Issue 1

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GERONIMO Newsletter

Genome and Epigenome eNabled breedIng in MOnogastrics

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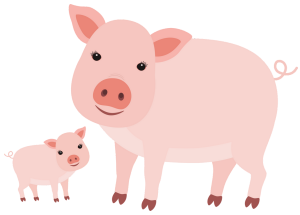
SUMMARY



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EDITORIAL

Frédérique Pitel and Tatiana Zerjal
Project Coordinators - INRAE

Human population growth, improved economic conditions in developing countries and changing consumer preferences are all contributing to the increased demand for animal products. Genetic selection has been extremely powerful, allowing for a considerable increase in the growth rate and feed efficiency of animals. However, this largely production-oriented strategy is showing its limits, as it is confronted with growing concerns about the environment, animal welfare and changing socio-cultural values. A renewal of production systems is now needed to ensure efficient livestock production (ELP), while promoting animal health and welfare and sustainable use of resources. Pigs and poultry are the two main animal sources of protein for human consumption in the world. Their mode of production is pyramidal, with the production, mostly under optimal rearing conditions, of small parental (pure) lines that lead to the final production of the very large populations reared for human consumption in production farms worldwide and thus exposed to various environmental and rearing conditions. The differences in environment between the breeding and the production populations are often significant and can lead to performance losses. This can be explained considering that environmental factors are certainly critical in defining phenotypes through complex mechanisms of regulation, including epigenetic modifications that affect gene expression and by consequence the expression of traits. The measure of genetic, epigenetic and phenotypic variability on a large scale of individuals exposed to different environments, will help to understand the impact of the environment on animal performances and contribute to produce commercial animals better adapted to local production environments. While guaranteeing high production levels, livestock farming needs to move towards other more virtuous systems that favor an efficient use of resources, have a lower environmental impact, and preserve animal health and well-being as well as genetic diversity.

Until now, genomic prediction has been based on models that take into account, as molecular information, exclusively DNA variants. However, the relationship between the genome and the expression of traits (phenome) is more complex than this, as epigenetic mechanisms also influence phenotypic variation, contributing to rapid adaptive responses to environmental changes. Future models in animal selection should represent this complexity to improve prediction.

Increasing breeding sustainability by enhancing our knowledge about genetic and non-genetic components of phenotypic variability at the population scale, under various environments, is the essence of the GEroNIMO project. The success of the project depends on a close-knit and interdisciplinary team. From the outset, we adopted a 'multi-actor' strategy by organising transdisciplinary discussions involving scientists and major players of the pig and poultry production sector as private breeders, associations and farmers' unions. With them, we identified the major issues of the sector that needed to be addressed in the project. We then enlarged the consortium by integrating partners from other European countries and other disciplines, in particular the humanities and social sciences.

We welcome you to GEroNIMO, a 5-year program involving 21 partners from 11 countries, organized in 8 work packages. In this first year of work, we have largely advanced in phenotype recording and sample collection on commercial populations as well as on local breeds, performed the first large-scale surveys, and will shortly start with the genomic and epigenomics analyses.

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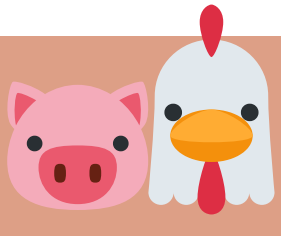

IN THE SPOTLIGHT

GEroNIMO COORDINATION TEAM

Frédérique Pitel is a senior scientist at the French National Research Institute for Agriculture, Food and Environment (INRAE) in Toulouse (France). After a master degree in animal production science at the National High School of Agronomy in Rennes, she obtained a PhD from Rennes University, France. Prior to the current position she was a research associate in the poultry genomics team (INRA Toulouse).
She participated in the development of genetic and cytogenetic maps in chicken, and took part in the duck and quail genome sequencing consortia. She conducted programs on mapping genomic regions involved in traits of zootechnical or biomedical interests. Her research now focuses on understanding the genetic and epigenetic processes underlying livestock phenotypes, mainly in avian species. In GEroNIMO she co-leads the project management and the task related to transgenerational epigenetics.

Tatiana Zerjal is a researcher at INRAE at the GABI unit near Paris, where she leads the "Genomics, Biodiversity, Bioinformatics, Statistics" research team. After her PhD at Oxford University and a post-doc at the Wellcome Sanger Institute in Hinxton (UK) on human evolutionary genetics, she moved to France to work on plant and animal genetics and genomics.
Her current research focuses on understanding the genetic basis of chicken feed efficiency and adaptation to abiotic stresses (heat and non-optimal feed) using genomic and quantitative genetic approaches. She is co-coordinator of the GEroNIMO project and leads the WP2, which studies the impact of environmental factors and selection on epigenetic variation.

Elodie Tan is a consultant at INRAE Transfert. She holds a Master's degree in Management and Biotechnology, and has 10 years of experience in the operational management of European collaborative research projects (FP7 and H2020). She also provides support in European proposal building.
In GEroNIMO, she is part of the Project Management Team, providing support to the coordinators and consortium partners on administrative, logistical and financial issues, setting-up tools to facilitate the project monitoring.

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PUBLICATIONS

METHODOLOGICAL ARTICLE ON START PROTOCOLS

Fábio Pértille and Carlos Guerrero-Bosagna (Uppsala University, Sweden), members of the GEroNIMO H2020 project, together with collaborators from international research institutions, have recently published a methodological article on Star Protocols (Cell Press). that describes the GBS-MeDIP protocol, a novel procedure for parallel investigation of DNA methylation and genomic changes in fractions of the genomes of many animals at the same time.

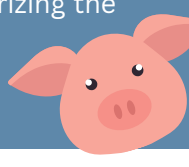
You can read the full press release here!

WP5 - ETICHAL ASPECTS OF GENOME EDITING IN FARM ANIMALS

WP5 is happy to announce that Milestone 14 consisting of 23 semi-structured interviews with breeders, farmers, and animal rights activists about the perceived ethical aspects of genome editing in farm animals is completed. Out of the 23 participants, 12 persons were related to the breeding sector, 6 to animal rights activism, and 4 to animal farming. The other participant was doing a PhD in neuroscience. There were 13 male and 10 female participants, who were between 22 and 66 years old with a median age of 33 years. The respondents were German (9), French (6), Dutch (3), Italian (1), Danish (1), British (1), and US-American (1). One last participant had both the Canadian and the US-American nationality. Based on a literature review of the existing analyses of the ethical and societal aspects of genome editing in farm animals (Milestone 13), a questionnaire has been designed that covered human-animal relations, ethical aspects of genome editing, and the future of animal farming.

Based on these interviews, as preliminary results, five different narratives could be identified, which are the neutrality hypothesis, the slippery slope, consumer capitalism, playing God, and the technological fix. The neutrality hypothesis refers to the idea of technology not being inherently good or bad, but that its moral implications solely depend on its application. Three participants compared genome editing to nuclear power which can be used for energy but also as a weapon. Therefore, participants endorsing that narrative advocate the use of technology in a good way. Second, the slippery slope refers to arguments of the following structure: if we allow an allegedly acceptable small step A, a morally unacceptable huge step B will necessarily follow. Third, the narrative of consumer capitalism refers to consumers having a “greed is good” mentality, thus merely basing their buying decision on prices rather than quality or ethical issues. In line with that, the economic pressure for farmers and other stakeholders involved in farm animal products to keep their prices low was mentioned. Fourth, several interviewees criticized genome editing as it is a sort of playing God or disrespecting nature. Such arguments often refer to the limits of human knowledge and the danger of possible side effects that are unpredictable.

Finally, a variety respondents argued genome editing is just a technological fix which does not aim for a system change in animal farming, but it aims at tackling solely some of the symptoms. According to some of the interviewees, the danger of such a technological fix lies in the possible maintenance or even legitimation of the current system. The following step of this research will consist of contextualizing and categorizing the given arguments with the use of existing ethical theories.



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GEroNIMO KICK-OFF MEETING!

The Horizon 2020 project GEroNIMO has started!

We are 21 dedicated partners from across Europe that will work towards more sustainable animal breeding and find more evidence to ensure efficient resource use and better animal health and welfare while preserving genetic diversity.

GEroNIMO HACKATHON

On the 6th and 24th of May of 2022 the GEroNIMO project organized an online hackathon on the contribution of new genomics technologies (NGT) to sustainable and efficient pig and chicken production with high biodiversity and good animal welfare.

Master and PhD students from European Universities with different backgrounds and with multi-disciplinary know-how, worked and presented creative ideas on challenges and application solutions for the use of NGT in animal production.

We would like to thank all the participants for bringing their brilliant ideas, and in particular, congratulations to the winner's: "Multi-omics approach to selective breeding for heat tolerance in pigs".

EFFAB & FABRE TP AGM

On 3rd and 4th May 2022, GEroNIMO took part of EFFAB/FABRE TP Annual General Meeting 2022 in Évora, Portugal.

On the 4 of May, EuroFAANG hosted a networking lunch where GEroNIMO was presented. Moreover, we had the opportunity to join an interesting discussion about new technologies and their relation with social sciences, the research priorities for animal breeding and reproduction, crisis preparedness and food security, as well as, the ongoing initiatives at animal welfare level.

Andreia Amaral from University of Lisbon

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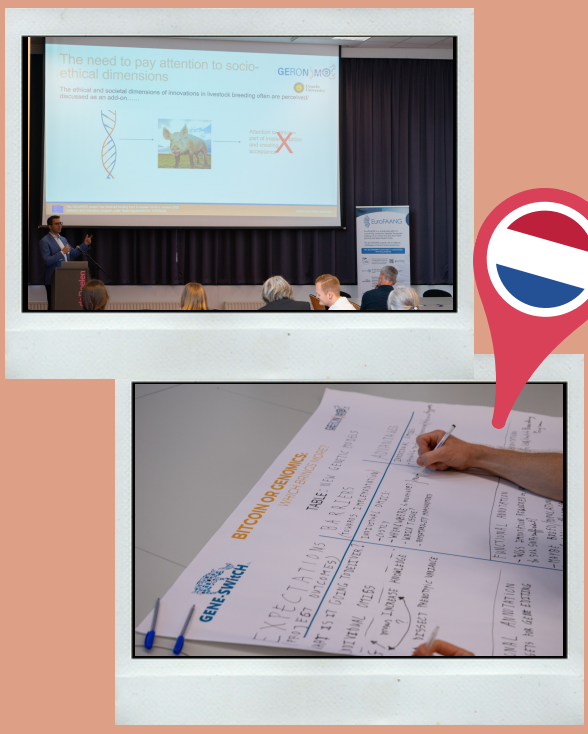

WCGALP 2022

On the 3rd of July 2022, GEroNIMO and GENE-SWitCH projects hosted a joint stakeholder event preceding WCGALP 2022 titled: “Bitcoins or Genomics: Which brings more?”.

WCGALP is the conference to share knowledge and to interact on innovations in the area of genetics applied to livestock production that enable to breed animals that allow livestock production chains to meet future needs.
Together with scientists from both projects, we discovered themes like animal breeding, functional annotation, genomics and the challenges in our society.

If you have missed this stakeholder event, you can watch it in our YouTube Channel!

GEroNIMO has joined EuroFAANG

By establishing EuroFAANG, the H2020 projects AQUA-FAANG, BovReg and GENE-SWitCH, and more recently GEroNIMO and Rumigen, have formed a closer relationship to coordinate their objectives within Europe in association with the international FAANG initiative.

EuroFAANG brings together a wide range of expertise in farm animal biology and breeding, genomics, bioinformatics, modelling and open data, as well as multiple platforms for dissemination and outreach, with a common goal to discover links between genome and phenome (i.e. G2P) in the frame of the FAANG to Fork strategy.

Check out more information here!

The GEroNIMO brouchure is already available!

Learn more about the project, the parts that are involved and how we aim to improve sustainability of pig and poultry animal breeding.

Download here!

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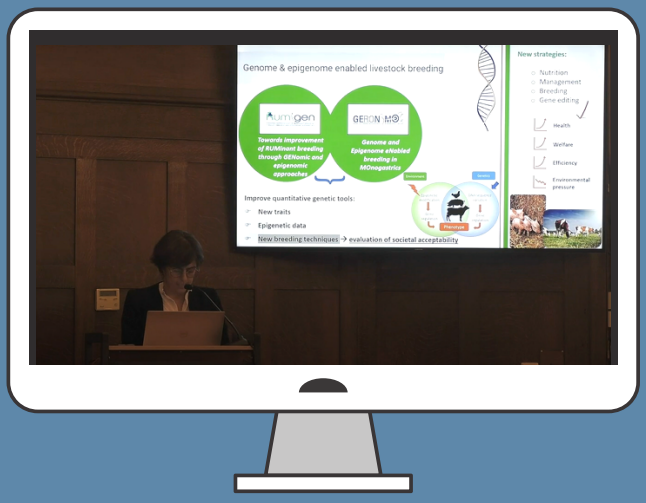
ANIMAL TASK FORCE MEETING

On the 18 of November 2021, the Animal Task Force (ATF) and the European Feed Manufacturer's Federation (FEFAC) hosted the 11th ATF Seminar. The topic of the day was "Going Beyond Feed vs Food". In the morning, an overview of policies, visions and current initiatives was given by representatives of different stakeholder groups such as DG Agri and IFIP. In the afternoon, a stakeholder event was organised where Ana Granados Chapatte (Director of EFFAB) presented GEroNIMO as part of an overview of the current Horizon 2020 projects that will contribute to the Feed vs Food competition.

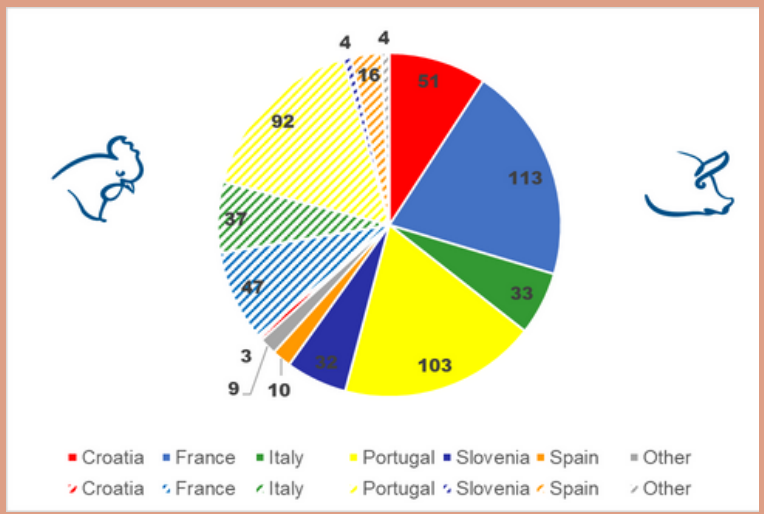


Watch the presentation here!

STAKEHOLDERS SURVEY

GEroNIMO carried out an in-depth survey of stakeholders (farmers, breeders, advisers...) of the pig and chicken local breeding sector. Over 550 questionnaires were processed to provide an overview of 126 local breeds: 32 pig breeds and 94 chicken breeds mentioned at least once. Participants came from 12 European countries, some of them more specifically targeted (see figure). Overall, the results show the specificities of the local breeds, which are mainly reared as purebreds, on small farms, outdoor or partly outdoor, using locally available feed resources. Stakeholders of both species state that they are primarily interested in genetic conservation; the economic activity associated with pig farming is mentioned next, while leisure is in second place with chicken.

With the exception of a few breeds, there is generally no selection programme, meaning no genetic or genomic evaluation; future pig or chicken breeders are chosen based on external characteristics such as breed standard and general appearance but also, for pigs, on inbreeding. However, most stakeholders demonstrate interest in selection, especially on pig reproductive traits and on chicken production traits. Nevertheless, in both species, the lack of human resources and variable rearing conditions greatly limit the possibilities to implement breeding schemes in local breeds. Other obstacles such as the lack of affordable measurement methods for the traits of interest and of pedigree data are also often cited in chicken questionnaires.



More worryingly, the Covid health crisis seems to have deteriorated the profitability of local breed farming. In addition, most of the respondents have concerns about the sustainability of their breeds in the more or less long term mainly because of economic risks or of regulation. Through this survey, stakeholders could express their expectations for more public support to encourage research and productivity and to fight against the unfair use of the breed names... More detailed results will be presented in the coming months at various meetings. Associated documents will be made available on GEroNIMO's website.

Many thanks to the participants who completed this survey!

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CLUSTER MEETING FOR LIVESTOCK RELATED PROJECTS

On 15th September 2021 GEroNIMO project has participated on the Cluster Meeting for Livestock organised by The European Research Executive Agency (REA). The objective of this meeting was present new projects and offer networking opportunities, convey information on the policy context and expectations and foster cooperation, synergies, policy feedback and exploitation of results.

This event is followed by a series of cluster meetings for thematically linked projects. The cluster meetings are coordinated with the relevant European Commission services and have been identified as priority activities as they have proven to be effective in early exchange of information and fostering collaboration among projects. This cluster meeting for livestock related projects is organised in cooperation with the Directorate-General for Agriculture and Rural Development of the European Commission (DG AGRI).

For more information, visit our website and follow us on social media!

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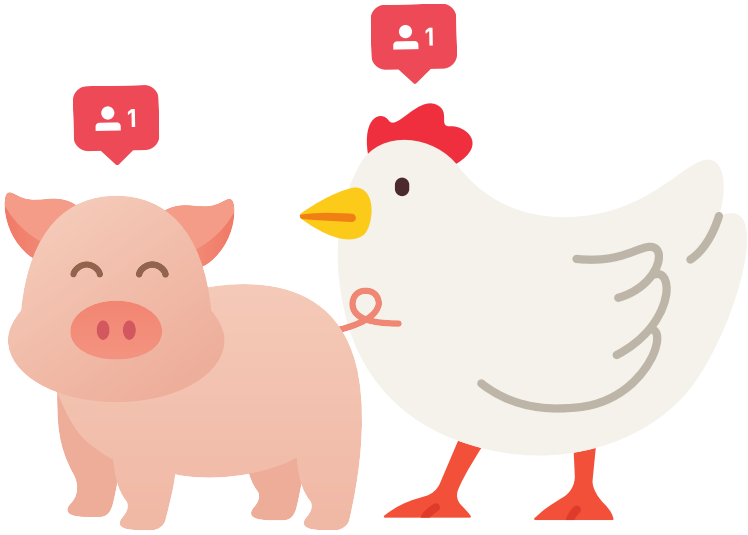

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