



TOWARDS IMPROVEMENT OF **RUMINANT BREEDING**
THROUGH **GENOMIC** AND **EPIGENOMIC** APPROACHES

NEWSLETTER

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Editorial

Eric Pailhoux

RUMIGEN Coordinator



Dear RUMIGEN Partners,

First of all, I hope you had a wonderful festive season and that you're all in good shape to start the new year 2025 in a world that many people are predicting as new (let's see...). With about fifteen months to go before the end of the contract, RUMIGEN is entering the money time with more and more deadlines (two reporting periods and two meetings in one year). The research efforts of the last four years will have to be put into practice if we are to achieve the ambitious goals initially set. I am confident that together we can rise to the challenge and bring this project to a brilliant conclusion, clearly defining the scientific advances made in RUMIGEN and the prospects opened up by the project in terms of sustainable breeding for Europe.

At the beginning of this year, eagerly awaited results should be available on two aspects of the RUMIGEN contract, the epigenetic aspect and the societal aspect. These results will certainly be the subject of much discussion at the fourth annual meeting to be held at the next annual meeting in Oslo, Norway on 17, 18 and 19 June. On the epigenetic side, I hope we will begin to see whether the use of the epiChip improves prediction of selection in cattle, as hypothesized expected. On the societal side social science side, the results of the consultation with several hundred European citizens in seven different countries should shed some light on the expected and desirable breeding practices in Europe in the coming years. I hope to see many of you in Oslo I'm looking forward to sharing and discussing these new advances and to define together a roadmap for the actions to be taken in the final phase of RUMIGEN.

Finally, I would like to wish you all a very happy 2025, full of personal and professional success, and I look forward to seeing many of you at future RUMIGEN events.



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NEWS

EcoGen Webinar Series – Episode 1:

Transforming Livestock Systems Through Integrated Research

The [first webinar](#) in the EcoGen series set the stage for interdisciplinary collaboration by introducing the EcoGen Cluster and its five pioneering projects. Speakers provided an overview of how integrated research on breeding, genetics, and - omics can drive more resilient and sustainable livestock production. Held on 6 March 2025, the online session gathered researchers, livestock advisors, professionals, policymakers, and students eager to explore cutting-edge livestock innovations.



[Watch the recording here](#)

Find out more about EcoGen here and stay up to date with upcoming webinars.

RUMIGEN Joins the EU-FarmBook Platform

We are excited to announce that the RUMIGEN project is now featured on the [EU-FarmBook platform!](#) The EU-FarmBook is a Horizon Europe project that is working at regional, national, and European (EU) levels to build an Online Platform. Gathering and sharing agriculture and forestry knowledge.

The main purpose of EU-FarmBook is to support knowledge exchange, by further developing, expanding and maintaining an easily accessible and user-friendly EU-wide Online Platform for practitioners in the agriculture and forestry sectors.



By joining EU-FarmBook, RUMIGEN's findings and outputs will now be more accessible to farmers, advisors and other practitioners.

[Find RUMIGEN's project page here to learn more.](#)

G2P in a dish workshop

A successful EuroFAANG initiative

The Genome to Phenome (G2P) workshop, hosted by the EuroFAANG project, concluded successfully in February, marking the end of a highly productive week-long course. The event fostered significant knowledge exchange and collaboration within the research community. The workshop featured talks on genome editing, biobanking, single-cell analysis, and in vitro models, with hands-on sessions and discussions shaping the future of animal genetics research. On day 4 of the workshop, RUMIGEN's coordinator Eric Pailhoux presented the project under the "In vitro vs. in vivo G2P research and the links to industry" sessions, discussing the topic "Genome-edited mammals as part of the H2020 RUMIGEN project and as a tool for studying G2P in farm animals"



[Want to know more? Check out the video here with interviews from the event!](#)



Meet RUMIGEN's Young Researchers:

Corentin Fouéré

Corentin Fouéré, a PhD student at Eliance and INRAE, is researching the interplay between genetics and epigenetics in cattle. With the growing interest in epigenetic information in livestock farming, Corentin's research aims to uncover how both the environment and genetics shape the epigenome.



The insights from his work will enhance the reliability of genomic selection, empowering farmers to breed animals that align with their objectives.

[Watch the video](#) to learn more about Corentin's research.



Meet RUMIGEN's Young Researchers:

Renzo Bonifazi

As part of our series on RUMIGEN's young researchers, meet Renzo Bonifazi, a researcher at Wageningen University & Research. In collaboration with colleagues from NMBU - Norwegian University of Life Sciences and INRAE, Renzo has been exploring how genomic selection impacts the genetic diversity of European local breeds.

Their findings will provide valuable insights for breeding organizations and farmers, helping them preserve genetic diversity in local breeds and promote sustainable livestock farming practices.



[Watch the video](#) to learn more about Renzo's research and its results.





Revolutionizing Animal Breeding:

RUMIGEN Interview Featured in Feedstuffs

Dr. Clotilde Patry (Eliance) and PhD candidate Adrián López-Catalina (INIA) recently spoke with Feedstuffs magazine about the RUMIGEN project and its development of a groundbreaking new chip for cattle breeding.



Discover how this innovation could transform animal breeding and production.

Watch the full interview here



RUMIGEN Results Presented at EAAP 2024

The RUMIGEN project was featured at EAAP's 75th Annual Meeting, held from September 1–5 in Florence, Italy. As Europe's largest animal science conference, the event brought together global experts to discuss the key role of livestock in supporting sustainable food production for a growing population.



RUMIGEN research was presented in several sessions, covering diverse topics such as:

- Dairy cows' responses to heat stress (Elise Vanbergue)
- Zooarchaeological insights for livestock management and genetics (Jeremie Vandenplas)
- Sequence-based GWAS of heat tolerance traits (Aurélie Vinet)
- Genetic evaluations using epigenetic information (Adrián López Catalina)

In addition, scientific posters highlighting RUMIGEN work were presented, including one by Theodorus Meuwissen on genomic relationships for optimal contribution selection.

[Download and explore RUMIGEN's presentations and posters on our website here.](#)





MEET THE CONSORTIUM

HELENE KIEFER, France

WP6



After graduating from AgroParisTech as an agronomy engineer, I started to study the molecular mechanisms regulating gene expression during animal development. During my PhD in Paris under the supervision of Dr. Jacques Mallet (CNRS),

I worked on the transcriptional regulation of genes important for brain development.

I moved towards post-transcriptional regulation of gene expression during my post-doc in the laboratory of Pr. Katsuhiko Mikoshiba (University of Tokyo and RIKEN), where I studied how RNA polyadenylation can be regulated by a stimulus. I started studying epigenetics in cattle when I obtained a permanent researcher position in 2010 at INRAE, in the “Biology of Reproduction, Environment, Epigenetics and Development” research unit (Jouy-en-Josas, France).

As a molecular biologist, I have developed several tools to study epigenetic marks at a genome-wide scale in cattle during my career and I coordinated the design of the RUMIGEN Epichip, the first cattle methylation array, in close collaboration with Eliance and Valogene. RUMIGEN members (INIA and Aarhus University), as well as partners external to the RUMIGEN consortium, have also contributed to this effort.

My research interest is to understand how epigenetic modifications vary under the influence of both environmental and genetic factors and contribute to phenotype variability in cattle, together with my INRAE and Eliance colleagues from the DREAM team and in collaboration with the quantitative geneticists of GBOS team. I am particularly interested in bull sperm epigenome and its potential role in mediating intergenerational inheritance effects and I took over the leadership of RUMIGEN WP6 in 2022 when the previous leader, Laurent Schibler, left the consortium.



RUMIGEN AT WORK

Impact of Maternal Heat Stress on Dairy Cow Offspring Performance

By Elise VANBERGUE (IDELE), Roxane VALLEE (IDELE), Laure BRUN-LAFLEUR (IDELE), Clara DIAZ (INIA-CSIC), María Jesús CARABAÑO (INIA-CSIC), Sophie MATTALIA (IDELE), Mohamed RAGAB (INIA-CSIC), Manuel RAMON FERNANDEZ (IRIAF), and Aurélie VINET (INRAE)

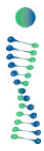
Part of the RUMIGEN project investigates how heat stress during pregnancy affects the production and fertility traits of dairy cow offspring. Partners from France and Spain, including Idele, INRAE, INIA-CSIC, and IRIAF, collaborated on this study, which supports climate-adaptive livestock breeding strategies.



By analysing livestock performance data alongside meteorological records, the study assessed the effects of heat stress at different stages of gestation on 305-day milk, fat, and protein yields, as well as conception rates in Holstein and Montbeliarde (in France) cows. Key findings include:

- Only slight impacts of maternal heat stress on progeny traits.
- Negative impacts of early gestation heat stress on offspring production, particularly protein and fat yields.
- Clear evidences of inter-transgenerational effects in the Spanish Holstein population, with third-generation cows showing noticeable declines in fat and protein yields, increasing with lactation number, when their dams, granddams, and/or great-granddams experienced heat stress during pregnancy.
- A maternal environmental effect on cows' production traits (up to 8% of the genetic variance), with an increase in impact according to the lactation number, suggesting that maternal stress (including heat stress) may influence progeny performance.

These findings, although of seemingly low magnitude on dairy cows productivity, emphasize the need for breeding strategies that mitigate the effects of heat stress, ensuring livestock resilience in a changing climate.



PUBLICATIONS

CRISPR/Cas9 Gene Editing of PRNP in Alpine Goats

Prion diseases, caused by misfolded PrP (PrPc) proteins, are fatal neurodegenerative disorders affecting many species, including goats. Resistance to these diseases can be achieved by knocking out the PRNP gene, which encodes PrPc. Using CRISPR/Cas9, researchers engineered Alpine goats with PRNP knockout (KO) alleles to explore resistance and assess potential impacts on health and performance.

In this study, genome editors were used to edit embryos, leading to 10 offspring from which eight founder animals with genome-edited PRNP alleles were obtained. Five carried KO mutations, and three founders with only edited alleles appeared phenotypically normal.



A male founder with a KO mutation is now being used to develop a PRNP-KO goat line for further study. Additionally, a novel PRNPdel6 genetic variant was identified in some founders, and its properties in relation to prion resistance will be investigated.



While PRNP KO has shown promise for prion resistance, previous studies in Norwegian goats revealed associated challenges like myelination defects and altered immune responses. This study aims to compare phenotypes under different genetic backgrounds to evaluate potential impacts and inform breeding strategies. With prion diseases posing zoonotic risks, such advances in gene editing could contribute to safeguarding livestock and public health.

Read the full paper [here](#).





UPCOMING EVENTS

EAAP 2025

The 76th EAAP Annual Meeting 2025 will take place in Innsbruck, Austria, between 25-29 August. The overarching theme of this years congress is 'Future-proof livestock farming' . Two joint sessions will be held with the RUMIGEN and GeroNIMO projects!The two session are:

- Session 78 "**Trans- and intra-generational effects and epigenetic mechanisms**" on Wednesday, 27 August afternoon.
- Session 15 "**From Genomic Applications to Societal Perception**" on Thursday, 28 August, morning. This session will conclude with a discussion focused on market uptake and will explore how these scientific breakthroughs can be applied to meet sectoral and consumer needs.

Further interesting sessions from the Animal Task Force (ATF), FABRE TP and EuroFAANG RI include:

- ATF Session 47: **Livestock farming systems for the next generation: can we imagine the future?** on Monday morning, 25 August
- FABRE TP Session 14: **Future of the EU breeding sector** on Wednesday morning, 27 August
- EuroFAANG RI Session 13: **European research infrastructures to support livestock science: whom and how?** on Wednesday afternoon, 27 August.

The EAAP Annual Meetings are one of the most significant forums for the exchange of information and discussion of animal science and production in Europe. More information to come soon!

Find out more [here](#)

