EAAP Conference, Session 43 – Burning issues in biodiversity, Ghent, 28th August 2019

SmartCow: integrating European cattle research infrastructures to improve their phenotyping offer

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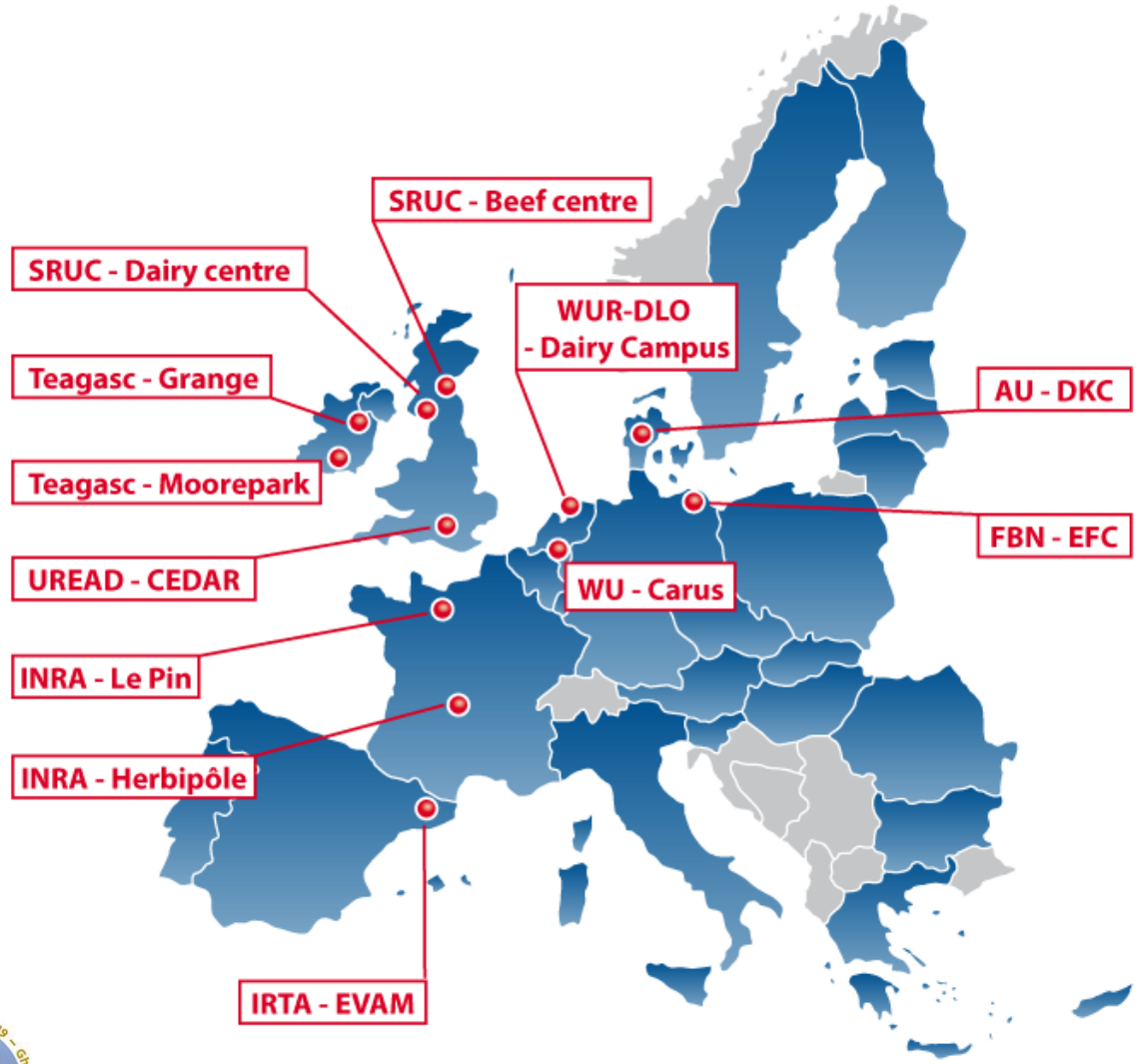
SmartCow
an integrated infrastructure for increased research capability and innovation in the European cattle sector

This project has received funding from the European Union's Horizon 2020 research programme under grand agreement N° 730924

Concept of SmartCow

- Better coordination of research infrastructures (RIs) in the cattle sector is necessary to develop more efficient approaches to address the various challenges in cattle breeding and research
- SmartCow is a first step towards the integration of RIs for the European cattle sector, developing:
  - A common language, the best standardized techniques and data sharing
  - Improved and new methods to enhance phenotyping of new and more complex animal traits
  - With the full range of genetic (breeds) and environmental diversity across Europe

14 partners across Europe



9 partners that bring RIs

- 11 major RIs distributed in 7 EU countries
- 12 locations, which include 18 installations
- 2500 dairy and 750 beef cows
  - *Part of the animals are genotyped*
  - *Possible link with gene banks trough identification number*

5 other partners for specific skills

- Agrimetrics : Cloud based data-platform
- CRA-W : NIR and MIR techniques for phenotyping
- Idele and EAAP: Dissemination and stakeholders
- INRA Transfert: Project management

A large range of measurement capabilities in nutrition, physiology and behaviour





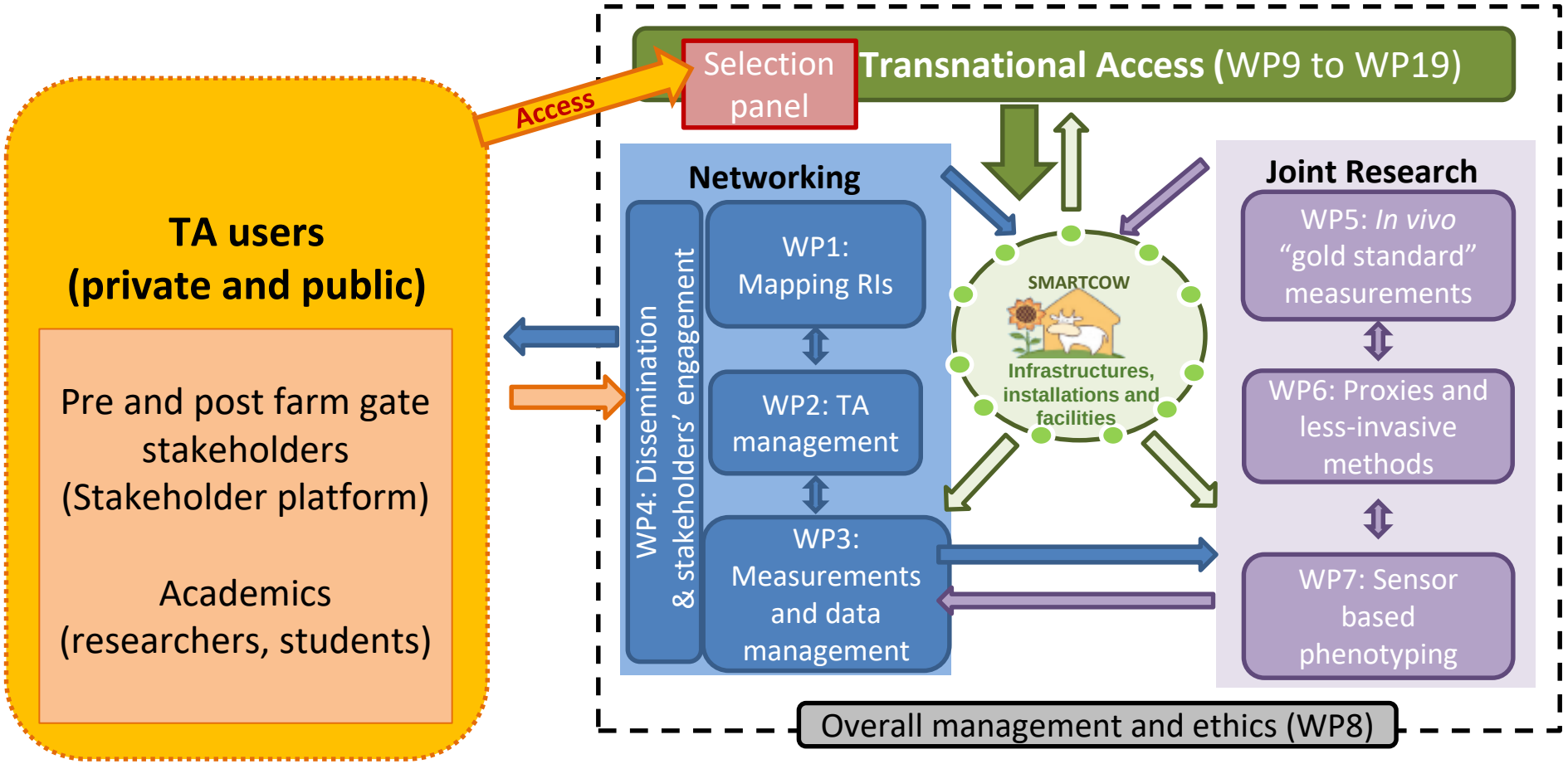








SmartCow WPs organisation



How will SmartCow improve phenotyping capabilities?

- Inventory equipment and related techniques
- Inventory of animal databases and sample banks
- Develop unified guidelines for specific measurements (book of methods)
- Improve the animal trait ontology for cattle (ATOL and EOL)
- Develop a cloud-based data platform to gather and share data
- Refine methods in the field of nutrient efficiency and emissions
- Develop proxies (biomarkers) and non-invasive methods
- Develop a multivariate approach to phenotype behavioural, health and feed efficiency traits based on sensor data

→ *Implementation of 3R principles (Replace, Reduce, Refine)*

Mapping of cattle RIs and inventories support project studies

- **Equipment and related techniques in cattle research**
  - Use of a common language:
    - Animal Trait Ontology: http://www.atol-ontology.com/en/erter-2/
  - Harmonization and refinement of gold standard methods
    - Ring test on CH4 chambers
    - Refinement of digestibility and N balance measurement
  - List of measurements: Book of methods in cattle physiology
- **Animal database and sample banks** (feed, faeces, urine, blood, milk)
  - Support studies of proxies (biomarkers) of nutrient efficiency and of their determinants

Book of methods in cattle physiology *(led by Björn Kuhla & Sadjad Danesh Mesragan)*

- Metabolic, digestive, anatomic, behavioural traits
- Mostly Innovative and/or minimal invasive tools/instruments
- Links with animal trait ontology (ATOL www.atol-ontology.com)
- Avoiding duplicates and taking ICAR guidelines in consideration

For each method:

- Pre-requisite
- Preparation
- Recording
- Validation (if necessary)

Publication of the book planned beginning 2021

Evaluation of proxies to predict feed efficiency and its determinants in cattle *(led by Cécile Martin, Gonzalo Cantalapiedra and Frédéric Dehareng)*

*To identify their **range of applicability** across **diets** and **individuals***

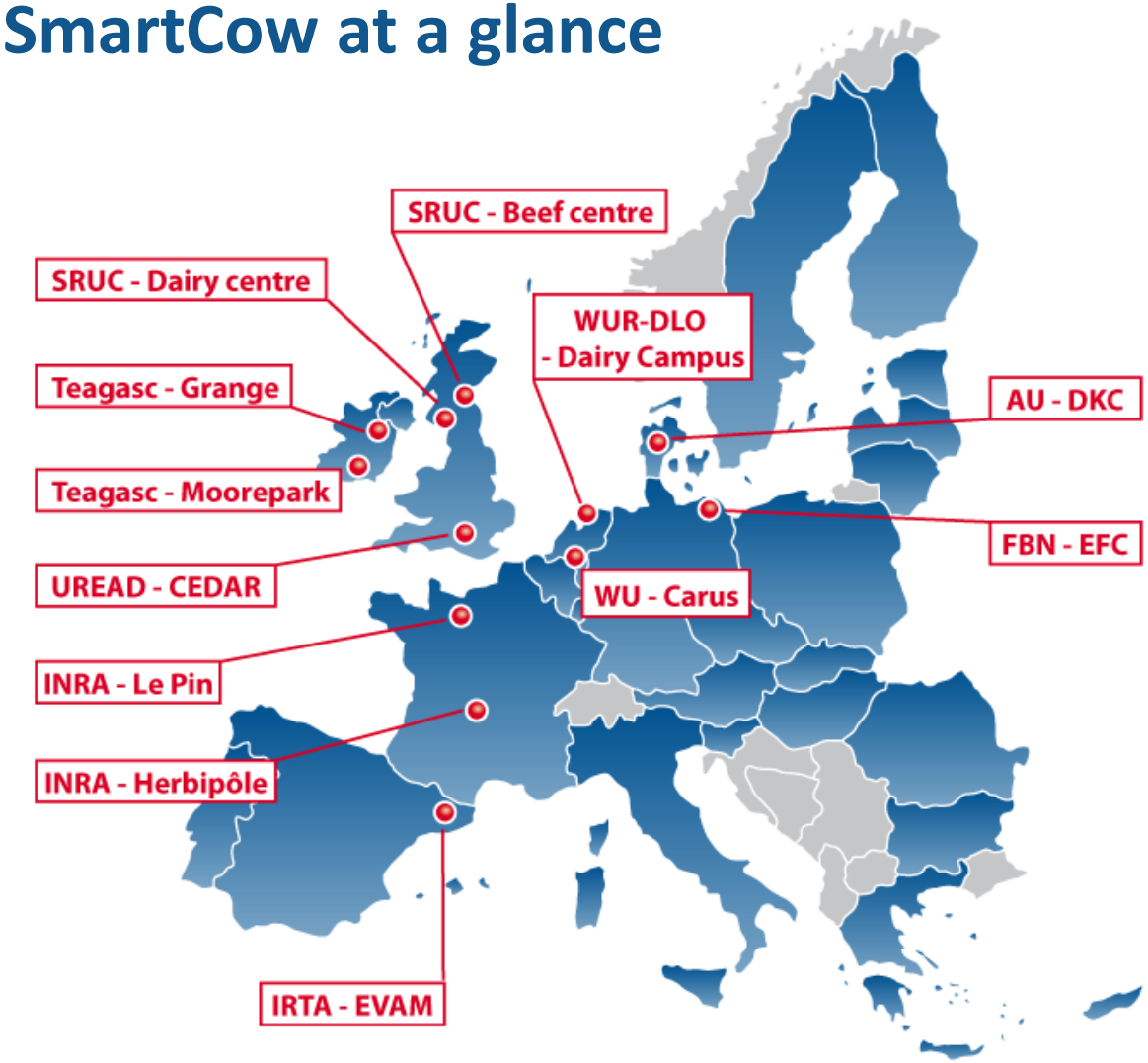
Parameter (GSM)	Proxies	Matrices	Status
• Total tract digestibility • N partitioning • Animal feed efficiency	• NIR • Urea-N; 15N natural abundance • Urea-N; 15N natural abundance • Metabolites	• Faeces • Milk, blood, Urine, faeces • Blood	• Solid • New
• CH4 emission • VFA, ammonia, pH (rumen)	• MIR • NIR • MIR • Volatile metabolome	• Milk • Faeces • Milk • Breath gas	• Solid • New

Poster 45.14

- ***Creation of databases and sample banks; Laboratory analyses***
- ***Meta-analysis of the data***

Thank you for your attention

SmartCow at a glance



First-class Cattle Research Infrastructures (RIs) across Europe:

- 11 major RIs distributed in 7 EU countries
- 12 locations, which include 18 installations
- 2500 dairy and 1000 beef cows

- **Networking of RIs** to inventorize resources, harmonize procedures, and share data
- **Joint research activities** to improve experimental methods and phenotyping capability
- **Interaction with stakeholders** to stay in line with industry needs and improve dissemination

http://www.smartcow.eu/stakeholders/

TRAINING PROGRAM

For Scientists, Technicians, Stakeholders, PhD students

- Face-to-face training courses
- Free web-conferences
- One-day study tours in 4 different countries

http://www.smartcow.eu/resources/training/

TRANSNATIONAL ACCESS CALLS

Offers external users (academic and industry) free access to SmartCow RIs

- 30 projects during the 4 years of SmartCow
- Access to around 10,000 cow-weeks

http://www.smartcow.eu/calls/

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SmartCow