



DIVISION OF ANIMAL PHYSIOLOGY AND LIVESTOCK FARMING SYSTEMS (PHASE)



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AGRICULTURE
ENVIRONNEMENT



The institute and PHASE

Inra is the largest institute for research in agricultural sciences in Europe and the second largest in the world. It finances and conducts goal-oriented research for good quality, healthy food, for competitive and sustainable agriculture, and for safeguarding and adding value to the environment.

Some facts & figures

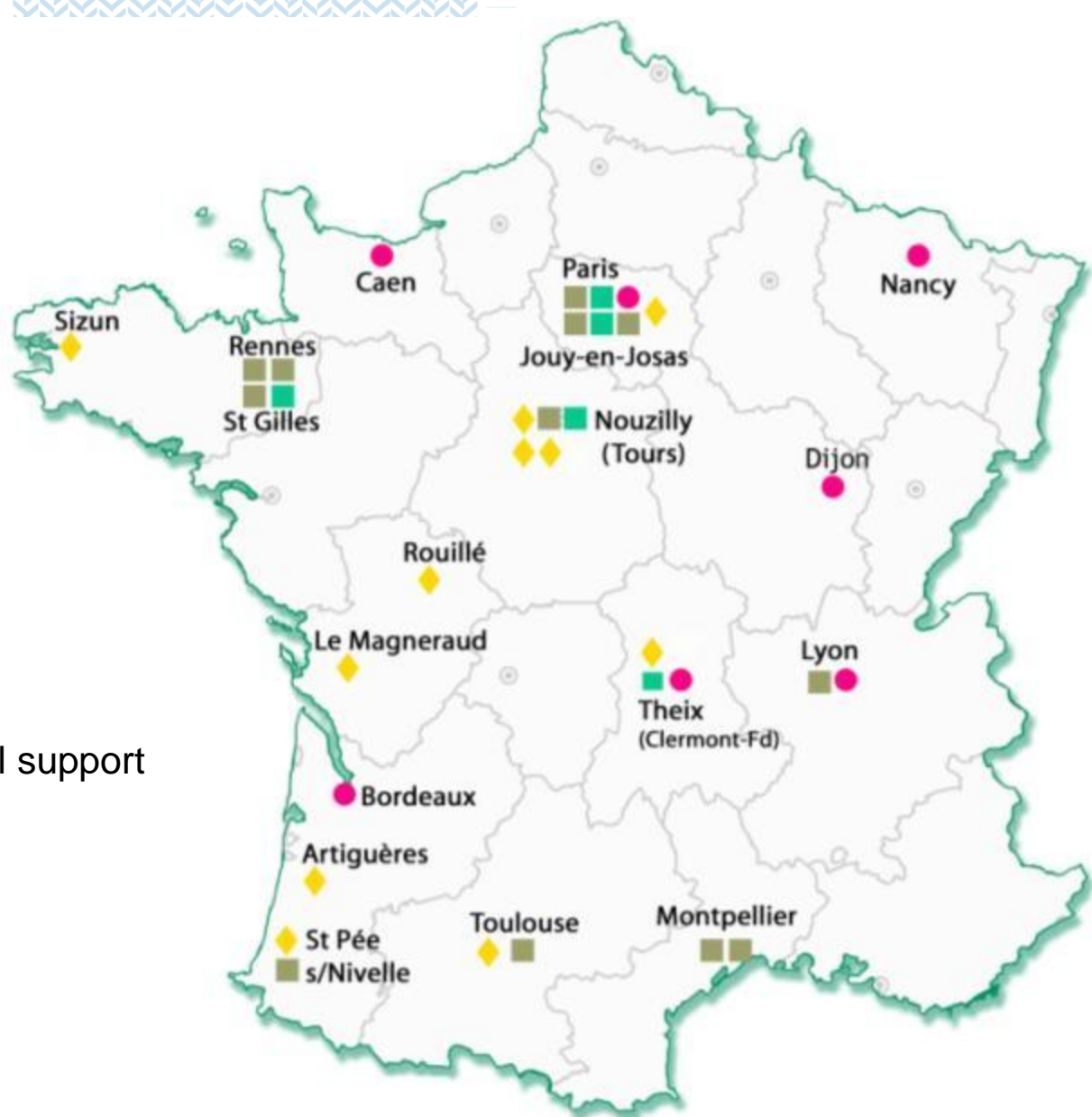
- 8500 employees, 2000 doctoral and post-doctoral staff,
- a budget of 730 M€,
- 230 research units, 19 research centres, 14 research divisions

The Phase division **implements the research policy of the institute** according to orientations chosen by the scientific directorate. Phase **defines and coordinates the research programmes** carried out in its research units.

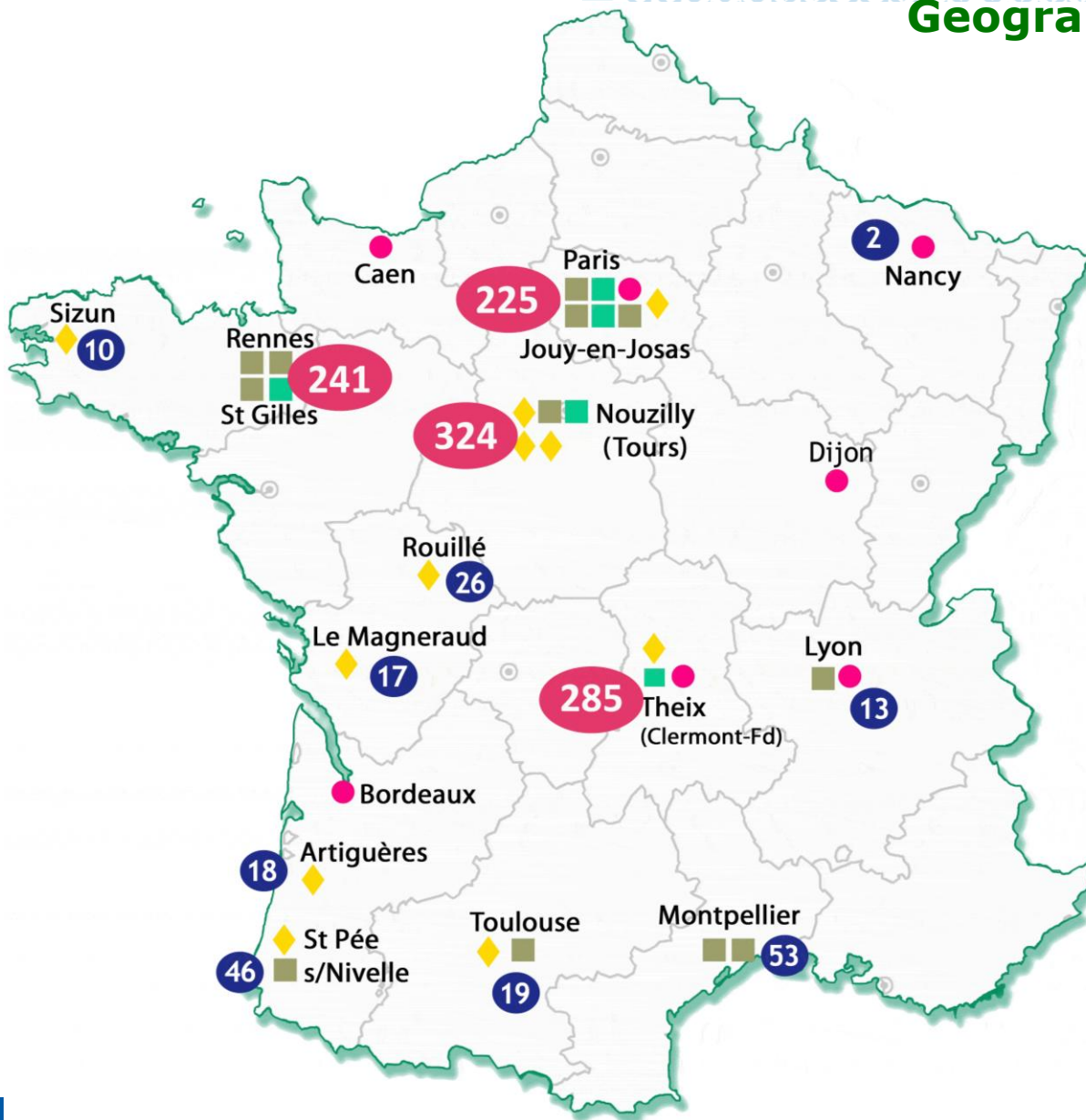
PHASE is **present in 10 of the 19 Inra Research Centres** spread across France.

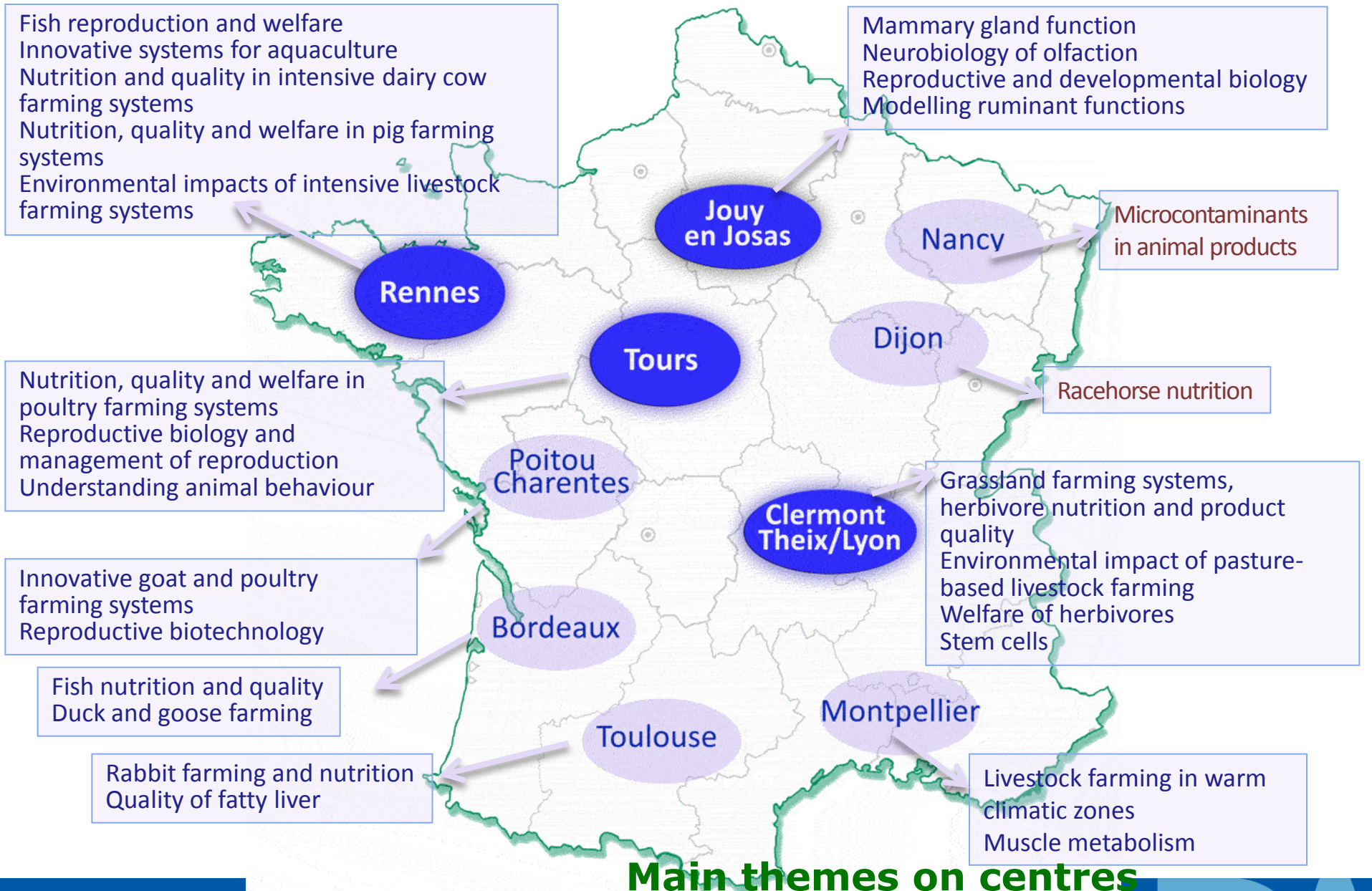
Location of PHASE Units

- 5 Major INRA units
- 12 partnership units
- 11 experimental farms/logistical support
- 7 units under contract



Geographical localisation of staff





An organisational tool that is spread across the country

17 experimental sites

Consumables budget
5,6M€

Implicated in
70% of results

380 staff

700
experiments
per year

Domestic animals	Numbers
Cattle	2 500
Goats	950
Horses	150
Rabbits	900
Sheep	4 400
Fish	240 000
Pigs	2 800
Poultry	76 000
Model animals	
Fish, rodent	

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UR Herbivores

(Inra – Clermont-Ferrand/Theix)



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UR Herbivores

- Largest French research unit on herbivores
- Research focus on
 - cattle and sheep (goats)
 - biology of herbivores: genomics, metabolism, products quality, digestion, behaviour
 - systemic approach: farming systems, modelling (incl. modelling of biol. functions)
- Ultimate goal: to improve farming practices in order to meet societal requirements

Context

- Production of animal proteins for human consumption
 - Climatic changes → agriculture, specially ruminants, produce large amounts of greenhouse gasses (FAO 2006)
 - Herbivores are not competitors of humans in relation to food
 - Herbivores contribute to rural development (FAO 2010)
 - Worries from citizens about 'industrialisation' of agriculture vs. welfare of animals + trust in science is decreasing
- Need to design and promote sustainable farming systems for herbivores



Research objectives

to produce and integrate knowledge to estimate and increase the sustainability of farming systems for herbivores

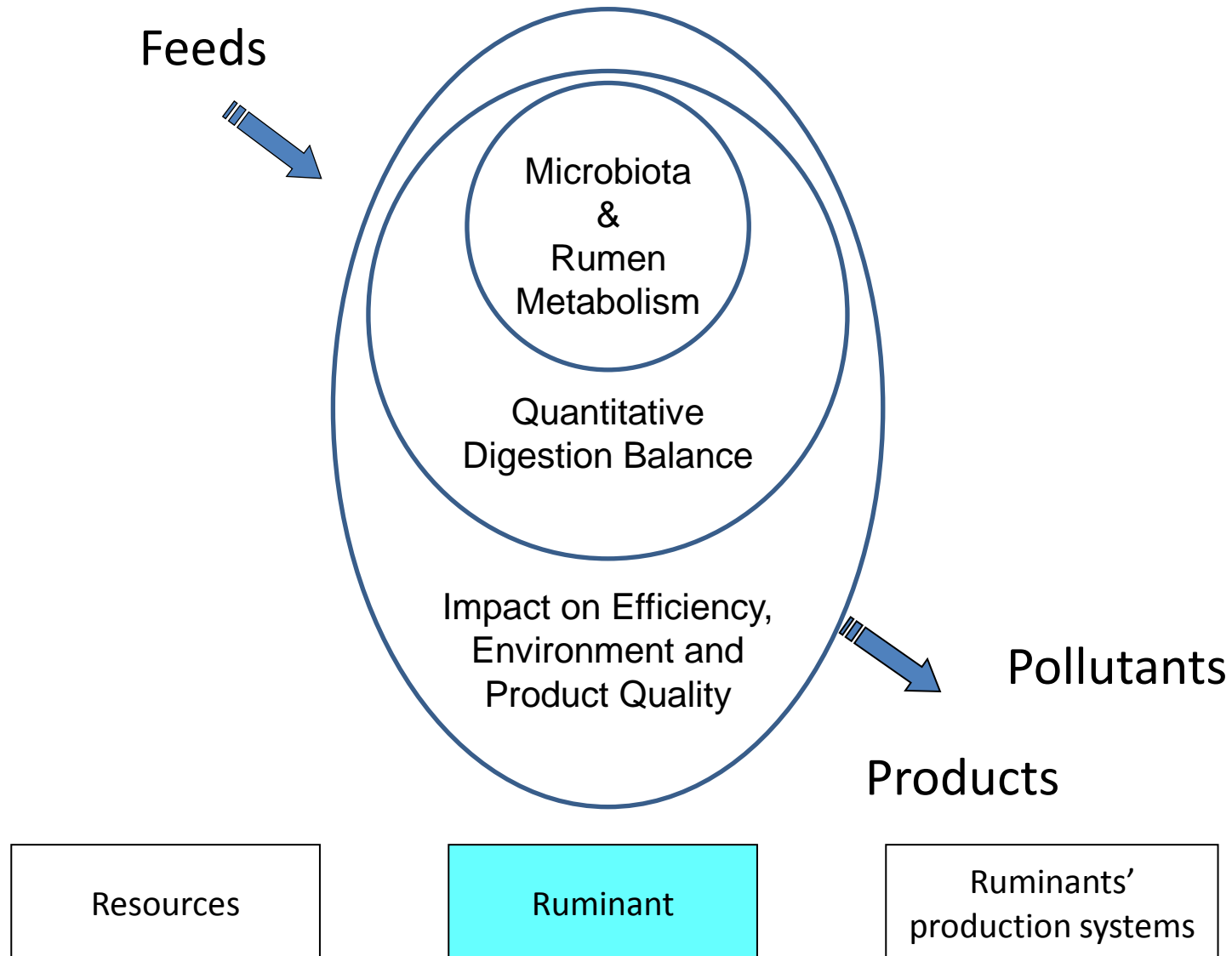
- to meet production, protection of the environment, animal welfare
- to analyse resistance of farming systems to aleas (climatic, economical, political)
- to increase biodiversity thanks to pasture management
- to increase quality of products = asset for rural development (eg AOP)
- to study the GHG balance emission from animals/retention by pasture
- to improve animal welfare on the farm and at slaughter, as well as during experiments



UR Herbivores teams

- 8 (→7) research teams
 - behaviour (2): welfare (ACS), foraging (Rapa)
 - metabolism (2): mammary gland (AGL), muscle (Amuvi)
 - digestion (1 Dima)
 - production system (2): efficiency (Sybel), economy (Egee)
- 2 support teams
 - administration and technical services
(mechanics, electronics, computer, surgery)
 - experimental farm and slaughter plant

Microbial Digestion and Absorption



Microbial Digestion and Absorption

- ✓ **Methane production**
- ✓ **N utilization and excretion**
- ✓ **Acidosis**
- ✓ **Fatty acids and milk composition**
- ✓ **Mycotoxins**
- ✓ **Micronutrients to improve the nutritional and organoleptic quality of milk and meat (e.g. flavonoids)**

Reduction of CH₄ emissions

Our activities

- Mechanisms of methane production
- Methane emissions as affected by feeding
- Life Cycle Analysis of GHG emissions
- French inventory & prospective scenarios

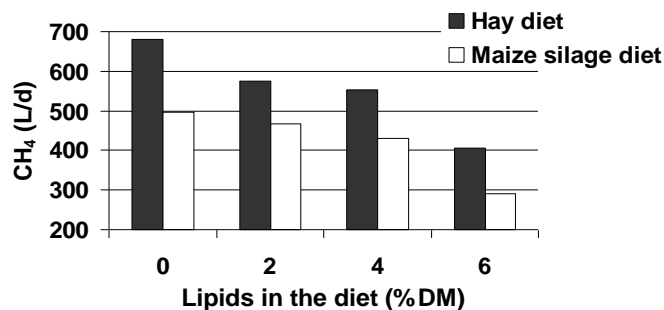


Our approach

- Rumen microbes
- Nutrition & animal level
- Herd and farm level

Result Example

Effect of linseed as feed mitigation option



■ A dietary supply of linseed lipids decreased CH₄ production with hay and maize silage diets without altering milk yield

■ The extent of abatement was linearly proportional to the amount of linseed supplementation

Team: Dima

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Metabolism Exploration Platform

This facility is equipped with about 10 different instruments in mass spectrometry and isotopic mass spectrometry.

- **GC-MS** quantification or fluxomic studies (high isotopic enrichments)
- **GC-C-IRMS** fluxomic studies (very low isotopic enrichments)
- **LC-QqQ** quantification or fluxomic studies
- **LC-ToF** metabolomic studies
- **LC / NMR / ToF** metabolomic studies with **Metabolic Profiler**
- **Hrmass**

The laboratory offers an access to the following instruments:

- **LQT Orbitrap et FT-ICR MS** metabolomic studies (Paris VI University, Paris, France)

Experimental facilities

1. Experimental Farm

- 230 ha
- 60 dairy cows
- 120 beef cattle
- 650 sheep
- 50 goats





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Experimental facilities

1. Experimental Farm

2. Experimental Unit Monts d'Auvergne

- > 1000 ha
- 240 dairy cows
- 300 beef cows
- ~300 heifers and fattening cattle
- 200 ewes