Beyond GM
March 2026

Gene Edited Livestock

UK policy context and global developments

The UK's Genetic Technology (Precision Breeding) Act 2023 established a new regulatory framework for certain gene edited organisms.

The Act explicitly includes both plants and animals, thereby creating a pathway for the authorisation and marketing of "precision-bred" animals – gene edited animals whose genetic changes could, theoretically, have arisen through conventional breeding.

However, while the primary legislation is in place, the regulatory system required to operationalise precision breeding in animals has not yet been introduced.

No secondary legislation is currently in force that would allow gene edited animals to be authorised, marketed, or farmed in England. As a result, gene edited animals remain subject to existing regulatory constraints and no applications can yet proceed under the new framework.

Evidence gathering

In 2022, Defra funded the SRUC research project AW0521, *Determining potential impacts of precision breeding on animal welfare*. This work formed part of Defra's evidence base on animal welfare prior to implementing the precision breeding framework for animals. When the final report was published in November 2023, it identified substantial limitations in the available evidence base for these gene edited animals. Welfare assessments were largely theoretical, key indicators lacked validation for on-farm use and multi-generational effects could not yet be evaluated. The report repeatedly noted that further methodological development and future work would be required before these gaps could be addressed.

In February 2024, Defra outlined an indicative timeline during a stakeholder webinar on forthcoming secondary legislation. At that point,

officials suggested a public consultation during 2025, followed by the introduction of animal-specific statutory instruments in 2026. In the same presentation, Defra announced a second SRUC project, AW0523, Developing further evidence requirements for gene edited animals, indicating that they were further building their evidence base.

The AW0523 project final report, published in March 2025, concluded that while precision-bred animals could deliver welfare benefits, the UK currently lacks the necessary welfare assessment tools, integrated data infrastructure, generational testing frameworks and post-market monitoring systems to regulate gene edited animals safely. It recommends case-by-case evaluation, holistic Five Domains welfare assessments, large sample sizes, multi-generational testing and stronger systems for post-market data collection and integration.

This conclusion is reinforced by subsequent academic work. As of August 2025, researchers at SRUC were still presenting work on the development of welfare assessment strategies for gene edited farm animals, indicating that practical assessment frameworks remain under active development.

Policy signals since 2024

Recent political and institutional signals suggest that implementation has slowed rather than accelerated.

During a House of Lords debate on secondary legislation for plants in May 2025, Baroness Hayman (Parliamentary Under-Secretary of State at Defra) stated:

> *"To inform noble Lords, we are currently continuing research on this but, while it is going forward, we will not be bringing forward any further legislation on animals."*

This statement confirmed that, currently, no animal-specific secondary legislation was imminent and implicitly acknowledged that the evidence base remains incomplete.

In September 2025, the Animal Welfare Committee published its forward workplan. This confirmed completion of the SRUC research and also listed an ongoing *'Review of livestock breeding and breeding technologies'*.

Although the scope of this review has not been publicly defined in detail, it indicates that Defra continues to treat animal breeding technologies – potentially including precision breeding – as an active area of policy development rather than one ready for implementation.

Current status

While earlier signals suggested animals could follow plants within a few years, the combination of research findings, ministerial statements, and advisory committee activity now points to a longer timetable.

Based on currently available information, 2027 appears to be the earliest likely point at which animal-specific secondary legislation could be introduced and this remains contingent on further welfare analysis and broader policy considerations.

Trade and SPS alignment

In addition to domestic questions of welfare evidence, the prospects for gene edited animals in the UK are shaped by external alignment considerations, particularly in relation to the European Union.

At the UK–EU Summit in May 2025, both sides signalled an intention to pursue closer cooperation on Sanitary and Phytosanitary (SPS) measures. A core element of the proposed

agreement is dynamic alignment, under which the UK would be expected to follow EU food safety and SPS standards over time unless specific exceptions are agreed. The exact nature of dynamic alignment, such as which standards would be covered and what exceptions might be permitted, are still to be negotiated.

Dynamic Alignment and Gene Edited Animals

In this context, gene edited organisms represent a potential flashpoint. The recently agreed EU compromise text for new genomic techniques is explicitly focused on plants and does not include gene edited animals.

The EU has no current plans to regulate gene edited animals. Such animals, therefore, remain subject to existing GMO regulatory regimes across the EU. This regulatory asymmetry intensifies the significance of any potential exemption for gene edited animals under SPS dynamic alignment negotiations.

For the UK, two broad trade-policy options appear to be emerging:

***Seek an explicit exemption for precision* breeding**
If the UK can secure an exemption from dynamic alignment for gene edited animals, it could maintain its own regulatory regime. However, such a negotiated exemption may be challenging.

Under dynamic alignment principles, an exception can only be agreed if it does not lead to lower standards in the EU and respects the principle that only animals and goods compliant with EU rules can enter the EU. This would be complicated for businesses wishing to export to the EU, especially if gene edited animals – as with plants – will not be labelled.

Align regulatory standards with the EU
Alternatively, the UK could opt to align with the EU's overall SPS regime. In practice this would mean retaining existing GMO legislation for gene edited animals.

These dynamics sit alongside domestic implementation considerations, such as welfare assessment frameworks and together help explain the UK's delay for animal-specific secondary legislation.

Table 1

Date	Event	Signal
2022	SRUC Research Project 1 begins: *'Determining potential impacts of PB on Animal Welfare'* (AW0521).	Defra collecting evidence.
March 2023	Genetic Technologies (Precision Breeding) Act received Royal Assent.	Legal architecture explicitly covers both plants and animals.
November 2023	SRUC AW0521 Research Project final report published.	Report outlines major gaps with current.
February 2024	Defra webinar on forthcoming SIs outlines timeline for introduction of animals – consultation during 2025 and introduction in 2026.	Defra plans to introduce SIs for animals in 2026.
February 2024	In the same webinar, Defra outlines a follow-up project at SRUC – 'Developing further evidence requirements for precision-bred animals' (AW0523).	The study shows that only pigs and fish have begun precision-breeding development and widespread data gaps mean the UK is not yet ready to regulate PB animals without building a comprehensive welfare-safeguard framework.
May 2025	UK-EU Summit agrees an intention to negotiate an SPS agreement with the EU with some level of dynamic alignment with the EU.	Could slow down the introduction of PB animals in the UK. The EU is not considering animals in its gene editing deregulation negotiations.

March 2025	SRUC AW0523 Research Project final report published.	The report concludes that PB in animals could bring welfare benefits, but the UK currently lacks the necessary welfare assessment tools, data infrastructure, generational testing frameworks and post-market monitoring systems to regulate gene edited animals safely. It recommends case-by-case evaluation, holistic Five Domains welfare assessments, large sample sizes, multi-generational testing and sector-wide data integration, while emphasising varied stakeholder concerns and the importance of strong safeguards.
May 2025	Baroness Hayman confirms during SI debate in House of Lords "*To inform noble Lords, we are currently continuing research on this but, while it is going forward, we will not be bringing forward any further legislation on animals.*"	No firm plans to introduce animals in near future.
September 2025	Animal and Welfare Committee workplan published. Confirms completion of SRUC research project, but also has 'Review of livestock breeding and breeding technologies' as an ongoing project – could include PB?	Defra still likely in the evidence-gathering phase. All signals now point towards a long delay. Realistic earliest timeline for animal SIs: 2027 depending on AWC output and SPS agreement (see Appendix, p9).

Gene edited farm animals: policy landscape

Precision breeding in animals raises a distinct set of policy, welfare and governance questions that differ fundamentally from those associated with plants. While the underlying technologies may be similar, animals occupy a different regulatory, ethical and societal position.

Farm animals are regulated not only as agricultural inputs, but also as sentient beings subject to specific welfare protections, veterinary oversight and public expectations.

As a result, decisions about gene edited animals engage multiple policy regimes simultaneously, including animal welfare law, veterinary regulation, food safety, environmental protection and trade. This helps explain why animals have not followed the same regulatory trajectory as plants under the UK's precision breeding framework.

Perspectives from Animal Welfare and Veterinary Groups

UK animal welfare charities and veterinary organisations have engaged closely with the question of gene editing in farm animals, particularly through responses to Defra's 2021 consultation on the regulation of genetic technologies. Across these interventions, a consistent theme is caution and a strong focus on animal welfare.

The British Veterinary Association (BVA) has adopted a conditional position, recognising potential benefits, but only when it has a positive health benefit for the animal.

In its response to Defra's 2021 consultation, the BVA argued for gene edited organisms to remain classified as GMOs:

> *"As gene-editing is still a relatively new process we consider that the risks are currently difficult to quantify, which is why it is essential that regulation and transparent reporting of data continues such that an evidence base can be built. If gene-editing is deregulated then the opportunity to gather data, continually improve on techniques and achieve better outcomes, will be lost."*

The RSPCA has also strongly criticised gene editing of animals. In its 2019 response to the Nuffield Council for Bioethics' call for evidence, they said:

> *"the RSPCA believes that genome editing animals for food is an absolute wrong and not justifiable. Sustainable changes in human consumption of animal products and alternative approaches to animal husbandry that put animals' needs towards the forefront of farming, should be adopted instead."*

Similarly, Compassion in World Farming (CIWF) urged Defra in 2021 "*not to permit the gene editing of farm animals other than in the most exceptional circumstances*", citing concerns about welfare and the risk of entrenching intensive production models.

These views are echoed in expert and ethical forums. A 2019 multi-stakeholder roundtable convened by A Bigger Conversation and Compassion in World Farming, involving animal scientists, veterinarians and policymakers, concluded that gene edited animals raise distinct welfare and governance challenges that cannot be addressed through technical risk assessment alone.

Public Trust and Governance Considerations

Evidence from UK public engagement exercises indicates that gene editing in farm animals does not command automatic public support and is subject to significant conditions around purpose, governance and welfare.

Public attitudes are shaped less by technical safety concerns than by questions about how animals are treated, the direction of the food system and whether new technologies are being used to address underlying problems or to accommodate existing ones.

A 2022 UK public dialogue on genome editing and farmed animals led by the Nuffield Council on Bioethics in partnership with Sciencewise, found widespread unease about altering the genetic makeup of animals used for food. Participants repeatedly expressed discomfort with changing animals in this way and felt that many possible applications of gene editing in animals would serve to undermine valid questions or concerns about the food system, which ought to be debated.

Crucially, the dialogue showed that participants did not see gene editing in animals as a neutral or technical policy choice. Instead, they viewed it as a decision that required strong moral justification and clear public consent. Participants expected policymakers to explain why gene editing would be pursued at all and to demonstrate that alternatives – such as changes to farming practices or reductions in disease pressure through non-genetic means – had been properly considered.

Participants emphasised that regulation should be used to promote the public good, not simply to manage risks once market activity was permitted.

While participants generally viewed existing regulatory oversight of animal research as robust, they expressed concern about transparency, accountability and the risk that governance frameworks for farm animals could default to minimal protections shaped by market forces. They rejected the idea that responsibility should rest primarily with individual consumers, instead arguing that public authorities should regulate in line with societal values and public aspirations.

Taken together, this evidence indicates that public acceptance of gene edited farm animals cannot be assumed. Advancing gene editing in animals without clear justification, visible welfare benefits, consideration of alternatives and strong public-interest regulation risks undermining social licence and provoking public resistance.

Industry Interest and Pressure

UK farming and agri-industry bodies have publicly supported access to precision breeding technologies in principle. The National Farmers' Union (NFU) responded to Defra's 2021 consultation on genetic technologies by arguing that gene editing could help UK agriculture address disease pressures and improve animal health and welfare.

Targeted commercial interest is most clearly illustrated by breeding and genetics companies working with research institutes. UK-based Roslin Institute and Genus / PIC collaborated on Porcine Reproductive and Respiratory Syndrome (PRRS)-resistant pigs. Following US approval, Professor Bruce Whitelaw, of the Roslin Institute described the development as a "*milestone in the use of gene editing in livestock and a landmark moment for the livestock industry towards managing a global disease that causes devastating losses*."

The National Pig Association (NPA) publicly welcomed the 2025 US regulatory approval of PRRS-resistant gene edited pigs developed by Genus/PIC in collaboration with the Roslin Institute, describing the decision as a "landmark" for the pig industry. They expressed their hope that the Precision Breeding Act "*could ultimately pave the way for the technology in the UK*".

What's being developed – animals closest to market

Although regulatory pathways for gene edited animals are not yet in place in the UK, research and development is continuing internationally. This section provides a snapshot of the gene edited animals most frequently cited as being closest to commercial relevance in the UK.

Research activity on gene edited animals is extensive, but highly concentrated at the experimental stage. A 2024 review identified 212 peer-reviewed articles describing the production of at least one living animal using gene-editing technologies for agricultural purposes. However, only a small fraction of these projects has progressed beyond research settings.

Data compiled by the International Service for the Acquisition of Agri-biotech Applications (ISAAA) illustrate this gap. Its database of gene edited animals for agricultural use lists 21 regulatory approvals across a limited number of countries (Argentina, Brazil, Colombia, Dominican Republic, Japan and US) compared with 192 projects that have not.

These 21 approvals represent just three projects on terrestrial animals – a pig resistant to porcine reproductive and respiratory syndrome (PRRS), heat tolerant cattle and cattle with increased muscle mass. Four fish projects have also received approval, mostly in Japan.

Beyond disease resistance and productivity traits, there is another category of gene editing proposal that has received less commercial attention but raises serious ethical questions. This involves editing animals so that they cannot feel pain – or more precisely, so that they can still physically react to injury but no longer experience it as suffering. This is known as "disenhancement".

The idea was put forward by philosopher Adam Shriver in 2009, who argued that since factory farming was unlikely to be reformed through moral pressure alone, the next best option was to edit the pain response out of the animals themselves.

The neuroscience behind it is real: researchers have identified genes in the brain region associated with emotional suffering and work on laboratory mice has shown it is possible to disrupt them. With CRISPR, the argument goes, doing the same in livestock is now technically within reach.

The obvious objection is that this gets things exactly backwards. Rather than using gene editing to make animals better able to cope with conditions that cause them suffering, the priority should be changing those conditions. Critics – including animal welfare organisations and ethicists – point out that pain-insensitive animals would be less able to signal injury or illness and that removing the suffering would simply remove

one of the main pressures to improve how they are kept. It is, in other words, a technological licence to keep doing what we are already doing.

The UK public, when asked about gene editing in farm animals through the Nuffield Council's 2022 dialogue (see above), were clear that they did not want it used to paper over problems with the existing food system. Pain-free gene edited livestock is perhaps the starkest example of exactly that.

This contrast between increasing research activity and limited regulatory uptake helps explain why policy attention focuses on a narrow set of species and traits, despite the apparent breadth of scientific work (see Appendix). The most advanced work is concentrated in pigs and aquaculture and there has been far more limited progress in poultry, cattle and sheep.

Pigs

Pigs represent the most advanced area of development for gene edited animals. Much of this work has focused on disease-resistance traits, which are often framed by developers and policymakers in terms of animal health and disease control and are associated with significant economic impacts.

The most prominent example is porcine reproductive and respiratory syndrome (PRRS) resistance, achieved through edits to the CD163 receptor. Animals carrying this edit, bred by UK-based Genus PIC and the Roslin Institute, were approved in the USA in 2025, with expected market launch in 2026. They are also approved in parts of Latin America, with commercial breeding programmes underway.

Other UK-based pig-related projects remain at earlier stages. These include research into resistance to classical swine fever and African swine fever, both of which are currently limited to laboratory or discovery phases.

Poultry

In poultry, gene editing research has focused primarily on avian influenza resistance, reflecting the scale of disease risk and associated culling practices. Researchers at the Roslin Institute have reported partial resistance in laboratory settings by editing the ANP32A gene. However, infections still occurred with higher doses, leading researchers to conclude that multiple edits will be needed.

Despite high policy interest due to avian influenza outbreaks, poultry gene editing remains far from commercialisation and is unlikely to drive near-term regulatory decisions.

Cattle and Sheep

Gene editing in cattle and sheep has been explored for over a decade, but progress toward commercial deployment has been limited. Projects include:

- **Hornless (polled) cattle** intended to remove the need for physical dehorning – this high profile project stalled when regulators found unintended foreign DNA and it was never commercialised.

- **Heat tolerant ('slick' coat) cattle**. Regulatory approval has been granted in the US (2022), Brazil (2021 and 2023) and Argentina (2020 and 2021) and in Brazil five calves have reportedly been produced with these traits in labs.

- **Higher muscle mass cattle.** Regulatory approval has been granted in Argentina (2021) and Brazil (2021) but they are not yet on the market.

- **Higher muscle mass sheep**, with researchers at Roslin Institute producing a genome edited sheep in 2013. There are indications this project is ongoing, but no timescales.

In practice, several high-profile projects have stalled or failed to progress due to technical setbacks, regulatory findings (including unintended DNA sequences), or lack of clear commercial pathways. While some cattle projects have received approval in non-EU jurisdictions, breeding populations remain small and

geographically limited. Sheep research, including edits targeting muscle development, remains at a research or experimental stage, with no clear pathway to market.

Aquaculture

Aquaculture stands apart from terrestrial livestock in both regulatory treatment and development pace.

Japan provides the clearest example of commercialisation. Under its notification-based

framework for genome-edited organisms without foreign DNA, several gene edited fish have received regulatory clearance. These include red sea bream, modified via a myostatin knock-out to increase muscle yield; tiger pufferfish, edited for faster growth; and more recently olive flounder. Gene edited red sea bream and tiger pufferfish have been sold to consumers in Japan, making them among the first gene edited animals globally to reach the food market.

Elsewhere, gene editing in fish has focused on traits such as growth efficiency, parasite resistance and reproductive containment. In Atlantic salmon, researchers at the Roslin Institute and Nofirma (Norway) are attempting to edit for lice resistance, whereas a team at IMR (Norway) has reached the field trial stage of a project to edit for reproductive sterility.

Fish are often treated differently from terrestrial livestock in regulatory terms due to shorter generation times and more controlled production systems. As a result, aquaculture has acted as a testing ground for more permissive approaches to gene editing across the world, though it remains to be seen whether the UK will do similar.

Non-agricultural Animals

The provisions in the Genetic Technology Act go much further than agricultural livestock.

Its provisions cover all organisms in the taxonomic group Metazoa, (excluding humans or human admixed embryo). The group Metazoa includes all multicellular animals, including insects, jellyfish, snails, octopuses and vertebrates.

Operationally, the Act currently only applies to vertebrates (fish, amphibians, reptiles, birds and mammals), but the text states that the scope can be extended, via secondary legislation, to include invertebrates (like insects) "*subject to the affirmative procedure*". This means it will get some minimal consideration in Parliament before being signed into law.

The scope of the Act means that in addition to livestock, "animals" can include pets, working or service animals, wild animals and experimental animals. Racing horses are a particular area of focus for gene editing projects around the world.

The first gene edited horses have been developed in Argentina, where polo is popular, to make them faster. The horses are approved by the country's regulatory authorities, but have been banned by the Argentine Polo Association and the Argentine Association of Polo Horse Breeders has said it will monitor them for 4-5 years before deciding whether they should be registered.

Appendix – Animal development timeline

Table 2 – Animal development timeline

Species	Trait and edit	Developer	Status
Pig	PRRS virus resistance (CD163 receptor removal).	Genus PIC & Roslin Institute (UK).	Approved in USA in April 2025, market launch expected in 2026. Also approved in Argentina, Columbia, Brazil and Dominican Republic Signalled intent to get approval in UK.
Pig	Classical Swine Fever resistance (DNAJC14 gene edit).	Roslin Institute (UK).	Oct 2025 – Researchers report success in lab conditions.
Pig	African Swine Fever resistance (SLA-DM gene knockout).	Roslin (UK) & Friedrich-Loeffler Institute (Germany).	Discovery phase – no live pigs yet. 2023 – researchers reported identification of responsible gene. No updates since.
Poultry	Avian influenza (H5N1) resistance (changed 2 amino acids in ANP32A protein).	Roslin Institute (UK).	Oct 2023 – researchers reported partial success in labs, saying that multiple edits will be needed.
Cattle	Hornless (Polled) – Introgress Angus POLLED allele.	Recombinetics/ Acceligen (USA).	2019 – Regulators found unintended foreign DNA sequence. Never commercialised.
Cattle	Heat tolerance ("slick" coat) – PRLR gene truncation.	Acceligen (USA) – a subsidiary of Recombinetics and EMBRAPA Dairy Cattle (Brazil).	Not yet commercialised. 2022 – US regulatory approval granted. 2020-3 – Regulatory approval granted in Brazil and Argentina. 2025 – Brazil reports five calves produced in labs there.
Cattle	Increase muscle mass of cattle – edit to the gene responsible for producing Myostatin.	Acceligen (USA).	2021 – approved in Argentina and Brazil.
Sheep	Increase muscle mass of sheep (halting myostatin gene).	Roslin Institute (UK.)	First genome edited sheep created in 2013. Indications that the project is still ongoing.
Atlantic Salmon	Lice resistance.	Roslin Institute (UK), Nofirma (Norway) and other partners.	Ongoing project, 2021-7.
Atlantic Salmon	Reproductive sterility – dead end (dnd) gene knock out (no germ cells).	IMR (Wargelius group) (Norway).	Ready for field trial (research).
Aquaculture fish (Red Sea Bream, Tiger Pufferfish)	Growth rate and yield – e.g. myostatin KO, appetite gene edits.	Regional Fish Institute (Japan).	Commercial sales have begun in Japan.

Text: Ayms Mason, Pat Thomas
beyond-gm.org