

## Postdoctoral fellowship: Modelling lifetime trajectories of beef and dairy cattle to predict animal and production system resilience and efficiency in future scenarios

**Duration:** 36 months

**Expected starting date:** June 2019

**Gross salary:** around 2 300 €/month (depending on experience )

**Host institution:** INRA (French National Institute for Agricultural Research)

**Research Units:** UMR 791 MoSAR Modélisation systémique appliquée aux ruminants 16 rue Claude-Bernard, 75005 Paris ([http://www6.jouy.inra.fr/mosar\\_eng](http://www6.jouy.inra.fr/mosar_eng)) and UMR1348 PEGASE Physiologie, Environnement et Génétique pour l'Animal et les Systèmes d'Élevage, 35590 Saint Gilles ([https://www6.rennes.inra.fr/pegase\\_eng/](https://www6.rennes.inra.fr/pegase_eng/))



**Context & mission:** the postdoctoral fellow will join an interdisciplinary European project (funded by Research and Innovation H2020 program) called GenTORE (“GENomic management Tools to Optimize Resilience and Efficiency”). GenTORE will develop innovative genome-enabled selection and management tools to empower farmers to optimize cattle resilience and efficiency (R&E) in different and changing environments. Ensuring these tools are sustainable implies evaluating the consequences of breeding strategies (including pursuing different genomic selection goals) under various scenarios of climate change, and that no trade-offs or unexpected side effects arise. The project will use existing systemic models that allow the representation of the herd and crops within a local production environment. A database will be developed to quantify the major resilience components in adult cows and the relationship with efficiency in order to weight resilience vs efficiency components according to the local production environment. This knowledge at animal level will be brought to herd and production system levels to ask “what if” questions, e.g. what are the economic consequences at herd level of a given breeding strategy, and how would they play out across different local production environments. The project will then develop simulation tools to predict the consequences of different selection strategies in different environments. The expected results will contribute to the definition of strategies of selection to combine efficiency and resilience. The project will provide a coherent framework to undertake a balanced genetic selection on these traits, and thereby make a significant - and lasting - contribution to improving production system resilience.

The main mission of the postdoc will be to i) extend an existing dynamic model at animal level to represent various breeds (dairy and beef cows) and to incorporate resilience in lifetime trajectories; ii) integrate this building block in an individual-based population model including management rules (feeding, culling and breeding) and trans-generational transmission of parameters/phenotypes; iii) combine the herd model with a crop model simulating feed availability depending on management, soil and climate conditions and iv) design and run simulation studies to evaluate the consequences of climate change on on-farm forage resources and of breeding strategies under different climate change and feed resource availability conditions. This modelling work will have to combine dynamic modelling components with quantitative genetic approaches.

The postdoc fellow will work in two teams located in Paris (UMR MoSAR) and Saint Gilles (UMR PEGASE). The main location will be Paris with some periods in Saint Gilles. The ideal candidate will have the following characteristics:

- 1) Excellent communication skills to interact in an interdisciplinary environment (geneticists, animal and crop scientists and modellers)
- 2) Expertise in modelling dynamic systems (ODE, parameter estimation, sensitivity analysis) and dedicated software
- 3) Good knowledge and/or strong motivation in biological systems
- 3) Previous experience in quantitative genetics will be a plus
- 4) Expertise in R and Python languages will be a plus

**Job application:** the interested candidates should contact Nicolas Friggens ([nicolas.friggens@agroparistech.fr](mailto:nicolas.friggens@agroparistech.fr)) and Philippe Faverdin ([philippe.faverdin@inra.fr](mailto:philippe.faverdin@inra.fr)) before March 4<sup>th</sup> 2019 providing a detailed CV, letter of motivation and the names of two scientific references.

### *Some research articles of our teams*

Friggens N.C., Blanc F., Berry D., Puillet L., 2017. Review: Deciphering animal robustness. A synthesis to facilitate its use in livestock breeding and management. *Animal*, 11:12, 2237-2251. DOI: 10.1017/S175173111700088X.

Graux, A. I., G. Bellocchi, Lardy R., Soussana J.F., 2013. Ensemble modelling of climate change risks and opportunities for managed grasslands in France. *Agricultural and Forest Meteorology* 170: 114-131.

Puillet L. and Martin O., 2017. A dynamic model as a tool to describe the variability of lifetime body weight trajectories in livestock females. *Journal of Animal Science*, 95, 4846-4856. DOI:10.2527/jas2017.1803

Puillet L., Réale D., Friggens N.C., 2016. Disentangling the relative roles of resource acquisition and allocation on animal feed efficiency: insights from a dairy cow model. *Genetics Selection and Evolution*, 48:72.