# Modelling Animal Robustness: Towards a Quantitative Understanding of the Biological Basis

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Internship proposal for : Master 1 or Master 2

Laboratory

Modélisation Systémique Appliquée aux Ruminants
UMR 791 INRA - AgroParisTech
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Director : Nicolas Friggens
Main discipline : Molecular biology/Systems Biology

Supervisor

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Subjects / Tools-Methodologies

1 : Quantitative biology/Dynamic modelling
2 : Physiology/Experimentation, metabolite analyses
3 : Modelling systems/Evolutionary theory, basic appllied mathematics

Summary of lab's interests

The INRA-AgroParisTech mixed research unit MoSAR brings together researchers and lecturers with backgrounds in animal nutrition, behaviour, rumen physiology, lipid metabolism, and modelling around a common research theme: Quantitative description of the processes by which ruminants acquire, ingest, digest, metabolise, and partition resources to production and other life functions. To achieve this, MoSAR is actively involved in knowledge generation through experimentation and modelling of the animal-feed complex. The Unit has a research herd of 120 goats and laboratory facilities for in vitro studies and nutrient analyses. The outcomes of this work will be: 1) improved tools to predict animal performance according to nutritional environment and physiological state, 2) the means to characterise individual differences between animals in their ability to adapt to challenges, and the underlying mechanisms. These two aspects are key to predicting the consequences of management and selection strategies on animal and system robustness.

Summary of project

Spectacular increases in the productivity of farm animals have been achieved by the use of genetic selection on production traits together with improved management, especially nutrition. However, this has had negative consequences on reproduction, health and longevity in the major livestock species. Modern livestock are less able to cope with environmental challenges, they are less robust. In this context, it has been shown that accelerating early reproductive performance can cause lasting physiological damage and thus decrease long-term performance and robustness. Further, there is evidence of emerging genotype environment (GxE) interactions for production and also for traits such as fertility and longevity. This evidence of emerging GxE interactions supports the notion that robustness is being adversely affected by selection. However, we currently lack the ability to predict the robustness of an animal to nutritional challenges at different stages in its life cycle. The purpose of this project is to use a modelling approach to examine the biological concepts underpinning robustness and trade-offs between life functions so as to develop the basis for predicting the consequences of selection and management on robustness