Profile N° (à remplir par VAS)	FUNDING Planned
	Obtained 100% (Feed-a-Gene)

Sheet abstract of thesis 2015	**Disciplinary Fields Agronomy** et Autres

Thesis Title : (1-2 lines)
Generic modeling of pigs growth when then animal is facing environmental perturbations

3 keywords : (1 line) **Modeling /Challenge / Pig**	**ACRONYME** PigModel

Unit/Team of supervising : (1-2 lines)
UMR Pegase; équipe Croissance

Name of the scientific director and co-director : (1 line)

Jaap van Milgen (director) and Masoomeh Taghipoor (co-director)

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Socio-economic and scientific context : (10 lines)

Farm animals are constantly facing fluctuations in their environment and farm conditions, which influence their health and production performance. With novel monitoring technologies, it is now possible to evaluate the impact of these perturbations on animal performance in real time and with a high frequency. A better understanding of the adaptation mechanisms used by the animal to cope with and to adapt to single and multiple challenges (through resistance and resilience) is important to propose adequate farm management strategies. Taking into account environmental perturbations in farm management and, subsequently, predicting the response of pigs are also important for the development of precision livestock farming systems.

Assumptions and questions (8 lines)

The response of an animal when facing perturbations can be considered as deviations from a standard performance trajectory, which are characterized by the intensity and duration of the perturbation. Our working hypothesis is that a perturbation influences not only the voluntary feed intake of the animal (nutrient acquisition) but also the partitioning of nutrients between productive and non-productive functions (nutrient allocation). The response strategy of the animal may also differ for short-term and long-term perturbations and are affected by the adaptation potential of the animal (robustness). The main question addressed in this thesis project is to propose a modeling method to detect deviations from ideal performance trajectory in growing pigs and, subsequently, to develop a mechanistic model to describe the influence of these perturbations on feed intake and nutrient allocation.

The main steps of the thesis and demarche (10-12 lines)
Several nutritional models for growing pigs exist, but these models assume that the animals are kept in a standard and constant environment. The InraPorc model (inraporc.inra.fr/inraporc/), developed in our laboratory, is one of these models and the objective of the thesis project is to further develop this model by integrating the animal's response mechanisms to environmental perturbations (e.g., thermal and sanitary stress). The project is based on complementary approaches of mathematical modeling and use of data from previous experiments. The thesis project is part of a work package on modeling of the European Feed-a-Gene project (www.feed-a-gene.eu), which aims to develop a mechanistic model for monogastric animals taking into account digestion, metabolism, variation among individuals, and, for this thesis project, the effect of perturbations. The PhD project will also use data on sanitary stress and its influence on animal performance obtained from the European ProHealth project (www.fp7-prohealth.eu).

Methodological and technical approaches considered (4-6 lines)

This interdisciplinary thesis project is based on the biology of animal production and mathematical modeling and the thesis supervisors have research experience in these fields. The animal is considered as a complex biological system for which it is not possible to understand and predict its response by simple intuition and a modeling approach is privileged to represent the complexity of the adaptive response of the animal. Data from animal experiments are essential to develop and validate the model, especially to use the model as a predictive tool in decision support systems. These data are provided in the collaborative framework mentioned above.

Scientific and technical skills required by the candidate (2 lines)
The candidate should possess skills in the biology of animal production (including in animal physiology and metabolism) with an interest in mathematical modeling. Good oral and written communication skills in English are required to exchange with other partners of the Feed-a-Gene project, to write publications, and to report the results at scientific conferences.