RUMIGEN: Towards improvement of RUMinant breeding through GENomic and epigenomic approaches

The RUMIGEN project (Towards Improvement of Ruminant Breeding Through Genomic and Epigenomic Approaches) officially began on June 1st, 2021. The consortium including 18 partners and nine European countries gathered during a virtual meeting at the end of June – early July 2021 to share constructively a lot of information.

RUMIGEN is a 5-year H2020 European project that is coordinated by Eric Pailhoux from the UMR BREED. Members of GABI's G2B and MoDiT teams participate in almost all the workpackages (WP), ensuring the coordination for some of them. The aims of this project are to improve and renew genomic selection in cattle within a context of climate change and agroecology, based on three levers: (i) quantitative genetics, (ii) epigenetics, and (iii) the possible use of new technologies for targeted modification of the genome (GE: Genome Editing). In addition to these biological levers, the RUMIGEN project includes a lever in the social sciences and humanities in order to propose new methods and objectives for breeding that are ethically accepted by European citizens. The implication of a group of multi-actors (selection companies, associations for the defence of animals, governmental committees) began by a virtual meeting where many viewpoints were exchanged. These biennial meetings should make it possible to define the main lines around the acceptability/non-acceptability of breeding practices.

The 'genetic' part of the project is aimed at (1) measuring the adaptative potential of bovine populations to climate change and to propose selection objectives for future breeding conditions and (2) developing selection methods that conserve diversity and limit genetic burden in order to increase the resilience of animals faced with more difficult conditions. The 'epigenetic' part of the project is focused on studying the impact of genetics and environmental parameters, in particular heat, on the epigenetic markers of different tissues and the prediction potential of performances using methylation markers. A high-throughput epigenotyping microarray will be developed to characterize a large population and measure in real conditions the gain in precision contributed by epigenetics. Finally, the 'gene editing' part of the project will explore the domains where GE could be useful in ruminants and will test (i) the putative impact on the rate of de novo mutations and (ii) its efficiency compared to classical crossbreeding.

Finally, the central idea of the RUMIGEN project is to adapt ruminants to climate change with the development of new breeding strategies aimed at "buffering" the deleterious effects in an approach involving the civil society. A workpackage is dedicated to the integration of all these approaches to offer operational solutions for a renewed selection. Thus, the RUMIGEN project fits perfectly into the four main scientific objectives of the Animal Genetics division.

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