PRECISION LIVESTOCK FARMING AND BREEDING IN WALLONIA,
THE NEXT CHALLENGES TO INCREASE ANIMAL WELFARE AND SUSTAINABILITY IN DAIRY PRODUCTION

Scientific context:

Animal welfare is an increasing concern in dairy production. Consumers want an ethical production while farmers want to ensure the health of the animals and the sustainability of their farms. Animal welfare measurements at the herd level using established protocols already exist but are time-consuming and costly. Those problems prevent the development and implementation of welfare monitoring tools in the field and their efficient use for management and breed. Moreover, assessing the overall well-being at the animal level becomes a challenge, as herd measures for welfare cannot be directly translated to the animal level. Two projects, active in the Walloon Region of Belgium, HappyMoo (Interreg NWE) and ScorWelCow, are trying to develop innovative methods around individual welfare scores and their prediction from routinely collected measures.

Another current trend in the animal production is the increasing influence of advance data collection technologies multiplying the number of traits collected from various sources. This leads to the accumulation of highly repeated, longitudinal data and, requiring its consolidation and allowing its use in data-driven models in order to assist farmers. This trend, called Precision Livestock Farming (PLF), serves many purposes, the most obvious being the monitoring of animals and the improvement of the efficiency of the farms. Monitoring helps in farm management by detecting problems and allowing a quick reaction. However, developing such monitoring method and extending them to decision support tools is complex. Animals are subject to many different influences and stresses from their environment that impair their welfare, health, longevity and productivity. Under the current circumstances of climate change, among those stresses, more frequent and more severe heat stress is a major concern. Associated to PLF is Precision Livestock Breeding (PLB), while sourcing on the more and more extended availability of genomic data, allows PLF to include profound knowledge about the genetic strengths and weaknesses of individual dairy cows.

The project and its challenges:

As explained above, the current context of PLF and PLB generates a very rich and stimulating environment in Wallonia where multiple challenges appear requiring novel and ingenious approaches to solve these issues. Therefore, this proposal is not a single, very precise topic, but an opportunity for applicants, according to their interests, to develop innovative research in line with several major topics currently under development in the host laboratory. The most important sub-projects, that were identified, are:

Exploiting the new, highly repeated, measurements from sensors using appropriated strategies (e.g., time-series):

New sensors are collecting new measures about animals such as Heart Rate, Rumination Time, … Automatic milking systems are collecting milk yields and more and more milk components, but also other functional traits as bodyweight and udder conformation or even methane emissions. Those measures are repeated frequently and new approaches (e.g., based on time-series) are required to model and interpret this type of data. Moreover, given the simultaneous nature of these measurements on the same animal, this data can also be interpreted as correlated highly-dimensional data.

Developing new breeding values for novel phenotypes and using them in advisory tools:

The host laboratory has a strong expertise in estimating breeding values for the industry in Wallonia, Europe and the USA. Through different projects, we collaborate with teams around the World that are developing new welfare traits (e.g. through new stress indicators). Advanced modeling of these novel phenotypes will allow to estimate relevant breeding values and to develop adapted strategies to add this knowledge to decision-support tools aiming for improved cow welfare and, subsequently, sustainability of dairy cattle production.

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[1] The project could be extend to 4, 5 or 6 years. A successful applicant will have the possibility to apply in 2021 and 2022 for a FRIA (3 additional years) or a FNRS (4 additional years) grant. One of the underlying projects will be most likely renewed allowing access to up to 2 additional years.

Contribution to the development of novel and advances computational strategies (e.g., GPU based):

Our team has been involved in the development of computational strategies for big data analysis and modeling tools (e.g., mixed models). Also in this field, new opportunities are emerging and among them, the use of Graphics Processing Units (GPU). GPUs are more efficient than general-purpose central processing units (CPUs) for algorithms that process large blocks of data in parallel. Currently, the most efficient way to solve many recent modelling challenges (e.g., highly dimensional data, dense genomic data) is the development of parallel computing where GPUs are ideal. The successful PhD student would contribute to new methods and approached to optimally adapt the models to the new type of computational environments. In this sub-project, access to the LUMI supercomputer will be provided (https://www.lumi-supercomputer.eu/lumi-consortium/).

Working Environment:

The position is currently open at Gembloux Agro-Bio Tech (ULiège) which is at the forefront of research in this field in Wallonia. The Numerical Genetics, Genomics and Modeling group has a strong experience in the context of animal production, numerical analysis, and animal breeding. The group is made up of international researchers collaborating at the international level for different projects as in recent European projects (RobustMilk, GreenhouseMilk, GplusE, 2-Org-Cows, OptiMIR, HappyMoo, Bluesel and Bluester) and many local Walloon projects (e.g., ScorWelCow).

What we offer:

The position offers an opportunity to develop her/his own PhD research in an international research laboratory having strong international scientific contacts but also contacts with key stakeholders in many countries and organizations (e.g., ICAR, INTERBULL). Those contacts will help the research to create an impact in the field and to develop your future career. This offer includes:

- A 24-month contract as full-time PhD (grant scheme, but fully social-secured)
- A potential extension to at least 4 years:
    o Pending motivation and success of the PhD student for a FRIA/FNRS grant application
    o Success of a pending research applications (most likely renewed project)
- A net monthly salary of 2100 €.
- The opportunity to develop your own research project according to the main objectives outlined here.
- The opportunity to travel abroad (short-term, long-term) and exchange knowledge with colleagues.
- The opportunity to make your research matter…

Responsibilities:

- Data management
- Data analysis of large amounts of data
- Participating in project meeting to make the project evolve
- Writing publications in scientific journals

Requirements:

Holding a Master degree in relevant fields (e.g., (bio-)engineering, agricultural (animal) science, (bio-)statistics, data science, (bio-)informatics or other related disciplines) is required. A mention of "Distinction" (*cum laud*e) by the time the applicant starts her/his work is required, but last year students finishing in September can also apply.

Method of application and deadline: September 15, 2020

By e-mail, please send us (Prof. N. Gengler (nicolas.gengler@uliege.be), CC to Mr. S. Franceschini (sfranceschini@uliege.be)) your CV and motivation letter. Please do not forget to mention two reference persons that we might contact. Please put our reference "Job Offer 202009" and your name in the subject line.

Contact:

For any questions, please contact Prof. Gengler (nicolas.gengler@uliege.be)