Welcome to Europe
Bienvenue en France
Degemer mater Breizh
Bienvenue à Rennes
From R&I to Impact:
Improving the efficiency and sustainability of monogastric livestock production systems

Jaap van Milgen
INRAE
Feed-a-Gene

Adapting the feed, the animal and the feeding techniques to improve the efficiency and sustainability of monogastric livestock production systems

(www.feed-a-gene.eu)
Adapting the feed, the animal and the feeding techniques to improve the efficiency and sustainability of monogastric livestock production systems.

It is about efficiency

feed efficiency = daily gain / feed intake?

The food efficiency of these musicians and giant pandas is zero.
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It is about sustainability

The Efficiency of the Animal Compared with the Steam Engine. It is of interest in studying the efficiency of the animal as a converter of energy in work and food production to compare it with a mechanical energy converter such as the steam engine. We have recently been confronted with the phenomenon of the burning of corn for fuel in place of the usual use as a food for animals or man. The economy of this substitute conversion might help solve the question of the ethics of such a substitution. Van de Velde has presented some figures to show that

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It is about variation

Variation among individuals is natural, essential, and very well controlled
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It is about observing
It is about observing
It is about understanding and complexity

The human body completely changes the matter it is made of roughly every 8 weeks, through metabolism, replication and repair. Yet, you're still you --with all your memories, your personality...

If science insists on chasing particles, they will follow them right through an organism and miss the organism entirely

(Robert Rosen)
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It is about control

**Observe** variation in feeds, animals, and the environment

**Predict** using concept-driven and data-driven models

**Understand** the underlying mechanisms

**Control** through livestock management
Objectives of the project

Feed:
- Develop new local feed resources that are not/less in competition with food
- Improve the nutritional value of feed resources

Gene:
- Identify novel traits indicative for feed efficiency and robustness that can be used in livestock management
- “Do better with feeds that may be worse”

Traits, models, and feeding techniques:
- Appreciate variation among animals
- Develop precision feeding techniques
- Evaluate the overall sustainability
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Feed-a-Gene

**Feed**
- Academic partners
  - Feed ingredient producer
  - Enzyme producer
  - Feed processing equipment manufacturer

**Traits, models, and feeding techniques**
- Academic partners
  - Precision farming equipment manufacturers

**Gene**
- Academic partners
  - Pig breeder
  - Poultry breeder

Interbranch organizations
- Extension services

17/02/2020 Final conference
Diversify to increase protein autonomy

European-grown soybean

Protein from green biomass

Rapeseed meal
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Novel traits to observe variation:

**behavior and welfare**
- Image analysis
- Serotonin, cortisol

**digestive efficiency**
- Digestibility markers
- Gut health
- Microbiota

**individual feed intake**
- Feed intake patterns
- Feeding behavior

**metabolic efficiency**
- Transcriptomics
- Proteomics
- Metabolomics
New traits and models for the genetic improvement of feed efficiency

Highly protected conditions

Pure line nucleus

Test

Genetic correlation between optimal and sub-optimal conditions ≠ 1 ➔ Reranking of performers

Multipliers

Genetic correlation between purebred and crossbred performance ≠ 1 ➔ Reranking of performers

Crossbreds

Commercial conditions
Modeling biological functions to understand and to predict

Nutritional growth models such as InraPorc use digestible nutrients as model inputs …

… to predict performance traits of a single animal in a “standard” environment
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Precision livestock feeding is about observing, predicting, and control

How much will this pig eat tomorrow?

And how much will it grow?
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Objectives of the final conference

Impact

Feed-a-Gene

R&I project

Technology Readiness Levels

System Test, Launch & Operations

System/Subsystem Development

Technology Demonstration

Research to Prove Feasibility

Basic Technology Research

TRL 9

TRL 8

TRL 7

TRL 6

TRL 5

TRL 4

TRL 3

TRL 2

TRL 1

17/02/2020 Final conference
Adapting the feed, the animal and the feeding techniques to improve the efficiency and sustainability of monogastric livestock production systems

Program

- **Wednesday January 22, 2020**
  - Plenary session
  - Interactive coffee session
  - Presentation of results of the project
  - Lunch
  - Discoffeery session
  - Workshop session 1: from R&I to impact (2 themes)

- **Thursday January 23, 2020**
  - Workshop session 2: from R&I to impact (2 themes)
  - Coffer break
  - Sustainability appraisal
  - Wrap-up of the workshops
  - Foresight discussion: What is the future for livestock production?
Themes of the workshop sessions

- New feeds and processes and nutrition: protein supply, assessment of nutritive value
- Big data and modelling
- Genetics and breeding: new traits, bioindicators, and breeding schemes
- Novel feeding technologies: precision feeding
From R&I to impact

World café setting

Plenary sessions
Discoffeery session

Workshop theme 2

Workshop theme 1

SWOT analysis

<table>
<thead>
<tr>
<th></th>
<th>Positive</th>
<th>Negative</th>
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<tbody>
<tr>
<td>Internal</td>
<td>Strengths (S)</td>
<td>Weaknesses (W)</td>
</tr>
<tr>
<td>External</td>
<td>Opportunities (O)</td>
<td>Threats (T)</td>
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Organization of the workshop sessions

- **Workshop session 1:**
  - S and W identified by the Feed-a-Gene partners
  - Amendment of S and W by participants
  - Identification of O and T

- **Workshop session 2:**
  - Presentation of SW and OT elements identified in session 1
  - Amendment of O and T by participants
  - Identification of “How to capitalize on O and minimize T”
    - Further development and application
    - Future research priorities
    - Legislation