BVA British Veterinary Association | Minutes

Gene Editing Working Group

15th June 2023, 9.30am on Zoom

Attendees:

Madeleine Campbell, Chair
Rose Jackson, BCVA
Charlotte Commins, BVPA
Dominic Wells, Professor of Translational Medicine, RVC
Richard Piercy, Professor of Comparative Neuromuscular Disease, RVC
Fritha Langford, BVA EWAP
Polly Compston, BVA Policy Committee

BVA:
Alison Ramsay – Head of Policy and Public Affairs
Hannah Killeen – Policy and Public Affairs Officer

Apologies:

Emily Craven, BVA Policy Committee, Anna Judson BVA JVP

Minutes and Updates

1. The minutes of the March meeting were agreed without amendment.
2. The group received an update from a recent meeting with the Home Office policy team, where they had indicated that they expected it to be around two years before secondary legislation from the Gene Editing (Precision Breeding) Act was in place.
3. BVA's Ethics and Welfare Advisory Panel (EWAP) Chair declared that she had been asked to chair the Government Animal Welfare committee (AWC). She noted that Defra had commissioned a report from the SRUC which was due for completion at the end of the summer. The focus was on farm animals and equids, but there was some work on companion animal breeding.

Work plan

4. Members agreed the revised workplan and proposed agenda for the next meeting. Members offered a potential contact on sustainability and gene editing in plants from the John Innes Institute, and mentioned a group at Oxford University who have been looking into this subject in detail. It may be useful to consult Katrin de Walder from the group. Considering impacts on human health, it might be useful to consult, Andrew George, the Vice Chancellor of Brunel, previously of the National Board of Research Ethics.

Action: Members to provide potential contacts to H Killeen for follow up (or to contact directly if appropriate).

Benefits and Risks

Productivity

5. Improving productivity is a major driver for the farming industry, where the market is dominated by a very few large companies. Increased productivity allows us to feed the world more sustainably – more meat on one animal is more efficient. However chickens are already pushing the limits of viable anatomy and physiology, and there are increasing

issues with lameness in pigs. Increased growth per se is a dangerous thing if skeletal development doesn't keep up with muscle.

6. Likening gene editing to conventional breeding is not necessarily reassuring, as dangerous things have been done without using gene technology. Oversight is essential and checks and balances are needed to prevent adverse consequences, which may be greater as the change is made much more quickly than in traditional breeding. Broiler breeders may be the biggest issue, with the negative impact on the parent potentially overlooked to get the desired impact in the production birds. It is not clear where welfare oversight would come from, and there is nothing in place for future generations, once a change has been made. Attempts have already been made to mutate the myostatin locus to produce double muscle on beef cattle, something associated with welfare issues in traditional breeding.
7. Gene editing will need to be a balance of priorities, like traditional breeding. There is more interest in welfare now, particularly with regard to poultry, but it's difficult to see how that can be ensured with gene editing. If gene editing increases the amount of meat produced per bird, then consumers enjoy the cheaper meat without knowing the consequences. Gene editing might be able to reduce congenital lameness in broilers, but that would permit more intensive farming methods.
8. Litter sizes for pigs are increasing with more piglets being born than the sow has teats. Gene editing would help to avoid runts who don't thrive, but larger litters have an impact on the lifespan of the sow. The same is true of dairy cows pressed to produce more milk. Shorter lifespans mean larger number of animals are needed, which has an impact on sustainability (although fewer older cows would reduce methane production). However most of an animal's carbon footprint is created before it reaches its productive phase. The dairy industry is working to increase a cow's longevity and number of lactations, measuring productivity by lifespan, not per annum. AHDB are focussing on more, not longer, lactations. Selecting for fertility reduces the calving interval. Increasing milk production may have an impact on mastitis. While the meat sector is looking for fast growth, the dairy/egg sector is selecting for longevity. However, a good environment and management practices are still needed to achieve optimum productivity. There was brief discussion of sheep, gene editing could change litter size and growth rates. There was also the possibility of self-shedding, potentially preventing flystrike.
9. While selective breeding is less controlled that gene editing, if you only alter one gene, it may not work, and you may need to make further changes to get the result you want. However you can make one precise change without breeding in other traits that are coincidentally present – for example, when selecting for milk production in cows, the same animals also had an unrelated trait for bad foot conformation. Gene editing gives you more control.
10. The group discussed whether the five domains could be used to assess the impact of gene editing. Multiple generations would need to be considered, as the impact on the parent would be different to that on the young. Any assessment would need to be at all levels, not just on the animal in commercial production.

Anatomy/Physiology

11. Polled cattle were an obvious example of where gene editing could be used to change anatomy or physiology. While it does render dehorning, with its attendant welfare issues, unnecessary, cattle do have horns for a reason. There may be some impact on heat dissipation, which could become more important with climate change. However farmed

cattle don't root around, which horns would be used for in the wild. It's possible that horns have a role in social interaction, which we don't understand.

12. Gene editing could also be used to decrease susceptibility to lameness, mastitis, maybe even TB. But lameness in particular can also stem from environmental factors, which gene editing would not affect. Gene editing may not make much difference to poor stock-keeping. Good farmers would not lower their standards just because they could; poor keepers will cut corners either way.
13. It's possible gene editing could reduce methane output, which would have environmental benefits and no obvious detrimental impact on the cattle. Short tails may reduce the need for tail docking in sheep and pigs, and would also reduce fly strike in sheep.
14. There was also a potential role for gene editing in sex selection, although 70% of Holstein inseminations are already sex-selected. Birth control to avoid spaying/castrations was already being done in cats. This is transgenic at the moment, carried on a virus, so doesn't involve gene editing, but could be a major benefit in the future.

Performance

15. One obvious benefit would be breeding animals to better cope with climate change – short-haired cows, sheep with less wool. A gene has been identified that can reduce heat stress in cattle, but this has yet to be developed. Drought-resistant animals will become incredibly important globally, but could this reduce emphasis on environmental solutions with wider benefits – including for enrichment – such as planting trees for shade. Gene editing animals to cope with changing conditions would be treating the symptoms rather than the cause. There is also a danger that the global south is pushed into using animals better suited to the northern hemisphere by the large multinational corporations who own the technology. Indian farmers are already abandoning breeds better adapted to their local conditions because of the ubiquity of sexed Holstein semen.
16. We can potentially use gene edited animals to select animals that can cope better with changing conditions, but should we instead be growing better forage? Breeding smaller more robust cows that cope better with multi-species leys? Manage grassland more sustainably, possibly using gene-edited plants?

Disease Prevention

17. There are potentially huge benefits of developing a calf that is resistant to BVD for example. However the major risk is that resistance would be used as an excuse for increasing stocking densities. For example (non-genetic) eradication of Foot and Mouth Disease in South America has allowed beef cattle to be intensively farmed on feed lots
18. Off-target side effects are a major risk of any gene editing process. Failed attempts to produce a gene edited calf would have a potentially terrible impact on the animals – set against the beneficial impact to the progeny of the successfully edited animal. Only one out of 100 – or even out of 500 may be successful.
19. There can also be issues with nuclear transfer techniques. In horses this can cause illness in neo-natal foals, but if they survive, there is no long-term impact. In cattle, however, there are instances of foetal overgrowth and placental issues, although these are apparently becoming less common.

Action: It would be useful to consult an expert from the Roslin institute.

20. There is a potential benefit for human health if resistance to zoonotic diseases is developed. There is also gene editing work using pigs as a model for human health – cancer treatments for example.

21. There was a discussion of avian flu resistance – this could lead to a monoculture in the poultry industry, with the flu-resistant breed crowding out alternatives. The impact on backyard keepers and wild birds would have to be considered, if there was no longer a commercial impetus to prevent or treat the disease.
22. There was some discussion of how ASPA covers gene edited animals developed outside the UK. It was confirmed that this is accounted for within ASPA, which requires a welfare assessment for any genetically altered animal imported into the UK. However, scaling this technology up to commercial level may make it more difficult to ensure this is carried out and to trace animals which are the result of genetic alteration.

Sustainable Farming Practices

23. A key focus in this area would be male chicks and dairy calves, although this might fall under genetic modification, rather than gene editing. There is also the possibility of sterile animals that don't need to be castrated. Castration is necessary for behavioural and management reasons. Sterility may have an impact on skeletal development, which would be an issue for animals that are not slaughtered before they are fully grown.
24. Semen sex sorting, while not infallible, is already used, and is far less invasive. Sexing embryos with IVF is also already possible, and more reliable that sexed semen.If a way could be found to determine sex phenotypically rather than in ovo, this would be a major benefit for laying hens. If the goal is sustainability, dual purpose chickens (layers and broilers) are an existing option. They are less efficient productively, but more efficient in using both males and females. The use of day old male chicks to feed raptors and reptiles is practical, but there are other sources of food for those species in captivity.
25. If we remove all the males of a species, we do not know the impact of future generations. There is an ethical argument that reproductive behaviours are normal, and removing this could have an impact on social behaviours. However once the gene edit is stable, reproduction would be normal.
26. There is also potential for reducing antibiotic use. If resistance to certain diseases is developed, antimicrobials are not needed nor is metaphylactic treatment. However, gene editing is the nuclear option. Should we be looking at environments and management practices to control disease and improve biosecurity.
27. The group is not clear wither gene therapy for individual animals is within the scope of the Act, or whether it only covers traits in the germline that remain for multiple generations.

Action: To clarify the scope of the Act, and therefore of the group

Next Meeting

28. The group agreed to review the impacts of gene editing for fish, for plants (including fodder) and humans (food and One Health) at the next meeting.

Action: H Killeen to arrange the next meeting accordingly.