Summary Results WP5: Use of traits in animal selection

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5 year research for Breeding towards improved Feed Efficiency

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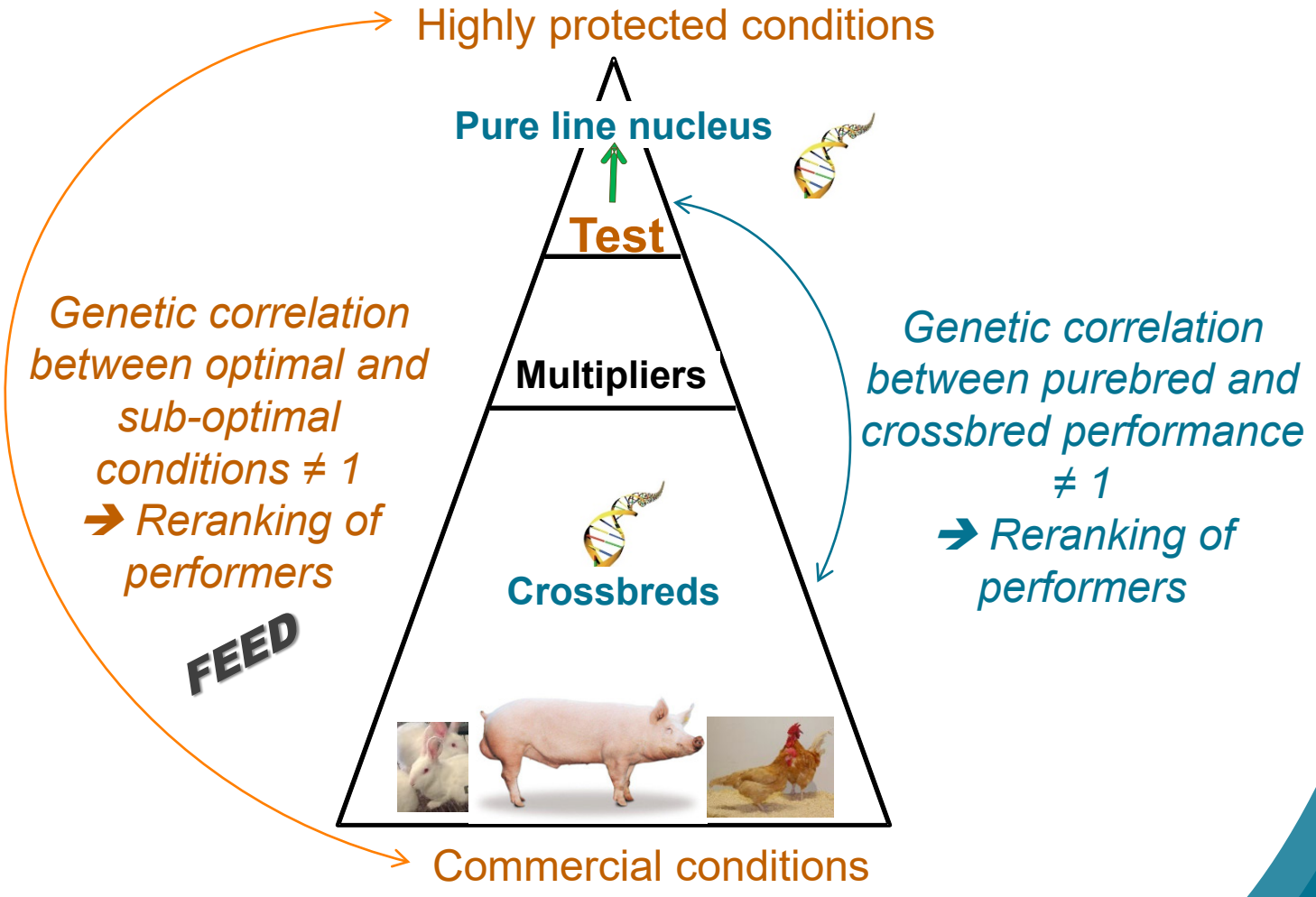
WP2 New animal traits for innovative feeding and breeding strategies
WP5 Use of traits in animal selection

New traits and models for genetic improvement of feed efficiency without impairing product quality, welfare and robustness



Challenges for WP5 Feed-a-Gene

- **More accurate predictions of crossbred feed efficiency?**
  → Increase EBV accuracies using:
  - Cheaper/easier measurements
  - Crossbred information
  - Additional components in models (penmates influence, dominance, time)

- **Make animals more feed efficient when breeding conditions vary (diets, feeding regimens, environment…)?**
  - Decomposing feed efficiency
  - Understanding which components play a role in different situations
  - Analysing the variability of the responses depending on the conditions

Objectives of WP5

- Inheritance of new feed efficiency traits (WP2) studied using classical & new genetic models (Task 5.3).
  - Considering indicators of robustness, welfare, and product quality
- Obtain genomic and physiological indicators of feed efficiency (and its components) using high throughput methodologies.
  - When possible, nutrigenomics approaches will be applied.
- These new traits will be used to propose new breeding strategies in Task 5.4.

New traits – at the animal level

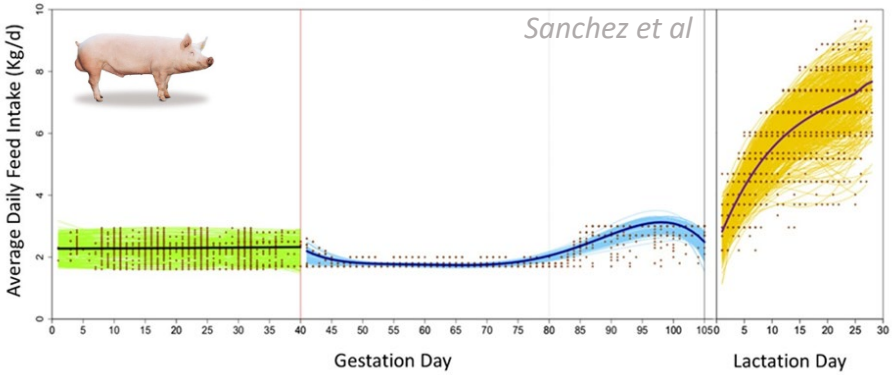
Direct measures of feed intake (WP2)

Broiler feed intake

Rabbit feed intake

- Large gains from individual measures of growing animals

Gestation and lactation feed intake



- Refined modelling of feed intake throughout gestation and lactation

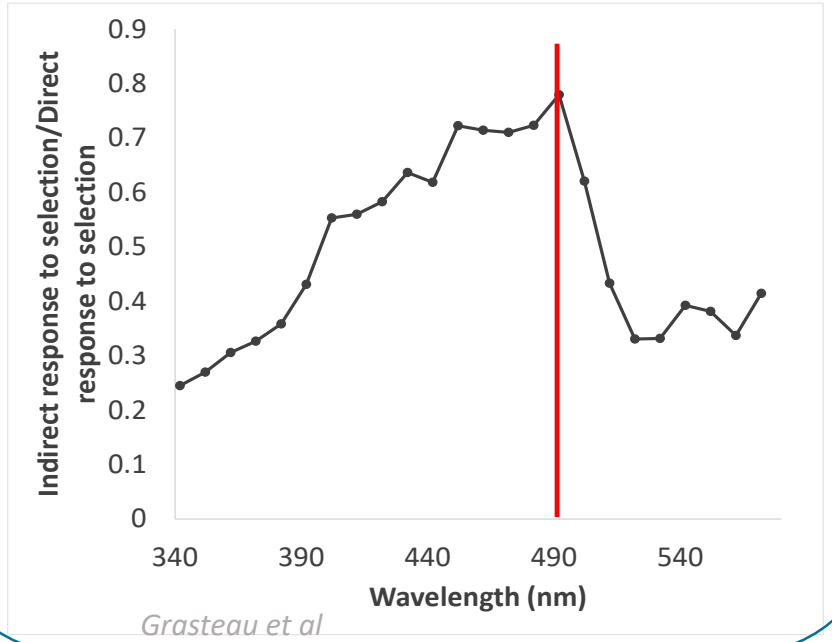
New traits – at the animal level

Indicators of feed efficiency

→ Biomarkers

Serum colour with:	r_g ± SE
Digestive efficiency	0.84 ± 0.28
Body weight	0.29 ± 0.27
Feed intake	-0.45 ± 0.22

Genetic gain in digestive efficiency with selection on colour of broiler blood serum



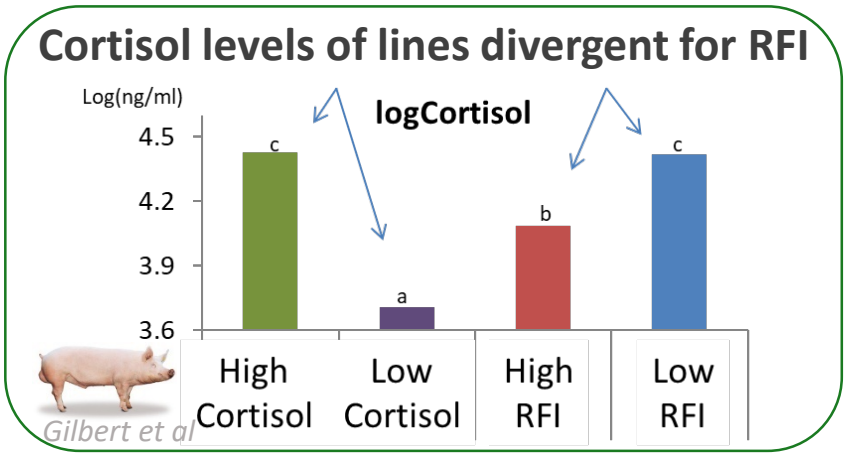
Grasteau et al

New traits – at the animal level

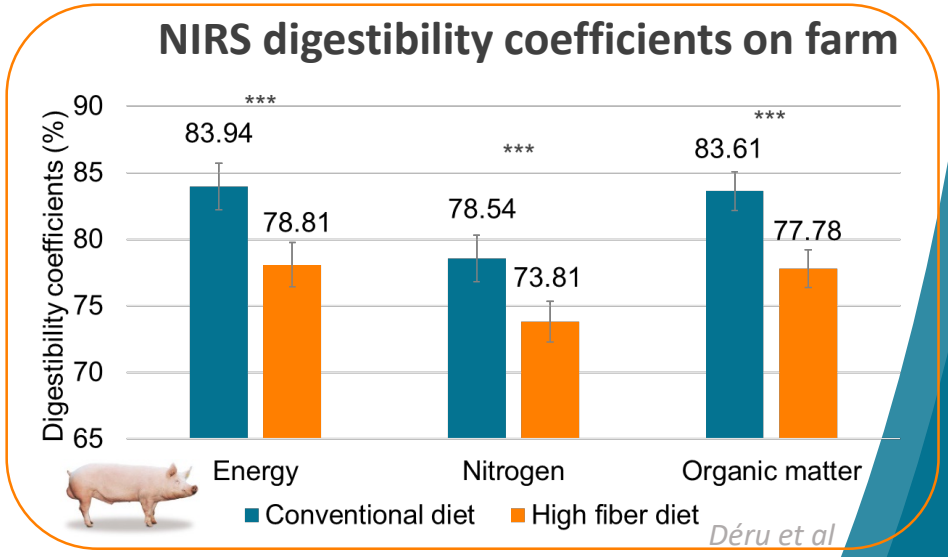
Measures of components of feed efficiency

Behaviour/aggressiveness - welfare/robustness - digestibility

Agha et al



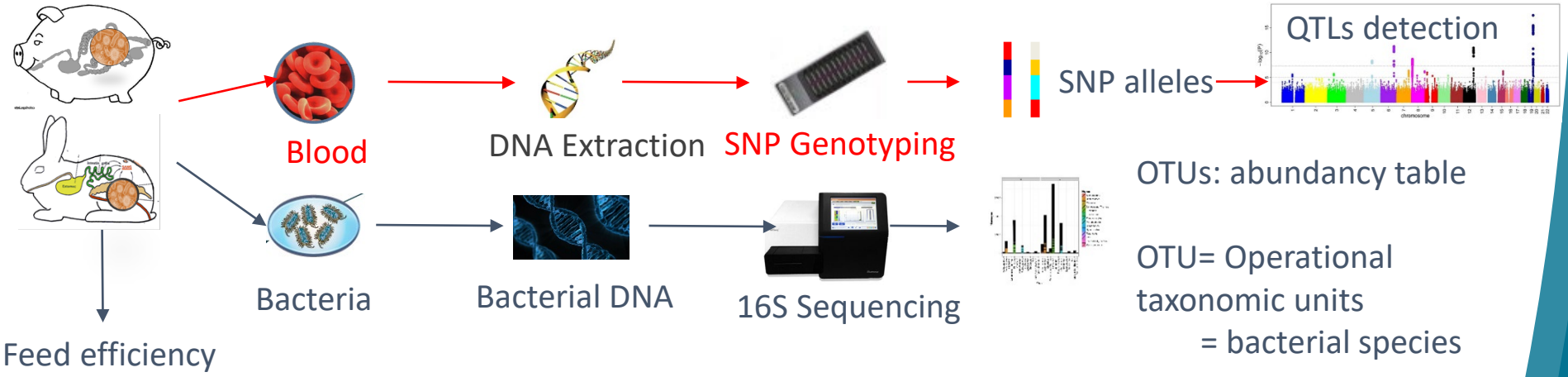
Gilbert et al



Déru et al

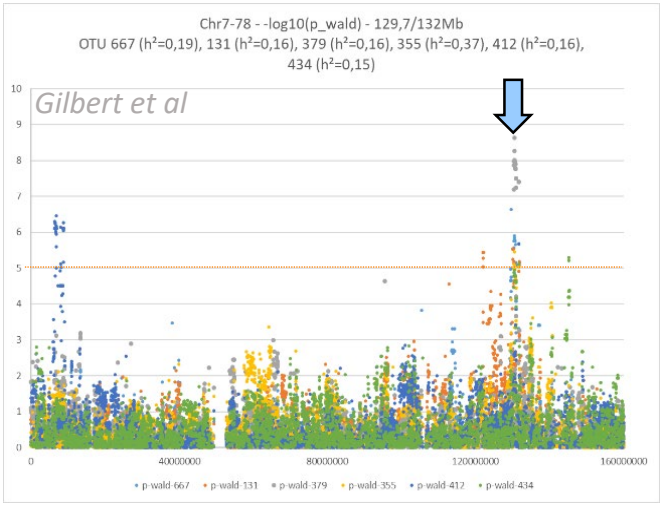
- No adverse relationships with behaviour or robustness indicators
- To test in selection strategies to select for better dietary fibre digestion

New traits – from microbiota

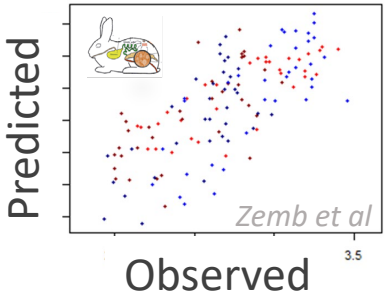


OTUs: abundancy table

OTU= Operational taxonomic units
= bacterial species



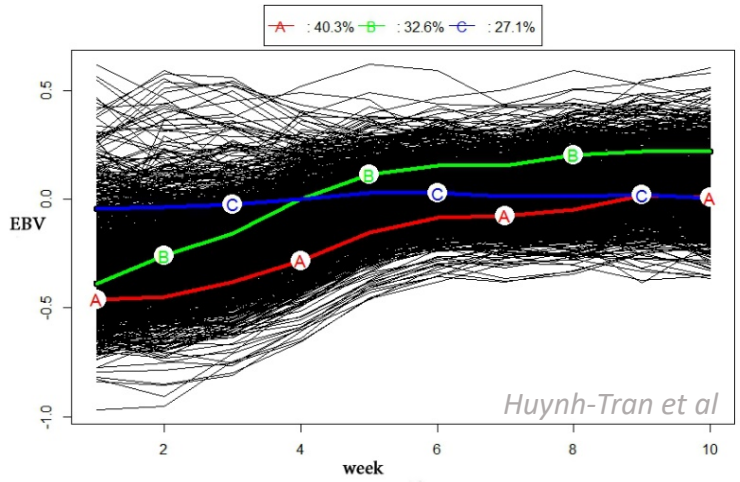
FCR predicted from OTU R^2=0.53

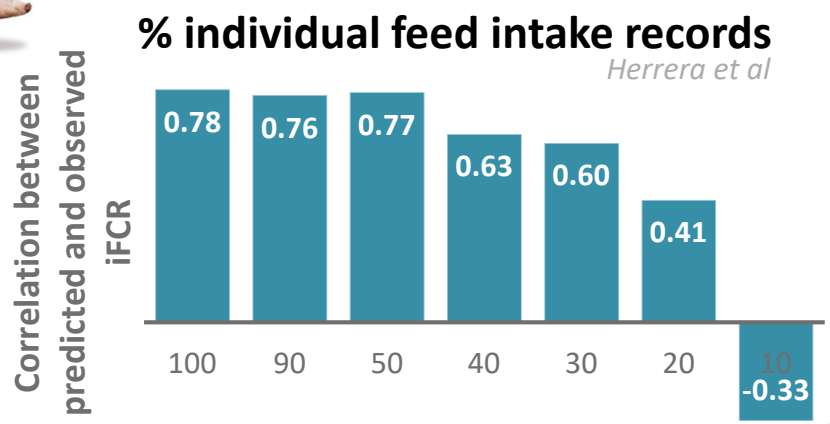


- A genetic control of gut microbiota
- Added value for prediction of feed efficiency?
- Large sensitivity to external factors (feed, antibiotics, temperature…)

New statistical models

- **Models to improve response on feed efficiency**
  - Analysis of feed efficiency over time
  - **Use of group records to select for feed efficiency** of animals under different feeding regimens





- Potential gains in identifying time dependent patterns of changes of feed efficiency
- Accurate FCR predictions with combined group and individual feed intake records

New statistical models

- **Models to account for indirect effect (social effects) on feed efficiency**
  - GxF interaction for direct (DGE) and indirect effects (IGE)

Piles et al

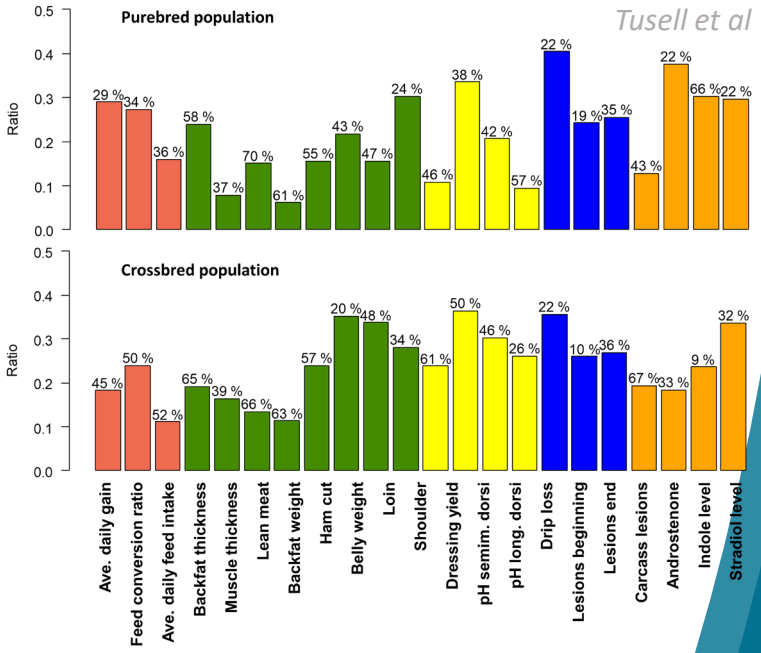
- **Models to account for individual's environmental sensitivity**
  - Genetic analysis of residual variation for multiple traits, **suggest some common genetic basis of responses to environmental variability**

Bodin et al

Using crossbred (genomic) information

- Architecture of the traits:
  - Additivity & dominance: dominance limited to 9% (PB) and 12% (CB) of feed efficiency variability
  - → not much impact expected

Tusell et al



- Which genomic prediction model to use?
  - Use metafounders in crossbred genomic evaluation: same genetic gains, but may ease calculations

van Grevenhof et al

- Propose new selection strategies for feed efficiency

Aldridge et al

Looking forward

- Using new traits & measures:
  - Individual feeders in rabbits and poultry
  - Group records in pigs, to increase genetic gain at low cost
- Promising indicators of FE (further validation needed):
  - Digestibility measurements
  - Microbiota analyses
  - Biomarkers
- Evaluate genetic gain FE with best indicators