



## Gene editing: Can we afford (not) to use precision technologies in livestock breeding?

*FABRE TP EAAP session*

**Date:** Wednesday 28 August 2019, 08:30-12:30

**Location:** ICC, Ghent, Belgium **Room:** Auditorium (400)

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Gene editing techniques are a major development which may have large benefits in the field of animal and aquaculture breeding. Breeders could potentially use gene editing techniques to spread interesting characteristics and to accelerate processes that occur naturally through breeding over many generations and without introducing foreign genes. The potential benefits include opportunities for, better use of resources, animal and human health, animal welfare, climate change, and new approaches to conservation.

There are, however, many challenges related to the application of these techniques. Challenges are related to societal distrust, regulatory issues (e.g. the European Court of Justice stated that organisms obtained by mutagenesis are GMO), and technical issues. In this session we wish to have a discussion among a set of relevant stakeholders (breeding industry, politicians and authorities, ethics, NGOs? and scientists) about gene editing in the context of animal breeding. What are the recent developments in the domain (technical, ethical, legislative). What has been done in the field of gene editing research in livestock? In other words: where are we and where are we heading to?

*\*Please note that in order to attend this session you need to register as a conference delegate for EAAP 2019.*

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## Preliminary programme

**Gene editing in the context of animal breeding: a short history, opportunities and boundaries**

*Tad Sonstegard, Acceligen*

**Gene editing techniques – what are the mechanisms and applications?**

*Mike McGrew, The Roslin Institute*

**Update on the legislative framework for Gene Editing in Europe - Global legislation for gene editing**

*Philippe de Jong, Altius*

**Understanding the prospects and pitfalls of (animal) genome editing: a viewpoint from science and society**

*Phil Macnaghten, WUR*

**Different perspectives of gene editing**

*Emily Metz, Genus PLC*

*Jaana Kiljunen, Association of ProAgra Centres*



## **Editing for animal welfare and environmental sustainability: are these traits important?**

*Tad Sonstegard*

*Acceligen – Recombinetics Inc., St. Paul, MN, USA*

Gene editing based on site-directed nucleases is recognized as a breeding method best suited to introduce animal health, well-being, and climate adaptive alleles into naïve populations of food animals. These methods provide new opportunities in the marketplace with great potential for rapid genetic improvement, which in some applications can help meet global food security challenges related to animal protein production. However, there has been only a few privately funded initiatives attempting to bring edited animals to market; suggesting commercial providers of elite genetics are still reticent to apply this technology as first movers for this method of animal improvement. The pre-commercial deployment of animal welfare traits for genetic improvement in food animals and potential economic value to producers will be reviewed to provide background on the absence of biosafety risks associated with this technology. Other important factors affecting future acceptance and widespread adoption of gene editing technology as a primary tool of animal breeding will be discussed based examples of traits from proof of concept animals on the ground. Finally, perspectives for regulatory approval and commercialization are summarized to highlight some of the challenges, affecting widespread adoption of gene edited animals for emerging markets and complementation of genome-directed animal breeding.



## Gene editing techniques – what are the mechanisms and applications?

*Mike McGrew*

*The Roslin Institute, University of Edinburgh, UK*

Increased animal productivity using decreased resources, meeting higher welfare standards and having decreased environmental impact is key for future sustainable farm animal production. Since domestication, genetic selection for improved production traits has been the mainstay of advanced animal breeding. Initially reliant on local farmer preferences, selection is now quantitative and moving towards the use of whole genome sequence information. However, genetic selection is constrained by the genetic variation existing within the target population.

New genetic tools using site-specific nucleases have advanced the genetic modification of animal species that were traditionally recalcitrant to genetic changes. These genome editors – ZFN, TALEN, CRISPR/Cas9 – enable specific, predetermined changes to the genome. This includes single base changes, allele swapping, small deletions or insertions, or large chromosomal deletions and insertions. Furthermore, the genome editors are simple to use. It is not surprising that genome editing has caught the attention of regulators, industry, the media, and the general public. Gene editing tools are substantially different from traditional transgenic technology. However, will this difference matter to regulators and consumers?

Whatever the final outcome of this technology, gene editing tools has already revolutionised genetic modification of both laboratory and livestock animals. I will present the current state of the art focusing on poultry species. Previously, the genetic modification of poultry was extremely difficult but we, and others, have recently developed methods that makes the generation of genome edited chickens as or more efficient than other animal species. I will discuss some of these developments and the use of genome editing for poultry breed conservation.



## **Update on the legislative framework for Gene Editing in Europe - Global legislation for gene editing**

*Philippe de Jong*

*Altius*

“Philippe de Jong will discuss the legal aftermath of the Confédération Paysanne decision of the EU Court of Justice of 25 July 2018, in which it was essentially held that all organisms obtained through modern forms of mutagenesis (such as ODM and SDN techniques) are “genetically modified organisms” within the meaning of the EU GMO Deliberate Release Directive 2001/18, and that such organisms will only be exempted from the scope of that Directive if it is established that the underlying technique has “conventionally been used in a number of application” and has “a long safety record”. During this presentation, an overview will be given of the legal consequences of this court decision, how they can potentially be overcome under the existing regulatory framework governing the agrifood production chain, and what the EU institutions can do to assist in this process”.



## Understanding the prospects and pitfalls of (animal) genome editing: a viewpoint from science and society

*Phil Macnaghten\* and Senna Middelveld\**

*Knowledge, Technology and Innovation Group, Department of Social Sciences, Wageningen University, the Netherlands*

Genome editing is a novel technique for making changes to an organism's genetic material – the genome. The development of genome editing technology has made it arguably much more precise, efficient, flexible, and less expensive relative to previous strategies. These advances have generated an upsurge of interest in genome editing and its governance, including in animal livestock applications. While genome editing in livestock offers benefits, it also raises ethical and societal questions, not least because food is a matter of deep social and cultural significance. As the technology is still to be developed and implemented, it is the ideas, designs and visions that need to be assessed as objects for governance and societal engagement. In this paper we examine the driving visions and expectations of genome editing technology in scientific and corporate programmes and how this compares with how animal genome editing is configured in a public engagement initiative. In the first half, we analyse the expectations and visions of animal scientists and breeding companies about animal genome editing and the pathways envisaged from science through to application, paying attention to the assumptions, values and commitments that underpin corporate and scientific practices, and their influence on how companies manage technical change. This paper is based on interviews with animal breeding companies in the Netherlands, interviewing employees both in the business and R&D divisions, paying attention to the different corporate and governance structures of the firms. This is then compared with how genome editing is configured in a public engagement exercise with members of the Dutch public. This comparison will help us to understand the conditions, if any, under which genome editing can become embedded in society.

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## Exchange of views about the use of GE by Animal Breeders

*Emily Metz*

*Genus PLC, UK*

Media outlets have recently dubbed the double helix “most iconic image of the 20th century,” a significant characterization for a scientific concept that few understand yet has been studied since the early dawn of science. In this interactive talk, Genus will discuss its burgeoning technological advancement to combat Porcine Reproductive and Respiratory Syndrome Virus, PRRSv, a devastating swine disease for which there is no cure. The discussion will include Genus perspective to invest and believe in these applications. It will include further Genus’ strategy to ensure market and consumer acceptance and the methodical steps taken to avoid the consumer-fears over modern agriculture technologies of the past.



## Are we fighting for the license to produce?

*Jaana Kiljunen*

*Association of ProAgria Centres, Finland*

Animal production and the whole agricultural business has been facing strong criticism in headlines and social media in last years. There are issues like pollution, poisons used in farming, subsidies, overproduction, decreasing diversity, genomic modification, poor animal welfare, new diseases, dog breeding and the biggest one – climate change. If you just look at the news, you may get a picture that there must be something wrong in the whole business. At the same time there are fewer farmers and the consumers are having less contacts on countryside.

Understanding animal breeding is very complicated to the public. Genetic selection is hard to understand, new technologies like gene editing is connected to GMO. Reading is not any more in fashion either. Newspapers are competing from our time by publishing sensational and short news. We get our information more from social media. People are living in their own ideological silos, which encourage their own attitudes. Climate change has put meat and milk into focus by raising up animal production footprints. It is hard to explain, that efficient production is more climate friendly when the consumers are questioning the whole business.

Defending is not the right strategy to animal business and science. We need to get public acceptance. For example climate change may cause risks, which we can solve only by new technologies like gene editing. We must act more open, transparent and find the way to explain to the public what we are really doing in the Europe. We need to look at our food chain as well in a new way. Probably in the future we cannot feed the animals with food.