions

**Pedagogical approach:** Lectures – incorporating video clips of the equipment under discussion.

**Duration:** 2 x 1 hour sessions

**Trainers**

Pr Richard Dewhurst, Dr Gemma Miller and Laura Nicoll (SRUC)

**Date of course or estimated period of course**

2019

## Measurement techniques and proxies for feed efficiency of beef cattle

**Type of training:** Web conference

**Organizing center:** SRUC (UK)

**Target participants**

Early career researchers and research technicians  
Master or PhD students

**Training objectives**

After the training session, the trainee will be able to:

- Understand the reasons for measuring feed conversion efficiency of beef cattle – particularly in the context of breeding programs
- Describe and justify appropriate protocols for measuring feed conversion efficiency in beef cattle
- Understand the basis of proxy measurements for feed conversion efficiency in beef cattle (rumen microbial genes; Nitrogen isotopic fractionation).
- Understand the strengths and weaknesses of these techniques

**Pre requisite skills**

Graduate-level understanding of ruminant production systems and ruminant nutrition

**Program**

- Background to the economic significance of feed efficiency in beef production.
- Theory and practice of feed efficiency protocols for beef cattle – equipment and techniques for recording feed intake, growth rates and the composition of weight gain. International examples of incorporation of feed efficiency into breeding programs.
- Theoretical basis of proxies for feed efficiency in beef cattle (1) rumen microbial genes and (2) Nitrogen isotopic fractionation

**Pedagogical approach :** Lectures – incorporating video clips of the equipment under discussion

**Duration:** 2 x 1 hour sessions

(1) measuring feed conversion efficiency and residual feed intake in beef cattle

(2) markers or proxies for feed conversion efficiency in beef cattle.

**Trainers**

Professor Richard Dewhurst, Dr Carol-Anne Duthie and Laura Nicoll (SRUC)

**Date of course or estimated period of course**

2019

## Feed efficiency in dairy cattle

**Type of training:** Web conference

**Organizing center:** IRTA (Spain)

**Target participants**

Scientist, RI technicians, stakeholders  
Master or PhD students

**Training objectives**

*After the training session, the trainee will be able to:*

- evaluate feed efficiency in dairy cattle using several methodologies

**Pre requisite skills:** Dairy nutrition knowledge

**Program**

Comparison of direct measurements of feed efficiency (RFI vs milk/DM intake)  
Feed efficiency under negative energy balance  
Alternatives methods to assess feed efficiency

**Pedagogical approach**

Lectures and practical sessions

**Duration:** 2 x 1 h session

**Trainers**

Àlex Bach and Marta Terré (IRTA)

**Date of course or estimated period of course**

2019

## Ethics and welfare in animal experimentation

**Organizing center:** INRA (France)

**Type of training:** Face to face training

**Target participants**

Scientists, RI technicians, stakeholders, etc. All people dealing with experimental projects  
Bachelor, Master or PhD students

**Training objectives**

After the training session, the trainee will be able to:

- Manage his/her own attitude towards the concepts of animal welfare, emotions in animals, ethics, and individual and collective responsibilities in the process of animal experimentation
- Raise his/her own awareness about evaluation and management of pain in herbivore experimentation

**Pre requisite skills:** experience in animal experimentation

**Program**

Concepts of animal welfare and emotions in animals  
Animal-centered or human-centered ethics, human-animal relationship, individual and collective responsibilities in animal experimentation  
Concepts of pain and suffering, evaluation and management tools of pain in the process of animal experimentation

**Pedagogical approach**

Lectures and discussions

**Duration:** 1 or 2 days

**Location:** France (probably at INRA Center in Theix or VetAgro Sup in Lyon)

**Trainers**

Scientists from INRA

**Date of course or estimated period of course**

Spring or autumn 2019



## Respiration chamber and methane emission

**Type of training:** Face-to-face course

**Organizing center:** FBN Leibniz (Germany)

**Target participants**

Early career researchers, Research Technicians  
Master or PhD students

**Training objectives**

After the training session, the trainee will be able to:

- Understand the principles of respiration chamber and GreenFeed
- Understand the relationships between methane production, intake and composition of feed
- Sample rumen fluid and analyze selected methane proxies

**Pre requisite skills**

Advanced PhD students and PostDocs with a Master in Animal Sciences or related fields

**Program**

Visit and introduction to Respiration Chamber and GreenFeed  
Dietary factors influencing methane production  
Host Physiology effects on methane production  
Hands on training of oral rumen fluid sampling  
Methane proxies  
Lab analysis of methane proxies from ruminal fluid: Short-chain fatty acids and mcrA abundance using GC-FID and real-time PCR  
Lab analysis: Fecal archaeol extraction and subsequent GC-MS analysis

**Pedagogical approach:** Lectures, case study, practical sessions

**Duration:** 2 days face-to-face course

**Location** (for face-to-face courses only): Leibniz Institute for Farm Animal Biology (FBN), Germany

**Trainers**

Cornelia Metges, Björn Kuhla, Michael Derno (FBN Leibniz)

**Date of course or estimated period of course**

Late 2019, early 2020

## Ontologies in SmartCow

**Organizing center:** INRA (France)

**Type of training:** Face-to-face

**Target participants**

Scientists, RI technicians  
Bachelor, Master or PhD students

**Training objectives**

After the training session, the trainee will be able to:

- Understand the usefulness of the ontologies to name experimental measures
- Use these ontologies
- Use the ontologies adapted to SmartCow

**Pre requisite skills**

Basic knowledge in biology

**Program**

What is an ontology?

- Definition
- History
- Examples of use of ontologies (application of ontologies)
- Exercise: building a small ontology

French ontologies from INRA-PHASE:

- Animal Ontology for Livestock (ATOL)
- Environment Ontology for Livestock (EOL)
- Animal Health Ontology for Livestock (AHOL)

Ontology in SmartCow:

- Description
- Use of this ontology in infrastructures of SmartCow

**Pedagogical approach:** Lectures, practical sessions

**Duration:** 2 days

**Location:** France, to be defined

**Trainers**

Catherine Hurtaud, Olivier Dameron, Marie-Christine Meunier-Salaün, Jérôme Bugeon, Alice Fatet,  
and Claire Nédellec (INRA)  
Monika Solanki (Agrimetrics, UK)

**Date of course or estimated period of course**

Early 2020

## Validation and use of sensor outputs for recording animal behavior

**Organizing center:** Aarhus University (Denmark)

**Type of training:** Face-to face

**Target participants**

Scientists

Master or PhD students

**Training objectives**

After the training course the participants will be able to

- Understand the protocol for validation of sensor output delivered in Task 7.1 of the SmartCow project
- Develop a protocol for validation of a specific sensor for automatic recording of behaviour
- Describe the pitfall in using sensor outputs

**Pre requisite skills**

Basic knowledge on cow behaviour and statistical methods for validation

**Program**

Different type of sensors, different types of behaviour. What do the sensors measure. Lectures on how to validate the out from sensors that record behavior. Barn visits and data flow from cow (sensor) to database including pitfalls for data transfer sensor- computer- database – computer for analysis.

How to develop a protocol for validation of output from a specific sensor. Lectures and training sessions in pitfalls in use of different types of sensors.

**Pedagogical approach**

Lectures and sessions including training on real dataset obtained from the research farm

**Duration:** Two days with arrival the day before and short welcome in the evening

**Location:** Denmark, Aarhus University and Foulum with access to the research farm and programs needed for access to data

**Trainers**

Pr Lene Munksgaard, Emma Ternman and technician from our data group (Aarhus University)

**Date of course or estimated period of course**

Early 2020

## Introduction to Infrared spectroscopy tools developed in SmartCow

**Organizing center:** CRA-W, Centre wallon de Recherches agronomiques, (Belgium)

**Type of training:** Web conference

**Target participants**

Scientists, R&D stakeholders  
PhD students

**Training objectives**

After the training session, the trainee will be able to:

- understand the principle of Infrared spectroscopy
- use the proxies to investigate rumen fermentation parameters

**Program**

General introduction to Infrared spectroscopy  
Presentation of example of the proxies developed

**Pedagogical approach**

Lecture, question and answer section

**Duration:** 2 hours

**Trainers**

Vincent Baeten, Frédéric Dehareng, Clément Grelet and Amélie Vanlierde (CRA-W)

**Date of course or estimated period of course**

In the second half of 2021

## Biomarkers assisted-predictions of feed efficiency and their main determinants in cattle

**Type of training:** Web conference

**Organizing center:** INRA (France)

### Target participants

Scientists, Students, RI technicians, stakeholders  
Bachelor, Master or PhD students

### Training objectives

*After the training session, the trainee will be able to:*

- Understand the principle by which some biomarkers could be related to feed efficiency and their determinants (digestibility, N balance and rumen fermentation parameters including CH<sub>4</sub> emissions)
- Overview of the main laboratory steps enabling to analyze the proposed biomarkers
- Understand the advantages, limits and the conditions of use of biomarkers to predict feed efficiency and their determinants at the herd and individual level.

**Pre requisite skills:** Knowledge on ruminant digestion and metabolism

### Program

The main drawbacks associated to the gold standard methods for measuring the whole tract digestibility, N balance, CH<sub>4</sub> emissions and feed efficiency in cattle.

The historically proposed as well as recently discovered biomarkers to predict feed efficiency and their determinants and the methods and equipment enabling their laboratory analyses

The limits and potential of some biomarkers to predict feed efficiency and their determinants in cattle at the herd and individual level

Presentation of a guideline for an optimal biomarkers-assisted prediction

### Pedagogical approach

Lectures and study case

**Duration:** 2 x 1.5 hours session

### Trainers

Cécile Martin, Gonzalo Cantalapiedra-Hijar, Donato Andueza, Pierre Nozière and M. Nasrollahi (INRA UMR Herbivores)

### Date of course or estimated period of course

Late 2021

### *One-day study tour*

## Innovations to improve feed efficiency, reduce GHG emissions and improve the welfare of beef cattle

**Organizing center:** SRUC (UK)

### **Program**

Visit SRUC research facilities with presentation from researchers on:

- Feed efficiency and proxies
- Precision livestock farming technologies
- Animal handling and welfare
- Methane emissions (respiration chambers and proxies)
- 

Visit to a commercial farm demonstrating precision livestock farming technology, with presentations from the farmer and technical staff of Agri-EPI Centre Ltd.

### **Location**

UK, Scotland, in SRUC Beef Research Centre, Easter Howgate Farm (close to Edinburgh) and a commercial beef farm in the Scottish Borders (<1 hour coach journey from Edinburgh).

### **Period**

February or March 2019

## INRA Herbipôle: A European Research Infrastructure on cattle in mountain grassland area

**Organizing center:** INRA (France)

### Program

The Herbipôle is a multidisciplinary experimental research platform on ruminants and grasslands, with a regional, national and European vocation, largely opened to scientific and professional partners, federating on a single facility complementary scientific approaches and disciplines. The aims of the research projects conducted at the Herbipôle deal with ruminant farming systems in grassland mountain areas, preserving their welfare and in connection with product qualities (milk, meat, cheeses and meat) and environmental impacts.

The Herbipôle gathers all the INRA experimental installations of ruminants in Auvergne-Rhône-Alpes region (Massif Central, in the center of France) that are distributed over 3 locations: Laqueuille, Theix and Marcenat. The unit consists of 90 permanent staff. The experimental herds are of 900 bovines and 800 sheep distributed on more than 1100 ha of grassland, located at an altitude between 850 and 1500 m a.s.l.

The visit will be focused on experimental tools for phenotyping animals:

- Feed intake and eating behaviour
- Activities of dairy and beef cows
- Beef cow milk production
- Greenhouse gas emissions by ruminants

For further details: [https://www6.ara.inra.fr/herbipole\\_eng/](https://www6.ara.inra.fr/herbipole_eng/)

### Location

France, INRA experimental farm of Laqueuille and Marcenat

### Period

The study tour will take place early October 2019, around the *Sommet de l'élevage*, which is the Europe n°1 livestock show (<https://www.sommet-elevage.fr/en/home-en/>) held every year near Clermont-Ferrand.

## Danish Cattle Research Centre

**Organizing center:** Aarhus University (Denmark)

### **Program**

Introduction to Research farm at AU by The head of the Danish Cattle Research Centre (Merete Jensen) including the management of the Centre.

Tour to the facilities where researcher using the different parts of the facilities will introduce and explain about the options in the specific parts of the barn. This will include facilities for behavioural studies, facilities for studies of nutrient digestion and metabolism using fistulated and multi-catheterized cows, and facilities for measuring enteric methane. The collection of data and handling of data both automatically recorded data and manually recorded data will be demonstrated as well as the options researchers have for access to the data by a person from the data group as well as a researcher.

### **Location**

Denmark, Aarhus University in Tjele

### **Period**

Early 2021

## Intensive grazing systems in temperate climates

**Organizing center:** Teagasc (Ireland)

### **Program**

The role of the Dairy Research Programme in Moorepark is to increase the competitiveness of the dairy industry through scientific research and to do so in a manner compatible with food quality and safety, the environment and animal welfare requirements. The Centre is engaged in a number of areas of research. Staff work collaboratively on specific research issues.

Attendees will see firsthand grazing management research in intensive grass based systems with a range of topics including – selecting the right cow for the system, choosing the right grassland cultivar/mixture for our systems and many other topics to be confirmed closer to the visit.

### **Location**

Ireland, Teagasc Moorepark, AGRIC, Fermoy, Co. Cork

### **Period**

Early 2022